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JOINT INTERNATIONAL CONFERENCE

Co-organised by

The Federal University of Technology, Akure (FUTA), Nigeria,
De-Montfort University (DMU), Leicester, United Kingdom
&
London South Bank University (LSBU), London, United Kingdom

PROCEEDINGS

of

THE JOINT INTERNATIONAL CONFERENCE JIC 2016

on

21st Century Habitat: Issues, Sustainability and Development

21st - 24th March 2016

held at

The Federal University of Technology, Akure (FUTA) Nigeria.

EDITORS:

Prof. Ebohon, Obas J.
Dr. Ayeni Dorcas A.
Prof. Egbu, Charles O.
Prof. Omole, Felix K.

JOINT INTERNATIONAL CONFERENCE

21ST CENTURY HUMAN HABITAT: Issues, Sustainability and Development

PROCEEDINGS OF THE JOINT INTERNATIONAL CONFERENCE (JIC) AKURE, NIGERIA

Monday 21 – Thursday 24 March, 2016

Editors

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PEER REVIEW PROCESS

The quality of the contents in this publication is guaranteed through thorough review process of abstracts submission and screening. All accepted papers were subjected to a blind peer review process. Papers in the various subthemes were reviewed by a minimum of two referees; from the abstracts submission through to the full paper submission and finally, the reviewers' reports were sent back to authors for modification and final submission.

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FOREWORD

This Joint International Conference is about sustainability in its wider sense.

Sustainability suffuses all we do and is, arguably, the world's most talked about concept and, perhaps, least understood. This is partly due to the level of complexity associated with how the discourse around sustainability issues is framed; how the contexts associated with it are imagined; how the challenges associated with it are addressed and grappled with, and how the resources and solutions offered are meaningfully operationalized. The lens at which we use to view sustainability is seemingly the problem and the solution at the same time, and therein lies the conundrum.

Sustainability is an important area of discourse, as it pertains to how we work and how we lead our lives, now, while considering the lives, communities, and workplaces of future generations. At the same time, few would question the power that lies within a collective and a channelled effort, where there is sense-making, joined up thinking, and the sharing of lessons learned in addressing key sustainability issues in pursuant of key 21st century human habitat needs, expectations and desires.

It is pleasing to see some level of agreement in the recent UN Sustainable Development Summit (2015) held at the UN headquarters in New York, and around the 17 Sustainable Development Goals.

A host of stakeholders have a significant role to play in this regard, not the least of which are governments, practitioners, communities, academics, the third sectors, and users. The wider architecture, engineering and construction (AEC) sectors consume in excess of one-third of our energy use; over one quarter of all raw materials; and about half of our water use. In addition to this all other sectors are serviced or service the AEC sectors. The issue becomes one of interconnectedness and complexity, calling for interdisciplinary, joined-up, and holistic considerations. There is much to know and share.

This joint international conference particularly sets out to explore some of the developments, challenges, innovations, environmental friendly and adaptability offerings around sustainability. It also offers the scope to address, real estate, valuations and management concepts and practices. In addition issues around landscape design, tourism, remote sensing and industrial design are explored. There is also a growing interest around education and professional ethics, which are further explored and discussed. Similarly, both developing and emerging economies are grappling with issues around physical planning, urban renewal and urban poverty. These important issues are to receive due coverage during the conference. Same goes with issues around architecture and national development in both emerging and developed countries.

A number of developed and developing economies continue to experience major unrest and challenges leading to massive immigration across countries and continents, and security issues. At the same time, the low oil prices raise significant economic challenges to development. Housing provisions, in terms of sustainability and affordability, also continues to be an issue in a number of countries and continents. As built environment academics and researchers, these changes would have an impact on us in one way or the other. No doubt, it would form an interesting area of debate in our conference.

For this Joint International Conference, the call for papers elicited 320 abstracts. The International Scientific Review Committee has also worked tirelessly to uphold standard of quality and consistency of the papers. After the two stage blind review processes, we have 201 accepted papers. This means that if your paper have been accepted for the conference, and is in the proceedings, then you should feel very proud of your achievement. It is pleasing to note that a good proportion of the papers have come from both new researchers, including those engaged in their PhD studies, as well as established researchers and academics. The papers have also come from over 12 countries. Similarly, the topics are wide, covering different aspects of sustainability research and practice.

It is also worthy of note that the content of the papers reflect the use of different research methodologies and philosophies.

We hope that this conference affords us the opportunity to address some of the challenges that confront research, practice, policy making, education and the wider areas of sustainability, in this very interesting and challenging time.

We also look forward to the usual networking which is one of the hallmarks of such international conferences; to renewing old acquaintances and making new friends during the conference.

Prof. Ebohon, O. J.

Dr. Ayeni, D. A.

Prof. Egbu, C. O.

Prof. Omole, F. K.

ACKNOWLEDGEMENTS

A conference like this would be impossible to run without the help and assistance of a huge number of volunteers who have worked tirelessly to ensure its success. Our special thank you goes to the Local Organising Committee and Sub-committees, the International Organising Committee, and the International Scientific Review Committee who have worked tirelessly to meet all deadlines for paper review and for upholding the high standard of academic quality.

A special mention of Dr. Dorcas Ayeni, who also took on the majority of the organisational and administrative burden for the conference.

Thank you also goes to, Prof. F.K Omole, Arc. Olufemi Samson Adetunji, Mr Bayode .T, Dr Adelabu Samuel, Mr Ewuonwu Obiora and Mary Samson. Who were instrumental in the arrangement of papers for the conference proceedings and making sure that we were "ready to go" for the printers.

We are grateful for the support received from The Federal University of Technology Akure (FUTA), London South Bank University, UK and De-Montfort University, Leicester, UK.

A huge thank you goes to the Vice Chancellor and the Chief Executive Officer of the Federal University of Technology Akure (FUTA), Prof. A. G Daramola, for his vision in sowing the seed for this joint conference. We are also indebted to the Dean of School of Environmental Technology (FUTA), Professor J.A.B Olujimi, for his unwavering support in the organisation of this conference. We equally extend our gratitude to all Heads of Department in the School of Environmental Technology, senior academic members of staff of FUTA and all sub-committee members for their various supporting roles, and for the opening of the conference and the welcoming of national and international delegates.

A number of organisations, industrialists and academics have supported the conference in a number of ways. We are thankful for their kind generosity and support.

A special thank you to the Keynote Speakers; Professor Olunride Lafe and Professor Charles Egbu.

Finally, we are also indebted to members of the professional and non-academic staff of FUTA for their support in the organisation of the conference, and making sure that all who attended the conference had a worthwhile and enjoyable time during their stay in FUTA, Akure, and in Nigeria.

Prof. Charles Egbu

MAJOR SPONSORS

The Federal University of Technology Akure (FUTA) was established in 1981 to give prominence to training in technology and applied science and to assist in ensuring rapid technological and industrial development of Nigeria. The University which formally took off in 1982, has grown tremendously since its establishment to become the best University of Technology in Nigeria. Currently, it has 30 academic Departments spread within eight (8) schools. FUTA is located in Akure, the capital town of Ondo state, Nigeria. The vision of the university is to be one of the best Universities of Technology in the world, committed to carving out an enviable niche for itself as a centre of excellence, epitomized by high quality programmes, products and contributions to the society. The mission is to promote technological advancement of Nigeria through emphasis on programmes that will engender the development of such products and services in which the Nation possesses great comparative advantage. In doing this, the university is committed to providing a conducive teaching and research environment attractive enough to retain highly motivated leading academics capable of channelling research outputs to meeting peculiar national needs. Through its research output, train and produce highly technological –oriented and self-reliant high level manpower committed to self-employment as basis for national development.

London South Bank University (LSBU) has been transforming lives, communities and businesses for over 120 years. We take a practical approach; professionally accredited and connected to industry. We offer some of London's best courses in engineering for cities, surveying, construction, architecture and design. The breadth and quality of our research and enterprise activities is widely acknowledged. Our applied research tackles real-world issues. We are the top modern university in London, UK, for world-leading and internationally excellent research in General Engineering (which includes The Built Environment and Architecture research). LSBU provides a highly applied academic environment which supports students into professional careers by providing them with the knowledge and skills that are attractive to employers.

De-Montfort University (DMU) offers the perfect combination of outstanding teaching, first-class facilities and a fantastic student experience, placing research excellence and innovation at the heart of its mission. Our innovative and life-changing research has a direct and positive real-world impact, confirmed by the REF 2014, the most recent UK-wide initiative to access the quality of research in universities. We work with leading national and international employers to develop and deliver courses that equip our students with the knowledge, skills and abilities they need to succeed in a competitive job market. We also work with some of the most successful organisations in the world to offer 1,850 work placements a year. The Leicester School of Architecture is a prominent part of the university, established in 1887 the school is a leader in the field Architecture, offering innovative

architectural education at all higher education levels. The school has a track record of equipping students with a fearless approach to unforeseeable problems in the built environment.

CO-SPONSOR

LAFARGEHOLCIM was formed in 2015 as a result of the successful merger between two global cement giants – Lafarge (headquartered in France) and Holcim (headquartered in Switzerland). The merger, which was announced to be the second largest merger in 2014 has witnessed the emergence of the world's largest building materials ad construction solutions provider. With the world biggest material testing laboratory, LafargeHolcim with vision to be the leading and highest performing company in the building materials industry, is rated as the most advanced building materials company in the world offering an unprecedented range of products and services to answer the changing demands of the construction industry and the challenges of increasing urbanisation. LafargeHolcim is clearly the industry leader in terms of innovation, sales and manufacturing capacity. LafargeHolcim is located in 90 countries spread across all 5 continents with 115,000 employees. The company has 2,500 operations and is set to transform the global construction industry.

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KEYNOTE SPEAKERS

Biography of **Professor Charles Egbu**

(PhD FRICS FCIOB FAPM FRSA FHEA)

Professor Charles Egbu is Dean of School of the Built Environment and Architecture at London South Bank University, England, UK, where he holds the Chair in Project Management and Strategic Management in Construction. His First Degree was in Quantity Surveying [First Class Honours] – Leeds Metropolitan University, UK, and he worked briefly as a site Quantity Surveyor for a large UK construction company. His Doctorate was obtained from the University of Salford, UK, in the area of Construction Management. He is a Fellow of the Royal Institution of Chartered Surveyors (FRICS); a Fellow of the Chartered Institute of Building (FCIOB), a Fellow of the Association for Project Management (FAPM), a Fellow of the Royal Society for the Encouragement of Arts, Manufacture and Commerce (FRSA), and a Fellow of the Higher Education Academy (FHEA). He is currently a Member of the Policy Board of the Chartered Institute of Building (CIOB). He was until 2014 a Director and member of the Board of Trustees for the Association for Project Management (APM), and Chairman of the Professional Standards and Knowledge (PS&K) committee of the Association for Project Management. He has lectured, nationally and internationally, at undergraduate and postgraduate levels in areas such as construction economics, contract procurement, project management, construction management, construction process improvements, sustainable development, and Innovation & knowledge management in complex environments. His research is in similar areas, where he has attracted in excess of £25m from many research funding bodies – nationally and internationally. He is an author of 12 books in Construction Management, Knowledge Management, Sustainable Development, Refurbishment Management, and Health & Safety in Construction. He is currently a Member of the Peer Review College of the UK Economic and Social Sciences Research Council (ESRC). He was a member of the Peer Review College of the UK Engineering and Physical Sciences Research Council (EPSRC- 2006 – 2009). He also sits on many editorial boards, and national and international scientific committees to do with research in construction management, project and programme management, innovation and knowledge management, and sustainable development. He was the Chair of the Association of Researchers in Construction Management (ARCOM: 2010 – 2012). He is a Visiting Professor to a number of Universities in Europe, Africa, and Asia. He has supervised over 25 PhD students and examined over 60 PhD candidates world-wide; and has acted as an External Examiner to many undergraduate and postgraduate programmes in many universities all over the world. He has contributed over 350 publications in various international journals and conferences and has hosted, chaired and spoken at many conferences in his areas of expertise. In addition, he has produced many practitioner-based reports, policy and guidance documents, and conducted many workshops and seminars internationally in his areas of discipline. He is also a member of the International Council for Research and Innovation in Building and Construction's Working Commission, where he is a co-ordinator of the CIB W102 on "Information and Knowledge Management", and the CIB W117 on "Performance Measurement in Construction".

Professor Charles Egbu
Email: egbuc@lsbu.ac.uk Website: www.charlesegbu.com

Biography of **Professor Olurinde E. Lafe**

BSc (UNILAG), DHE (DELFT), MS (CORNELL), PhD (CORNELL)

Director – Centre for Renewable Energy Technology (CRET) & Professor – School of Engineering & Engineering Technology, Federal University of Technology, Akure (FUTA)
ACADEMIC HISTORY Prior to his joining FUTA as Engineering Professor and Director of CRET, Professor Lafe held senior academic positions at a number of universities including the University of Lagos, the University of Dar-es-Salaam, the University of Nairobi, Case Western Reserve University and African University of Science and Technology where he was a visiting distinguished professor of engineering.

SOLVING CHALLENGING PROBLEMS Professor Olurinde Lafe has spent the past 4 decades working on providing engineering solutions to development problems around the world. Professor Lafe has consulted with both governmental and non-governmental agencies including the United States Office of Naval Research - Strategic Defense Initiative Program on the "Star Wars" Project (where special multi-megawatt battery technologies were developed for space weapons), National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), United States Department of Agriculture (USDA), United States Agency for International Development (USAID), United Nations Educational, Scientific and Cultural Organisation (UNESCO), World Vision International and Defense Advanced Research Programs Agency (DARPA).

PUBLICATIONS & PATENTS Professor Lafe has published numerous learned articles and written single and multi-author books. His latest book is "Abulecentrism – Rapid Development of Society Catalysed at the Local Community Level" (Springer, 2013). The development concept abulecentrism is what Nigeria needs in order to move forward. Abulecentrism seeks to achieve rapid and sustainable development of a given society by the strategic execution of projects and the provision of critical services at the local community level. Abulecentrism is built on the philosophy of using small, modular systems, such as a village, as building blocks for developing the greater society. Latest developments in renewable power systems are described extensively in the book.

INVENTIONS Professor Lafe's research and development efforts have resulted in 9 issued United States patents. His inventions have been implemented commercial and consumer products sold worldwide. Global telecom conglomerate, Nortel Networks, licensed his technology for their e-Mobility accelerator product. SONY Corporation used his invention for transmitting large digital files across the Internet.

CAPACITY DEVELOPMENT INITIATIVES Professor Lafe established the TechAlive Training Programme in Nigeria as a vehicle for capacity development in renewable energy systems. During the Year 2010, one hundred unemployed Nigerian graduates were given a 6-week intensive training in renewable energy (with emphasis on solar power) and clean-power related software engineering. Graduates of the TechAlive Programme are now involved in the design and installation of smart micro-grid community power systems for communities around Nigeria. In September 2012, another set of one hundred unemployed Nigerians were camped and given a 4-week TechAlive intensive training in renewable energy systems. These trainees constitute the pioneering set of workers for a nationwide PAWA774 initiative to generate, transmit and distribute 10MW of clean power in each of Nigeria's 774 local government areas (LGAs). PAWA774 is an acronym for Providing Alternative Watts for All 774 LGAs.

CHAIRMANSHIP OF POWER REVIEW COMMITTEES Professor Lafe has served as the Chairman of several committees setup to review renewable energy projects around the country. The plants range in capacity from 20MW to 1,200MW grid-tied solar power systems in strategic locatio45ns and different regions of Nigeria.

SOLVING NIGERIA'S POWER PROBLEM Professor Lafe has a clear, cost effective, and sustainable solution to Nigeria's power problem. His idea will provide an accelerated solution to the national electricity challenge, create millions of jobs in every nuke and cranny of the country and energize the economy in each of the 774 local government areas of the country. He has appeared on national television and published articles in national newspapers proffering his solution to the power problem.

JOINT INTERNATIONAL CONFERENCE PROGRAMME

Monday 21st – Thursday 24th March 2016

DAY 1: MONDAY 21ST MARCH 2016					**Venue**	**Time**
REGISTRATION					**2500-capacity auditorium**	**08:00 – 08:45**
OPENING CEREMONY (Moderator: Protocol Unit FUTA)					**2500-capacity auditorium**	**08:45 – 11:30**
Arrival of Special Guest of Honour, other Dignitaries and invitation to the High table					2500-capacity auditorium	**08:45** – 09:00
Anthems (National and FUTA)					2500-capacity auditorium	09:00 – 09:05
Welcome Address – Prof. J. A. B. Olujimi, Dean, School of Environmental Technology, Federal University of Technology Akure					2500-capacity auditorium	09:05 – 09:15
Introduction – Conference Chair- Prof Charles Egbu, LSBU, UK					2500-capacity auditorium	09:15 – 09:25
Opening Address by Vice-Chancellor, FUTA – Prof. Adebiyi Gregory Daramola					2500-capacity auditorium	09:25 – 09:35
Goodwill message by Ondo State Governor – His Excellency Dr Olusegun Mimiko CON					2500-capacity auditorium	09:35 – 09:50
KEYNOTE ADDRESS 1 – Prof. Olu Lafe					**2500-capacity auditorium**	**09:50 – 10:30**
Entertainment by Dance troupe					2500-capacity auditorium	10:30 – 10:45
Announcement and Acknowledgement of Sponsors and partners – Mr. Adegbenro Adebanjo (FUTA PRO)					2500-capacity auditorium	10:45 – 11:00
Speech by Major sponsors					2500-capacity auditorium	11:00 – 11:20
Vote of Thanks – Prof. Olatunde Arayela (Chairman, Local Organising Committee)					2500-capacity auditorium	11:20 – 11:25
Anthems (FUTA and National)					2500-capacity auditorium	11:25 – 11:30
Conference group photograph					Entrance porch of 2500-capacity auditorium	**11.30 – 12:00**
TEA BREAK / WELCOME COCKTAIL FOR SPECIAL GUESTS AND OTHER DIGNITARIES					**Corridors of 2500-capacity auditorium**	
PARALLEL SESSION 1					**PSR01 - PSR05**	**12:00 – 13:30**
Session 1A - Session Chairman – Prof. T. L. Akinbogun (DVCD) Rapporteur – Dr. I. B. Kashim (IDD)	**Venue**	**Session 2A - Session Chairman – Prof. J. A. Fadamiro (ARC) Rapporteur – Dr. (Mrs) M. A. Ajayi (ESM)**	**Venue**	**Session 3A - Session Chairman – Prof. O. O. Ogunsote (ARC) Rapporteur – Dr. O. O. Popoola (URP)**	**Venue**	**Time**
THEME 1 Innovations, Environmental Friendliness and Adaptability		**THEME 2 Real Estate, Valuation and Management**		**THEME 3 Landscape Design, Tourism and Remote Sensing**		
2016JIC-ST1-001 Building Adaptation and the impact of Maintenance Budget: Case studies of selected Higher Education Institutions in Nigeria **Olowoake Mohammed**	**PSR01**	**2016JIC-ST2-007** Evaluation Of The Problems Associated With Construction Claims Management Process In Ondo State, Nigeria **Akinradewo O. F.; Ogunsemi D. R.; Dada M. O. & Aje I. O.**	**PSR02**	**2016JIC-ST3-001** Resources, Process and Challenges of User-Initiated Transformation of Public Housing Units in Lagos, Nigeria **Adetokunbo O. Ilesanmi & Kolawole O. Morakinyo**	**PSR03**	12:00 – 12:15
2016JIC-ST1-004 Identifying Success Factors in the Construction of Healthcare Facilities in Iran **Reza Zandi Doulabi & Ehsan Asnaashari**	**PSR01**	**2016JIC-ST2-008** Effects Of Work Attitudes Of Design Team On The Service Delivery Of Quantity Surveyors **Olaniyi Alake; J.O. Abiola-Falemu; T.A. Folorunso & S.A. Makanjuola**	**PSR02**	**2016JIC-ST3-002** Landscaping and Sustainable Housing Development in Akure, Nigeria **Mary Ajayi; Morisade Adegbie & Felix Omole**	**PSR03**	12:15 – 12:30
2016JIC-ST1-025 Fire Safety Education and Training in Architecture: An exploratory study Ibrahim Ebenehi1, Kirti Ruikar1, **Tony Thorpe & Peter Wilkinson**	**PSR01**	**2016JIC-ST2-009** Performance Of Insurance Firms In Housing Deliveryin Nigeria **N.B. Ezeokoli & T.B. Oyedokun**	**PSR02**	**2016JIC-ST3-012** Adoption Of Transformable Furniture For Space Utilization In Residential Spaces In Lagos, Nigeria **Onanuga, O. A.; Folorunso, C. O. & Adeyanju, A.**	**PSR03**	12:30 – 12:45
2016JIC-ST1-035 Evaluation of Procurement Methods used for Residential Building Maintenance in Ondo State, Nigeria **Folorunso, Tunde Akinola; Akinyemi, Tobi Akinlolu**	**PSR01**	**2016JIC-ST2-010** An Assessment of Risk Factors Impacting on Construction Contractors' Cash-in Forecasts in the Nigerian Construction Industry	**PSR02**	**2016JIC-ST3-038** The Production And Exploitation Of Rattan Products For Interior Decoration	**PSR03**	12:45 – 13:00

& Farayibi, Olatunde Oluwatosin		**Mustapha Abdulrazaq; Yahaya Makarfi Ibrahim & Ahmed Doko Ibrahim**		**Komolafe Olubunmi**		
2016JIC-ST1-056 Assessment Of Factors Influencing Building Maintenance In Public Housing Estates: A Case Study Of Ijaiye Medium Housing Estate, Agege, Lagos **Ogunleye, M. B. & Ajani, U. Y.**	**PSR01**	**2016JIC-ST2-020** Claimants' classification of Heads of Claims for Oil Spill Damage Assessment in Ondo State, Nigeria **Mustapha Oyewole Bello & Michael Ayodele Olukolajo**	**PSR02**	**2016JIC-ST3-033** Synopsis of Washed and Unwashed Eucalyptus Ash Treatments on Formulated Ceramic Glaze Properties **Ajala, Adewale Oluwabunmi & Kashim, Isah Bolaji**	**PSR03**	13:00 – 13:15
2016JIC-ST1-086 The Nigerian Water And Waste Water Industry: Governance, Efficiency, Procurement And Infrastructure **Joshua Sanga; Suresh Renukappa & Subashini Suresh**		**2016JIC-ST2-022** Impact of Design Errors and Incomplete Drawings on Construction Project Delivery in Edo State, Nigeria **Ebekozien A.; Uwadia, F. E. & Usman, D. A.**	**PSR02**	**2016JIC-ST2-065** Stakeholders Management for Public Private Partnerships in Niger-Delta Region of Nigeria **Adeniran Toyin Lashinde; Deji Rufus Ogunsemi & Oluwaseyi Alabi Awodele**	**PSR03**	13:15 – 13:30
Session 4A - Session Chairman – Prof. A. O. Olotuah (ARC) Rapporteur – Dr. A. A. Emmanuel (URP)			**Venue**	**Session 5A - Session Chairman – Prof. D. O. Olanrewaju (URP) Rapporteur – Dr. M. B. Ogunleye (ESM)**	**Venue**	**Time**
THEME 1 Innovations, Environmental Friendliness and Adaptability				**THEME 5 Physical Planning, Urban Renewal and Urban Poverty**		
2016JIC-ST1-018 Mitigating Effect of Green Infrastructure on Environmental Degradation in Nigeria Urban Centres **Dipeolu Adedotun Ayodele & Fadamiro Joseph Akinlabi**			**PSR04**	**2016JIC-ST5-003** Analysis Of Factors Responsible For The Location Pattern Of Petrol Filling Stations In Akure, Nigeria **Olufayo, O. & Omole, F. K.**	**PSR05**	12:00 – 12:15
2016JIC-ST1-019 Assessment of Carbon Monoxide Levels in a Commercial District of Akure, Nigeria **Afolami, Adewale James; Ogunsote, Olu Ola; Elnokaly, Amira & Okogbue, Emmanuel Chilekwu**			**PSR04**	**2016JIC-ST5-005** Environmental Assessment Of Students Hostels In Federal University Of Technology, Akure, Nigeria **Rotowa, O.O.; Akinbode, T. & Gabriel, E.**	**PSR05**	12:15 – 12:30
2016JIC-ST1-026 Integrating Green Infrastructure to Enhance the Environmental Quality of High Density Residential Areas in Zaria **Musa Lawal Sagada**			**PSR04**	**2016JIC-ST5-014** An Appraisal Of The Geographical Influence Of The Cocoa Products Limited, Ile-Oluji As A Regional Agro-Pole In Ondo State, Nigeria **Akinbamijo, O. B. & Adegboyegun, K. A.**	**PSR05**	12:30 – 12:45
2016JIC-ST1-063 Integrating Life Cycle Assessment Into Architectural Practice In Nigeria **Oladokun, Oyindamola S. & Odekunle, Oluwole Olayide**			**PSR04**	**2016JIC-ST5-059** Environmental Impact of Petrol Retail Outlets in Selected Local Government Areas of Osun State, Nigeria **Emmanuel, A. A. & Adisa, A. O.**	**PSR05**	12:45 – 13:00
2016JIC-ST1-071 The Building Profession and the Challenges of Achieving Sustainable Buildings in Nigeria **Abiodun, Isaac**			**PSR04**	**2016JIC-ST5-029** A Survey On Social Studies Teachers' Opinion On Factors Inhibiting Successful Implementation Of Millennium Development Goals In Nigeria **Salihu, Jamilu Ja'afar & Adamu, Sule**	**PSR05**	13:00 – 13:15
2016JIC-ST1-072 Economic Impacts Of Energy Consumption And Supply In Office Buildings of Kaduna Metropolis, Nigeria **Salihu Murtala Muhammad & Ejeh Ekoja David**			**PSR04**	**THEME 6 Architecture and National Development** **2016JIC-ST6-003** Contextual Harmony Between Traditional Architecture And City Identity In Ebonyi State, Nigeria **Onanuga O. A.; Folorunso C. O. & Ajewole M.**	**PSR05**	13:15 – 13:30
Lunch					**Corridors of 2500-capacity auditorium**	**13:30 – 14:30**
Networking and Stakeholders meeting					**2500-capacity auditorium and the Vice Chancellor's Office**	**14:30 - 15:30**
PARALLEL SESSION 2					**PSR01 - PSR05**	**15:30 – 17:00**

Session 1B - Session Chairman – Prof. S. R. Ogunduyile (IDD) Rapporteur – Dr. Y. M. D. Adedeji (ARC)	Venue	Session 2B - Session Chairman – Prof. B. E. Ojo (IDD) Rapporteur – Dr. (Mrs) R. A. Oladapo	Venue	Session 3B - Session Chairman – Prof. D. R. Ogunsemi (QSV) Rapporteur – Dr. C. O. Folorunso	Venue	Time
THEME 1 **Innovations, Environmental Friendliness and Adaptability**		**THEME 2** **Real Estate, Valuation and Management**		**THEME 3** **Landscape Design, Tourism and Remote Sensing**		
2016JIC-ST1-037 Towards Achieving Low Cost Housing: Use of Traditional Building Materials (A case study of Fayose Estate, Ado-Ekiti, Nigeria). **Victor Olufemi Adegbehingbe**	**PSR01**	**2016JIC-ST2-036** Application of Construction Management, Procurement and Project Delivery Systems by Private housing developers in Nigeria for sustainable development **Raimi, Taofiq Idowu**	**PSR02**	**2016JIC-ST3-009** Assessing Nature-Based Tourism Potentialss For Socio-Economic Development In Ekiti State, Nigeria **Adeyemo, Akinola & Bada, Afolabi O.**	**PSR03**	15:30 – 15:45
2016JIC-ST1-058 Compressive Strength Characteristics of Laterized Palm Kernel Shell Concrete **Popoola, O.C.; Obaju, N.B. & Alake, O.**	**PSR01**	**2016JIC-ST2-041** Perceptions of Construction Practitioners on the Benefits of Construction Change Management Practices **Adedokun, Olufisayo Adewumi**	**PSR02**	**2016JIC-ST3-013** A Critique Of The Implementation Of Abuja Tourism Development Master Plan **Idris Isah Iliyasu**	**PSR03**	15:45 – 16:00
2016JIC-ST1-070 Evaluation of Different Plastering Materials for Mud Buildings **Alabadan B. A.; Ajayi E. S. & Y. P. Musa**	**PSR01**	**2016JIC-ST2-043** Assessment of Construction Cost Escalations in the Public Sector's Projects in Lagos State, Nigeria **Fatoye, E. O.; Enenmoh, R. C.; Opara, V. I. & Oyekanmi, O. O.**	**PSR02**	**2016JIC-ST3-016** Socio-Economic Impacts of Architecture on Sustainable Tourism Development in Nigeria: Case Study of Idanre Hills, Ondo State **Ola, Omobolanle Arike & Ayeni, Dorcas A.**	**PSR03**	16:00 – 16:15
2016JIC-ST1-073 Statistical Investigation Of Effects Of Different Brands Of Cement On The Strength Of Pavers **Yusuff, A. Q.; Adams,B. A.; Olatoke,T. I.; Emmanuel, I. B.; Adedeji, M. S. & Bankole, S. O.**	**PSR01**	**2016JIC-ST2-053** Assessment of Organisational Culture and Employee Commitment in Construction Companies in Lagos State Nigeria. **Abiola-Falemu, Joseph Ojo**	**PSR02**	**2016JIC-ST3-018** City Aesthetics And Sustainable Recreational Open Spaces In Planned Residential Estates: Focus On Lsdpc Estate, Lekki, Lagos, Nigeria **Ajenifujah-Abubakar, A. O.; Ayeni, Dorcas A. & Fadamiro, J. A.**	**PSR03**	16:15 – 16:30
2016JIC-ST1-074 Comparative And Statistical Analysis Of The Strength Of Pavers Made From *Milicia Excelsa* And *Gmelina Arborea* Sawdust **Yusuff, A. Q.; Adewole, A. T.; Shaib-Rahim, H. O.; Awotedu, O. L.; Alarape, A. B. & Adedeji, M. S.**	**PSR01**	**2016JIC-ST2-061** Factors Affecting Construction Project Handover and Feedback Mechanism **Oke, A. E.; Olatunji, S. O. & Ajulo, A. A.**	**PSR02**	**2016JIC-ST3-028** The Economic Impact Of Ikogosi Warm Spring On Its Immediate Environment **Olanrewaju, D. O. & Adedeji A. A.**	**PSR03**	16:30 – 16:45
2016JIC-ST1-076 Effect Of Blended Cement On The Hydration Properties, Compressive Strength And Environmental Compatibility Of Concrete **Folagbade Samuel Olufemi**	**PSR01**	**2016JIC-ST2-073** The Issue of Communication in the Construction Industry: A case of South Africa **Berenger, Yembi Renault & Justus, Ngala Agumba**	**PSR02**	**2016JIC-ST3-025** Graphic Communication For Sustainable Development: Eliciting Desired Response From Target Audience **Ebigbagha Zifegha Sylvester**	**PSR03**	16:45 – 17:00
Session 4B - Session Chairman – Prof. A. S. Asaju (ESM) **Rapporteur – Dr. T. O. Odeyale (ARC)**			**Venue**	**Session 5B - Session Chairman – Prof. O. M. Bello (ESM)** **Rapporteur – Dr. E. B. Oladunmoye (IDD)**	**Venue**	**Time**
THEME 4 **Education and Professional Ethics**				**THEME 5** **Physical Planning, Urban Renewal and Urban Poverty**		
2016JIC-ST4-008 Impact Of School Environments On Academic Performance: Feedback From Senior Secondary School Students **Okafor, C. A.; Maina, J. J.; Stephen, H. & Ohambele, C. C.**			**PSR04**	**2016JIC-ST5-013** Effect Of Infrastructure Provision On Residential Property Values In Ijaiye Housing Estate, Lagos, Nigeria **N.B. Ezeokoli & A. E. Nwosu**	**PSR05**	15:30 – 15:45
2016JIC-ST4-027 Promoting Environmental Sustainability For The Attainment Of Agenda 2063 In Nigeria: The Role Of Social Studies Education **Salihu, Jamilu Ja'afar & Muhammed, Aminu**			**PSR04**	**2016JIC-ST5-018** Residents' Participation in Infrastructure Provision and Maintenance in Residential Neighbourhoods in Akure, Nigeria **Fakere, A. A. & Ayoola, H. A.**	**PSR05**	15:45 – 16:00
2016JIC-ST4-030 Developing Independent Learning Among Lower And Middle Basic Pupils: The Impact Of Inquiry Teaching Strategy On Learners' Cognition Level			**PSR04**	**2016JIC-ST5-030** Assessment Of Local Government Council And Community-Based Development Associations In	**PSR05**	16:00 – 16:15

Salihu, Jamilu Ja'afar; Yahaya, Idris A'ishatu & Abdullahi, Munirat Binta		The Provision Of Infrastructure In Ilawe-Ekiti, Nigeria **Okosun, S. E. & Olujimi, J. A. B.**			
2016JIC-ST4-021 Mapping Of Secondary Educational Institutions Using Gps & Gis Technology In Shomolu Local Government Area Of Lagos, Nigeria **Oseni, Ayokunle Ebenezer & Ode Godwin Omenka**	**PSR04**	**2016JIC-ST5-043** Assessment Of Local Government Council And Community-Based Development Associations In The Provision And Maintenance Of Educational Facilities In Ilawe-Ekiti, Nigeria **Okosun, S. E. & Olujimi, J. A. B.**	**PSR05**	16:15 – 16:30	
2016JIC-ST4-028 Impact Of Field Trip Technique On Students' Cognition Level Of Environmental Health Hazards In Junior Secondary Schools, Kaduna State-Nigeria **Muhammed, Aminu & Salihu, Jamilu Ja'afar**	**PSR04**	**THEME 4** **Education and Professional Ethics** **2016JIC-ST4- 001** Facilities Maintenance-Towards Enhancing Learning and Teaching Environments: Case Studies of Higher Education Institutions (HEIs) in Nigeria **Mohammed Olowoake**	**PSR05**	16:30 – 16:45	
2016JIC-ST4-026 Community Participation In Education: The Role Of Parent Organizations (Pos) In Decision Making Process **ALFA, Muhammad Gimba**	**PSR04**	**2016JIC-ST4-018** Appraisal Of Stakeholder Management Practice In Tertiary Education Trust Fund (TETFund) Construction Projects **M. L. Ibrahim; Y. M. Ibrahim & K. J. Adogbo**	**PSR05**	16:45 – 17:00	

DAY 2: TUESDAY 22ND MARCH 2016					**Venue**	**Time**
REGISTRATION					**2500-capacity auditorium**	**08:00 – 08:30**
PARALLEL SESSION 3					**PSR01 - PSR05**	**08:30 – 10:00**
Session 1C - Session Chairman – Prof. J. O. Agbede (APH) **Rapporteur – Dr. O. Bamidele (ESM)**	**Venue**	**Session 2C - Session Chairman – Dr. M. A. Oyinloye (URP)** **Rapporteur – Dr. M. B. Ogunleye (ESM)**	**Venue**	**Session 3C - Session Chairman – Dr. A. E. Olajuyigbe (URP)** **Rapporteur – Dr. O. F. Kayode (IDD)**	**Venue**	**Time**
THEME 1 **Innovations, Environmental Friendliness and Adaptability**		**THEME 2** **Real Estate, Valuation and Management**		**THEME 3** **Landscape Design, Tourism and Remote Sensing**		
2016JIC-ST1-003 The levels of building stakeholders' motivation for adopting green buildings **Ayokunle Olubunmi Olanipekun**	**PSR01**	**2016JIC-ST2-017** Effect of Contractor's Selection Criteria on Cost Performance of Civil Engineering Projects **Akinmusire, A. O.; Adedokun, O. A. & Aje, I. O.**	**PSR02**	**2016JIC-ST3-034** Evaluation Of Pre-Consumer Textile Waste Treatment Practices And It's Potential For Economic Sustainablity In Akure, Ondo State **Adiji, Bolajoko Esther & Fagbenro, F. Moyo**	**PSR03**	08:30 – 08:45
2016JIC-ST1-009 An Assessment Of The Role Of Nigerian Architects Towards Climate Change And Global Warming In The Built Environment **Hassan Ozovehe Saliu & Lukman Achimugu**	**PSR01**	2016JIC-ST2-023 Effect of Unethical Practices on Procurement Performance of Public Building Projects in Edo State, Nigeria **Ebekozien A.; Uwadia, F. E. & Usman, D. A.**	**PSR02**	**2016JIC-ST3-040** Training for Industrial Design Product Development and Manufacturing in Nigeria: Implications for Sustainable Economic Development **Femi Kayode & Kanu, E. U.**	**PSR03**	08:45 – 09:00
2016JIC-ST1-011 Low Cost Approach to Energy Efficient Buildings in Nigeria: A Review of Passive Design Options **Ochedi, Ekele Thompson; Taki, Ahmad & Painter, Birgit**	**PSR01**	**2016JIC-ST2-040** Readiness of the Nigerian Building Consulting Firms to Adopt Lean Construction Principles **Olamilokun, O..; Ibrahim, A. D. & Ahmadu, H. A.**	**PSR02**	**2016JIC-ST3-035** Merging, Art, Design And Technology: A Virtual Tour Design Of The Department Of Industrial Design, Federal Univerity Of Technology, Akure, Nigeria **Ibiwoye, T. I.; Ogunlade, B. & Ugah, H. O.**	**PSR03**	09:00 – 09:15
2016JIC-ST1-013 Climate Change And Challenges Of Environmental	**PSR01**	**2016JIC-ST2-044** Assessment Of Construction Productivity Of	**PSR02**	**2016JIC-ST3-042** Adoption of sustainable risk management: A	**PSR03**	09:15 – 09:30

Sustanability In Lagos State, Nigeria **Dipeolu, A. A.;** **Jolaoso, B. A. & Elemide, O. O.**		Indigenous Construction Firms In Southwestern, Nigeria **Olawale T. Akinmoladun & Ibironke E. Ariyo**		study of chemical exposure in textile industry in Nigeria **Akintayo, Wole Lateef**		
2016JIC-ST1-014 Evidence Of Climate Change And Adaptation Strategies Among Grain Farmers In Sokoto State, Nigeria **Ikpe, E.' Sawa, B. A.; Ejeh, U. L.; Meshubi O. A. & Oladimeji J. S.**	**PSR01**	**2016JIC-ST2-046** Assessment of Lean Construction Practice in the Nigerian Construction Industry **Adegbembo, T. F.; Bamisaye, O. P. & Aghimien, D. O.**	**PSR02**	**2016JIC-ST3-030** Preference of Visual Aesthetic Architectural Features amongst Practicing Architects **Omale R. P.**	**PSR03**	09:30 – 09:45
2016JIC-ST1-015 Analysis Of Public Perception Of Climate Change And Its Impact On Health And Environment In Zaria City And Its Environs **Ikpe, E.' Sawa, B. A.; Ejeh, U. L.; Meshubi O. A. & Oladimeji J. S.**	**PSR01**	**2016JIC-ST2-052** Sustainability of Compressed Stabilized Interlocking Earth Blocks (CSIEB) for Building Construction in Nigeria **Aghimien, Douglas Omoregie & Awodele, Oluwaseyi Alabi**	**PSR02**		**PSR03**	09:45 – 10:00
Session 4C - Session Chairman – Dr. A. A. Taiwo (ARC) **Rapporteur – Dr. A. M. Adebayo (ESM)**			**Venue**	**Session 5C - Session Chairman – Dr. (Mrs) V. A. Bello (ESM)** **Rapporteur – Dr. G. E. Ajayi (SVG)**	**Venue**	**Time**
THEME 4 **Education and Professional Ethics**				**THEME 5** **Physical Planning, Urban Renewal and Urban Poverty**		
2016JIC-ST4-012 User Perception Of Comfort In Offices: A Case Study Of Architecture And Quantity Surveying Departments, Ahmadu Bello University **Stephen, H.; Maina, J. J.; Okafor, C. A. & Ohambele, C. C.**			**PSR04**	**2016JIC-ST5-039** Characterising Peri-Urban Sprawl Of A City In A Developing Country: Case Study Of Ibadan, Nigeria **Fasakin, J. O. ; Dosumu, N. A. & Omole, F. K**	**PSR05**	08:30 – 08:45
2016JIC-ST4-013 Assessment Of The Relatedness Of Quantity Surveyor's Skill Requirements For Diversification Of Practice Firms In Nigeria **Akinola, Joseph Aderemi; Ogunsemi, Deji Rufus & Awodele, Oluwaseyi Alabi**			**PSR04**	**2016JIC-ST5-046** Public Infrastructural Facilities and Urban Fringe Development in Developing Nations: A Focus on Ibulesoro, Ondo State, Nigeria **Olamiju, I. O.; Oyinloye, M. A. & Daramola, J. O.**	**PSR05**	08:45 – 09:00
2016JIC-ST4-015 Assessing The Cad Proficiency Level Of Architecture Graduates In Selected Architectural Firms In Akure, Nigeria **Olasunkanmi Samson Fagbemi; Adesola Moyosoluwa Ojo & Ayeni, Dorcas A.**			**PSR04**	**2016JIC-ST5-047** The Challenges Of Urban Sprawl Development In Suleja, Niger State **Idowu, O.O.; Shaibu, S. I.; Adeleye, B. M.; Medayese, S. O. & Abd'razack, N. T. A.**	**PSR05**	09:00 – 09:15
2016JIC-ST4-023 Effective Training for Construction Craftsmen and Optimisation of Productivity in the Nigerian Construction Industry **Dantong, Jack Sam Dalyop; Prucnal-Ogunsote, Bogda & Awulu, Samson**			**PSR04**	**2016JIC-ST5-052** Ajoda New Town Development, Oyo State, Nigeria: Lessons For Building Future New Towns In A Sustainable Manner **Ayangbile, Oluwabukola Adetola**	**PSR05**	09:15 – 09:30
2016JIC-ST4-024 Unethical Professional Practices and Poor Craftsmanship of Construction Projects Performance in Nigeria: Consequences and the Way Forward **Dantong, Jack Sam Dalyop; Prucnal-Ogunsote, Bogda; Okwoli, Peter & Dassah, Elizebeth**			**PSR04**	**2016JIC-ST5-057** Assessment of Peri–Urban Zones in Benin City, Nigeria: A Focus on Ekiadolor Community **Ayo E. Olajuyigbe & Olufolake A. Ayodele**	**PSR05**	09:30 – 09:45
THEME 6 **Architecture and National Development**			**PSR04**	**2016JIC-ST5-025** Building Tradition, Slum and Housing the Urban Poor: An Exploratory Study **T. Oluwaseyi Odeyale & Kayode Fagbemi**	**PSR05**	09:45 – 10:00
2016JIC-ST6-002 Effects Of Globalization Of Information Technology Communication Facilitieson Architectural Practice In Nigeria **Adegbehingbe,Victor Olufemi & Ogundiran, Ibikunoluwa Ajibola**						

TEA BREAK					**Corridors of 2500-capacity auditorium**	**10:00 – 10:30**
KEYNOTE ADDRESS 3 – Prof. Charles Egbu **Topic: Quality and Robustness in Ph.D Research**					**2500-capacity auditorium**	**10:30 – 12:00**
INDUSTRY DEBATE - Challenges and Solutions of achieving sustainability in Nigeria					**2500-capacity auditorium**	**12:00 – 13:30**
Chair/Moderator – Dr. Ayo Olajuyigbe 4 Panelists – Chairmen of Built Industry professional associations in Ondo State					2500-capacity auditorium	12:00 – 13:00
Questions and Answers					2500-capacity auditorium	13:00 – 13:30
Lunch					**Corridors of 2500-capacity auditorium**	**13:30 – 14:30**
PARALLEL SESSION 4					**PSR01 - PSR05**	**14:30 – 16:00**
Session 1D - Session Chairman – Dr. O. I. Aje (QSV) **Rapporteur – Dr. H. A. Ayoola (ARC)**	**Venue**	**Session 2D - Session Chairman – Prof. M. A. K. Smith (CSP)** **Rapporteur – Dr. N. Saka (QSV)**	**Venue**	**Session 3D - Session Chairman – Dr. J. O. Basorun (URP)** **Rapporteur – Dr. A. E. Oke (QSV)**	**Venue**	**Time**
THEME 1 **Innovations, Environmental Friendliness and Adaptability**		**THEME 2** **Real Estate, Valuation and Management**		**THEME 3** **Landscape Design, Tourism and Remote Sensing**		
2016JIC-ST1-005 ICT Integration In The Transport System **Nwankwo, Benjamin N.**	**PSR01**	**2016JIC-ST2-057** Impact of Macroeconomic Factors on Production Costs of Building Project in South-South Region of Nigeria **Emmanuel T. Adu & Anjiba D. Lamptey-Puddicombe**	**PSR02**	**2016JIC-ST3-005** Mapping and Analysis of Urban Land Use and Land Cover in Akure, Nigeria **Simeon Ogunlade & Gbenga Enisan**	**PSR03**	14:30 – 14:45
2016JIC-ST1-012 Socio-economic consideration of Housing Transformers and Non-transformers in Selected Government Estates in South-Western, Nigeria **Victor Olufemi Adegbehingbe**	**PSR01**	**2016JIC-ST2-069** Project risk factors effects on civil construction cost in the Niger Delta Region Contractors' and Consultants' Perspectives **Anjiba D. L. & Emmanuel, T. A.**	**PSR02**	**2016-JIC-ST3-011** Geospatial Analysis of the Distribution of Health Facilities in Peri-urban area of Ifedore, Nigeria **Olusola Popoola; Yusuph Adekoya & Tayo Obasanmi**	**PSR03**	14:45 – 15:00
2016JIC-ST1-020 Sustainable Site Planning; A Soil Conservation Strategy for Residential Developments in Lagos, Nigeria **Akagwu Mamajaunkwun**	**PSR01**	**2016JIC-ST2-071** Budgetary Reliability of Design Stage Elemental Cost Plan in Building Procurement **Adafin, J.; Wilkinson, S.; Rotimi, J. O. B. & Odeyinka, H.**	**PSR02**	**2016JIC-ST3-022** A Gis Approach In Spatial Distribution Of Water Pipeline Through Primary And Secondary Network In Lagos State **Ariyo T.O.; Tata H. & Omogunloye O. G.**	**PSR03**	15:00 – 15:15
2016JIC-ST1-031 Impact Of Cities Physical Development On The Aged Lifestyle In Akure, Nigeria **Onanuga Omotayo Adebayo**	**PSR01**	**2016JIC-ST2-072** Methodological Approaches to Risk Assessments during Cost Plan Production **Adafin, J.; Wilkinson, S.; Rotimi, J. O. B. & Odeyinka, H.**	**PSR02**	**2016JIC-ST3-023** Mapping And Spatial Distribution Of Petroleum Products By Marketers In Nigeria **Tata. H.; Ariyo T.O. & Omogunloye O. G.**	**PSR03**	15:15 – 15:30
2016JIC-ST1-055 Perception Of Residents On Impact Of Proximity Of Religious Camps On Residential Properties In Nigeria **Adeniran, Y. Olusegun & Bamidele M. Ogunleye**	**PSR01**	**2016JIC-ST2-097** Impact of Risks on Tendering and Procurement of Building Projects in Lagos State **Dosumu, Oluwaseun Sunday**	**PSR02**	**THEME 5** **Physical Planning, Urban Renewal and Urban Poverty** **2016JIC-ST5-050** Sustainable Urban Development and Management Strategies in Nigeria **Joseph Akinlabi Fadamiro & Joseph Adeniran Adedeji**	**PSR03**	15:30 – 15:45
2016JIC-ST1-066 Assessing Compliance With Noise Control Guidelines In The National Building Code For Residential Estates In Ondo And Ekiti States, Nigeria **Ganiyu, Sikiru Abiodun**	**PSR01**	**2016JIC-ST2-056** Risks Associated With Stakeholders At The Pre-Contract Stage Of Construction Projects In Ondo State, Nigeria **Dorcas Moyanga & Michael Ayodele**	**PSR02**	**THEME 2** **Real Estate, Valuation and Management** **2016JIC-ST2-016** A Study of Developers Speculative Activities in Lagos Urban Fringe **Esther O. Thontteh**	**PSR03**	15:45 – 16:00

Session 4D - Session Chairman – Dr. K. T. Gbadamosi (TMT) Rapporteur – Dr. O. S. Adelabu (IDD)	Venue	Session 5D - Session Chairman – Prof. (Mrs) O. F. Osundahunsi (FST) Rapporteur – Dr. O. O. Ojuri (CVE)	Venue	Time
THEME 4 **Education and Professional Ethics**		**THEME 5** **Physical Planning, Urban Renewal and Urban Poverty**		
2016JIC-ST4-004 Pedagogic experience of spreadsheet applications to contemporary valuation of property investments: Perspective of the Federal Polytechnic, Idah **Ataguba, Joseph Obaje & Ogungbenro, Matthew Taiwo**	**PSR04**	**2016JIC-ST5-048** Slum Development and Urban Renewal in Nigeria **Chidinma Emma-Ochu & Onwuka, Ethelbert**	**PSR05**	14:30 – 14:45
2016JIC-ST4-007 Drawing Pre-Knowledge And Design: A Case Study Of Year Two Undergraduate Architecture Students Of Ahmadu Bello University **Ohambele, C. C.; Maina, J. J.; Stephen, H. & Okafor, C. A.**	**PSR04**	**2016JIC-ST5-055** Appraisal of Characteristics of Slum Neighbourhood of Minna, Niger State **Adeleye, B.M.; Abd'razack, N.T.A.; Ndana, M.; Akande, O. S. & Popoola, A. A.**	**PSR05**	14:45 – 15:00
2016JIC-ST4-016 Sustainable Architectural Education: Perceptions From University Of Jos Post Graduate Students **Allu, Evelyn L. A.**	**PSR04**	**2016JIC-ST5-066** Comprehending the Role of People in Urban Redevelopment in Indian Cities **Dillip Kumar Das; Sanjaykumar G. Sonar & Fidelis Emuze**	**PSR05**	15:00 – 15:15
2016JIC-ST4-019 Factors Affecting Academic Performance of Architecture Students in Nigerian Private Universities **Opoko Akunnaya Pearl; Oluwatayo Adedapo Adewunmi & Ezema Isidore C.**	**PSR04**	**2016JIC-ST7-006** Investigating Slum Household Living Conditions In Aso Pada- Ward, Mararaba, Karu L.G.A. Of Nasarawa State, Nigeria **Kigun, P. A.; Surajo, L. A.; Buba, Y. A.; Majidadi, T. S. & Makwin, G.**	**PSR05**	15:15 – 15:30
2016JICST4-025 Architectural Transformations in an Educational Facility and its Impact on Teaching and Learning: a Study of the Department of Architecture Ahmadu Bello University Zaria **Halima Sani-Katsina & Aisha Umar Shuaib**	**PSR04**	**2016JIC-ST5-049** Gender Involvement In Sustainable Water Project Management In Ibadan, Nigeria: A Physical Planning Perspective **Olusa Adekemi; Olujimi Julius & Okoko Eno**	**PSR05**	15:30 – 15:45
THEME 2 **Real Estate, Valuation and Management**	**PSR04**	**2016JIC-ST5-028** Infrastructure Management in Peri-Urban Communities of Developing Nations: A Focus on Akure, Nigeria. **Olamiju Isaac. Oluwadare & Fasakin Julius. Olubunmi**	**PSR05**	15:45 – 16:00
2016JIC-ST2-018 State of Construction Change Management Practices in Ondo State, Nigeria **Adedokun, Deborah Oluwafunke**				

DAY 3: WEDNESDAY 23RD MARCH 2016					**Venue**	**Time**
REGISTRATION					**2500-capacity auditorium**	**08:00 – 08:30**
PARALLEL SESSION 5					**PSR01 - PSR05**	**08:30 – 10:00**
Session 1E - Session Chairman – Prof. S. D. Alfred (AEC) Rapporteur – Dr. T. O. Odeyale (ARC)	**Venue**	**Session 2E - Session Chairman – Prof. G. E. Onibi (CRC) Rapporteur – Dr. A. E. Oke (QSV)**	**Venue**	**Session 3E - Session Chairman – Dr. C. O. Folorunso (ARC) Rapporteur – Dr. J. O. Faseun (URP)**	**Venue**	**Time**
THEME 1 **Innovations, Environmental Friendliness and Adaptability**		**THEME 2** **Real Estate, Valuation and Management**		**THEME 5** **Physical Planning, Urban Renewal and Urban Poverty**		

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2016JIC-ST1-029 Control of Daylight and Natural Ventilation in Traditional Architecture of Ghadames, Libya **Jamal Alabid; Ahmad Taki & Birgit Painter**	**PSR01**	**2016JIC-ST2-062** The application of HSE in building construction – A case study of Moroto Regional Referral Hospital in Northern Uganda **Ishaq Ahmed Sohag & Mumtaz Ahmed Sohag**	**PSR02**	**2016JIC-ST5-032** Problems And Prospects Of Faecal Waste (Excreta) In Human Societies **Rotowa, O.O. & Gabriel, E.**	**PSR03**	08:45 – 09:00
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2016JIC-ST2-074 A Conceptual Model For Planning Construction Project In Abuja, Nigeria **AbdulAzeez, Abubakar Darda'u; Umar, Bello & Kado, Dikko**			**PSR04**	**2016JIC-ST5-023** Inner City Decay And Rehabilitation In Ile-Ife, Nigeria **Adewale Olufunlola Yoade & L.M. Olayiwola**	**PSR05**	08:45 – 09:00
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Questions and Answers					2500-capacity auditorium	09:30 – 09:45
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Questins and Answers					2500-capacity auditorium	10:45 – 11:00
TEA BREAK					**Corridors of 2500-capacity auditorium**	**11:00 – 11:30**
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Triple Bottom Line Approach **O. O. Olanrewaju & A. A. Ilemobade**		**Ige, Victor Olutope & Akinlabi, Akintomide Joseph**		**Lawan Musa & Isa Muhammad Zumo**		
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				Adegbembo, T. F.		
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				2016JIC-ST2-027 Value Profiling Of End-Users' Housing Needs In Selected Housing Scheme In Kaduna State **Fadason, Ruya Tambaya; Musa-Haddary; Yakubu Gamson & Ahmed Doko Ibrahim**	**PSR03**	15:15 – 15:30
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2016JIC-ST3-015 Mapping for Community Development: A Case Study of Apatapiti Community North East, Akure-Nigeria **Simeon Ogunlade, Samuel Tijani**						
THEME 5 **Physical Planning, Urban Renewal and Urban Poverty**			**PSR04**		**PSR05**	14:30 – 14:45
2016JIC-ST5-034 Akure Urban Land Use Change Detection Analysis Using Geographical Information System **Owoeye J.O.; Ibitoye O.A.; Hall S. & Sinnett. D.**						
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2016JIC-ST5-009 Crime Mapping and Analysis in the Core Area of Akure, Nigeria **Olajuyigbe, A; Omole, K; Bayode, T and Adenigba, A.**			**PSR04**		**PSR05**	15:00 – 15:15
2016JIC-ST5-010 Land Use Impact and Environmental Health Hazard of Abattoir Location in Ilesa, Osun State, Nigeria **Olukayode Rotowa & Gbenga Enisan**			**PSR04**		**PSR05**	15:30 – 15:30
WHERE DO WE GO NEXT? – Prof. F. K. Omole						**15:30 – 16:00**
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Closing Remark – Prof. O. Arayela or Prof Charles Egbu					**T.I. Francis Auditorium**	

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SUB-THEME ONE

Innovation, Environmental Friendliness and Adaptability

Building Adaptation and the Impact of Maintenance Budget: Case Studies of Selected Higher Education Institutions in Nigeria

Olowoake Mohammed

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ABSTRACT

The purpose of this study is to proffer solutions to shortages of staff offices and lecture rooms in Higher Education Institutions where old existing buildings are abandoned. However, such buildings could be adapted and backed up with adequate budgets. A cursory look at some of the HEIs buildings studied suggests that they are abandoned. The objectives are: To evaluate Works and Services Departments constraints in relation to building adaptation and budgets by conducting semi-structured interviews (qualitative), and survey (quantitative) for the staff and students of the selected HEIs in Nigeria; to develop a strategic framework to support building adaptation and effective budgeting techniques, and evaluate the framework by conducting interviews for experts. The study reveals some interesting results: Shortage of staff offices and lecture rooms could be resolved by adapting existing abandoned buildings after renovations. Data for budgeting for adaptation could be collected via reconnaissance surveys and letters of complaint for defects from the users. On the basis of the findings, these recommendations have been proposed: The Works and Services Departments could carry out reconnaissance surveys of their built environments with a view to identifying the affected buildings. The use of appropriate data collection techniques for the budget preparation is very essential. In addition, letters of complaint for defects from the assets users are also essential.

Keywords: Abandoned, Adaptation, Budget, Environment, Performance

INTRODUCTION

Wilkinson et al., (2011) define adaptation as a means of reducing building related urban energy consumption and greenhouse gas emissions. They add that, the need to adapt buildings and to reduce environmental footprints increase as the world concentrations of carbon increase, as built environment contributes half of all greenhouse gas emissions, and government is called upon to look for ways to lessen the part cities play in global warming, and adaptation is a sensible means of reducing building related greenhouse gas emissions-in order to mitigate the impacts of climate change and enhance the city for another generation of citizens and users. Fianchini (2007) explains that, adaptation is any work to a building over and above maintenance in order to change the building capacity, function or performance that is any intervention to adjust, reuse, or upgrade a building to suit new condition or requirements. In addition, there is the need for maintenance budget.

Adaptation factors include economic, social, environment, technological, legal and physical categories (Wilkinson et al., 2009, Remoy and Vander, 2007). Others include local economy, age of asset; physical conditions, heritage value, size and user demand (Fianchini, 2007). Building adaptation is an "essential component of sustainable development" as large numbers of obsolete buildings might blight the built environments, and after adaptation, they increase the value of the assets (Wilkinson et al., 2011).

In addition, the provision of an annual maintenance budget is germane to effective and efficient building adaptation, and such budget to be prepared from the reconnaissance surveys of the built environments. However, submission of an annual adaptation budget derived from reconnaissance survey of the built environment could accompany the use of maintenance toolkit. (Olanrewaju et al., 2011) assert that, "budgetary allocation for tertiary institutions buildings adaptation on annual basis is only one percentage of the total allocation for the

Olowoake, M. (2016). Building adaptation and the impact of maintenance budget: Case studies of selected higher education institutions in Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. *Procs. of the Joint International Conference (JIC) on* 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 2-7

education sector, and this is inadequate to cater for the maintenance backlogs".(RICS, 2009) asserts that, "any maintenance operation should be run to budget, and should be set up by taking information from the data collected".

Objectives of the Research

i. To review literature on building adaptation and budgeting techniques
ii. To evaluate Works and Services Departments constraints in relation to building adaptation and budgets by conducting semi-structured interviews (qualitative), and survey (quantitative)
iii. To determine if there are adequate staff offices and lecture rooms for the staff and students of the selected HEIs in Nigeria.
iv. To develop a strategic framework to support building adaptation and effective budgeting techniques
v. To evaluate the framework (by conducting interviews for experts)

Research Methods

For the purpose of the study, the researcher used mixed methods, that is, semi-structure interviews (qualitative) and questionnaire survey (quantitative) to collect data. For the first phase of data collection, the researcher conducted semi-structured interviews for the twelve directors of works and services of the selected HEIs in Nigeria. The use of the qualitative approach enabled the researchers to gain insight into the phenomena being studied, have deep understanding of the study area, improve the accuracy of judgments, and ensure that the variance reflects that of the trait being studied and not that of the method. According to Creswell (2003) and Rubin and Rubin (2005) that interviews would facilitate the collection of data with sufficient depth thus allowing the researchers to draw both meanings and ideas from the research participants. In addition, the researcher used questionnaire survey for the second phase of data collection from the technical officers (to validate) of the selected HEIs works and services in Nigeria.

Results and Discussions-Qualitative

Use of appropriate Procurement Strategies: From semi-structured interviews conducted, the following emerged

i. Outsourcing: Contractors and Consultants
ii. In sourcing: Director of Works and Services or Interviewee, project or construction team, Maintenance Officers or in-house technical staff or Labour.
iii. Professionals: Combination of outsourcing and in-sourcing technical staff.
iv. Tendering Procedures (TP)
v. Fluctuations and Variations (FV)

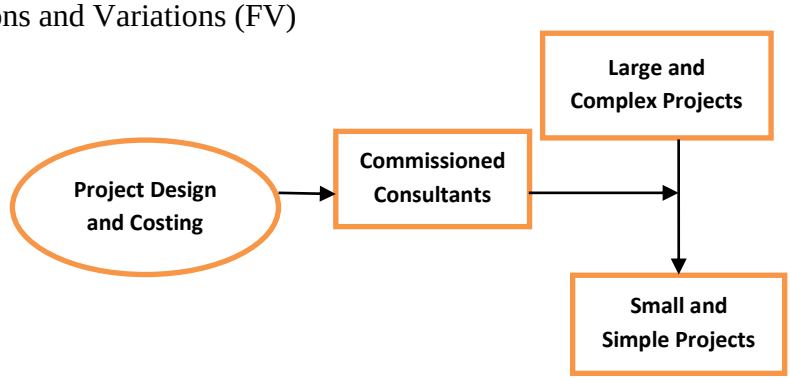

Figure 1: Use of Commissioned Consultants for project design and costing to achieve quality. Large and complex projects to be executed via outsourcing, and the in-house technical staffs to execute simple and small projects

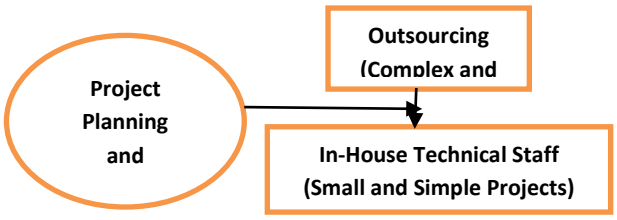

Figure 2 Project Execution-Large and complex projects to be outsourced, and small and simple projects to be executed by in-house technical staff

Figure 3 Procurement Strategies: Use of Outsourcing

Outsourcing involves contracting out of projects to qualified and competent contractors to execute. However, it is necessary to determine the type and nature of projects to be outsourced. From the interviews, large and complex projects could be outsourced, because of the complexities and the largeness of the projects. In addition, the departments could also outsource the project designs to qualified, experienced, and competent consulting firms to achieve quality. As it is the practice, the consulting firms, especially well-seasoned professionals among the personnel could be part of the project monitoring, control, supervision, and evaluation team (establishment of a control unit within the Works and Services Department).Other members of the team could be drawn from among the seasoned professionals in the Works and Services Department. The main duties of the unit are quality of project components, materials, and labour, with adequate considerations for cost and project agreed time. The unit monitors and controls project execution to avoid project over-run.

i. **Use of In-house Technical Staff:** The use of in-house technical staff to handle simple and small maintenance projects is desirable. Such projects can be more expensive if executed via outsourcing. These types of jobs are minor repair or replacement in nature, and they can be completed by the in-house technical staff within three- to-four days, and attracted little costs. In addition, the designs of such jobs could be handled by Consultants or by in-house technical staff (HEI-Planning and design unit).

Below shows the framework for "Planned Preventive Maintenance Method-Control Toolkits":

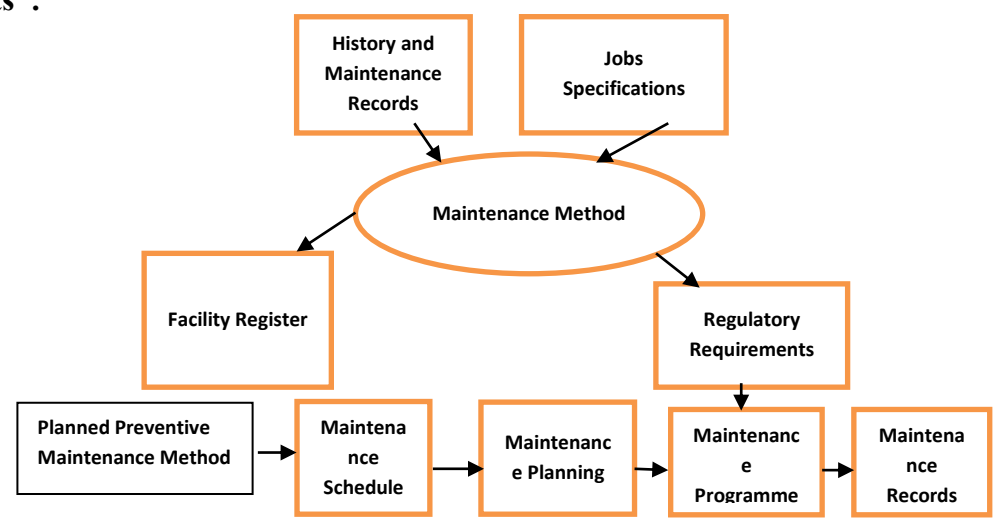

Figure 4: Maintenance methods involve the processes that could be adopted and used to cure, predict, or prevent failures occurring in buildings (Olanrewaju et al., 2011).

It is the organisation policy by the management that dictates the type of methods to be used by considering factors such as, culture, core business, technology, and other factors both internal and external to the organisation (RICS, 2009). Olanrewaju et al., 2011 assert that, most organisations prefer the use of curative method (restoration back to normal position), some combine conditions survey with curative method (that is, predictive with corrective methods).However, the best approach as confirmed from the interviews responses is **"Planned Preventive Maintenance**" method. To add more, this method prevents failures from occurring by using some maintenance control toolkit, such as, maintenance schedule, maintenance programme, jobs specifications, and facility register. Similarly, works and services departments of HEIs in Nigeria could attach the maintenance control toolkit with the annual maintenance budget (derived from the reconnaissance surveys of the built environments, and surveys conducted on users satisfaction of the built environments).

vi. Annual Adaptation Budget

From the semi-structured interviews conducted, there are various ways of calculating for HEIs Works and Services built environments budgets:

- **Budget Forecasting (BF)**
- **Previous Year Budget plus a Percentage Increase (PYBPI)**
- **Previous Year Budget with consideration for market prices of Components and Materials (PYBCM)**
- **Reconnaissance Surveys (RS)**

vii. **Below shows the framework for Maintenance Budget**

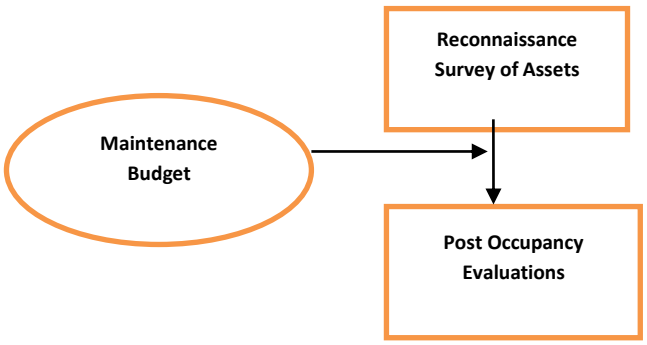

Figure 5 Maintenance Budget

From the results of the interviews, some of the HEIs do not run maintenance budget, they prefer the use of central budgeting system. Maintenance projects are carried out whenever there is the need to rescue situations that are going out of control (curative method).Those HEIs that are running maintenance budgets, majority of them prefer to add certain percentages to the previous year maintenance budgets for the coming year. Some HEIs use the prevailing market prices of labour, materials and components to add a lump sum to the previous year budget to make up for the year running, while some of them use Forecasting. However, none of the above mentioned techniques are suitable enough for the preparation of maintenance budgets for the HEIs built environments.

Results and Discussions-Quantitative

Out of a total of 156 respondents, 120 of them filled and returned the questionnaires. This is 76.92% of all the participants, and this makes the results obtained from the survey credible.

Majority of the HEIs Lecture rooms and Staff offices in Nigeria are provided with adequate facilities. However, there is room for improvement in the provision of adequate supply of furniture, ventilation, electricity, portable and drinkable water. Emphasis should also be placed on regular waste collection and treatment.

i. In the majority of the HEIs in Nigeria, complaints about noticed defects in staff offices and lecture rooms are lodged with the head (Director) of works and services departments.
ii. Majority of the HEIs works and services departments do not use maintenance budgets. Those that prepare and use maintenance budgets, use faulty techniques in the preparation of HEIs built environments annual maintenance budgets.
iii. Maintenance budgets of the HEIs built environments are prepared based on previous year budget plans.
iv. In most HEIs, response rate to Users' Complaints about defects are delayed due to delays being suffered by the works and services departments from the HEIs management in approving and releasing maintenance cash.
v. In addition, previous year maintenance projects in which maintenance cash was approved and released still re-appear in the following year (cultural influence) budget for implementation.
vi. Many of the HEIs Works and Services Departments base their maintenance budgets preparation on forecast.
vii. Most of the HEIs built environments noticed defects are major ones, due to delays in approving and releasing of maintenance cash by the HEIs management.
viii. Majority of HEIs works and services departments adopt and use faulty maintenance method and in-appropriate procurement strategy.
ix. Most HEIs do not carry out regular maintenance work on their built environments. This is due to the following: adoption and use of in-effective and in-efficient maintenance method, delays in approving and releasing maintenance cash, and adoption and use of in-appropriate procurements strategy.
x. Majority of HEIs works and services departments adopt and use curative and condition survey maintenance methods.
xi. Most HEIs works and services departments are under-funded due to the use of faulty maintenance budget, in-effective maintenance method, in-appropriate procurement strategy, and lack of sustainable programme.
xii. Majority of HEIs works and services departments do not have full complements of technical staff, hence, both small and simple projects and large and complex projects are outsourced. This makes the projects deliveries very expensive.
xiii. Majority of the HEIs works and services departments' staff members are not professionals. Most of the maintenance projects, budget preparation, and sustainable programmes are outsourced.
xiv. Most of the HEIs Works and Services Departments Technical staff lacks necessary technical skills and knowledge to perform their official duties satisfactorily.
xv. Majority of the HEIs prefer to keep backlogs of repairs and replacements of defects. They prefer building new staff offices and lecture rooms to maintaining the existing ones on time (curative method).
xvi. Most HEIs Chief Executives are not maintenance or technically inclined. They view regular maintenance of existing built environments as waste of revenue. They always favour erecting of new staff offices and lecture rooms for personal gains (attitudes).
xvii. Most HEIs do prefer existing buildings to be in dilapidated conditions or collapse before carrying out maintenance works on them (curative method).
xviii. Majority of the HEIs works and services departments do not prepare and use maintenance control toolkit. And, the absence of its use prevents the timely approval of maintenance budget, and adequate release of maintenance cash.
xix. Majority of the HEIs do not have full complements of technical staff, and those with full complements of technical staff, the staff do not have needed technical skills and

knowledge to perform their official duties satisfactorily. Most of them are not professionals, so, they out-source most of the maintenance projects.

Validated Framework

In order to validate the developed framework, semi-structured interviews were also conducted for Senior Technical Officers in four of the sampled HEIs in Nigeria. The question items bothered on the simplicity; sequences; adaptability, and cost effectiveness of the developed Framework. In summary, they all agreed that the framework is simple to understand, adaptable, and that, the stages involved are well arranged in sequential order. They argued further that, its use can help achieve effective project quality control, save cost, and ensures delivery to agreed time.

Conclusions

In Nigeria, some HEIs do not prepare and use maintenance budget. Those who prepare and use maintenance budgets derived from in-appropriate data collection techniques. For effectiveness, such data could be collected via carrying out reconnaissance survey of the built environment and from the letters of complaints from the assets users. The researcher used semi-structured interviews conducted for the 12 Directors of works and services departments of the selected HEIs to do the evaluations of the selected HEIs works and services departments in Nigeria. The strategies used for the development of the framework were derived from the literature review, and the results of the semi-structured interviews.

Recommendations

i. It is a good practice for each HEI to prepare and operate with maintenance budget, and such budget could be prepared from data derived from the reconnaissance survey, and users' satisfaction survey of the HEI built environment at the same time. This type of budget could be adequate and reliable.
ii. It is also a good practice for the HEI Works and Services Departments to carry out surveys of users' satisfaction of the built environment twice in a term time (at the beginning and at the end). This could enable the departments to know the needs and the feelings of the assets users.
iii. It is important for HEIs works and services departments in Nigeria to outsource large and complex projects, and use in-house technical staff for simple and small projects.
iv. HEIs works and services departments to establish quality control units within the departments.
v. HEIs works and services departments to adopt and adapt Planned Preventive Maintenance Method to preventive facilities failure and prolong their service years.
vi. HEIs works and services departments to prepare and use sustainable programme for their built environments.

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The Levels of Building Stakeholders' Motivation for Adopting Green Buildings

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ABSTRACT

As a result of the challenges that encircled green building in the building sector, building stakeholders' motivation for adopting green buildings has generated a considerable research interest in the literature. Given that building stakeholders' motivation for adopting green buildings is a psychology process, insights from the psychology theories of motivation such as Goal setting theory, Herzberg's two-factor theory etc. Revealed that the previous studies have only goal or intention at their core – meaning that they were only concerned with factors that promote (or not) the adopting of green buildings by building stakeholders. However, in addition to the core of goal or intention, there are different levels of motivation that leads to the achievement of the goal, and this is founded in another psychology theory, the self-determination theory (SDT) of motivation. Yet, this has not been explicitly (if at all) applied to explain the motivations for adopting green buildings by building stakeholders. The objective of this paper is to introduce the levels of motivation as proposed by SDT of motivation in terms of how they apply and predict building stakeholders' motivation for adopting green buildings. The methodology used was a Literature survey of 30 publications, the literature on the SDT of motivation, from the field of psychology, is used to inform the levels of building stakeholders' motivation for adopting green buildings, from the green building literature. The findings revealed that the levels of building stakeholders' motivation for adopting green buildings are external regulation, introjected regulation, identified regulation, integrated regulation and extrinsic motivation, and the difference in one level to another is the self-determination involved in a motivated action. As a recommendation, the design of policy interventions aimed at motivating the adoption of green buildings in the building sector should be structured based on the levels of building stakeholders' motivation**.** This paper concludes that the levels of motivation proposed by SDT of motivation can explain and predict building stakeholders' motivation for adopting green buildings.

Keywords: Developers, green building, motivation, psychology, self-determination theory, stakeholders.

INTRODUCTION

Green building is encircled with many challenges such as complex delivery process, high capital and transaction costs of development etc. (Qian, Chan and Ghani Khalid, 2015; Zhang et al., 2012), and as a result, motivation is a salient requirement for building stakeholders' adoption of green buildings (Cole, 2011). Consequently, many studies (Abidin and Powmya, 2014; Marker et al., 2014; Zhang et al., 2011) have delved into the subject of motivation, mainly as it applies to the building stakeholders' adoption of green buildings. The major contribution is the elicitation of the factors that promote building stakeholders' adoption of green buildings, and are categorised into government/polity factors, moral factors, economic/market factors, information and education factors, and lastly, corporate factors.

Clearly, this is a valuable contribution to the knowledge and practice of motivating the adoption of green buildings in the building sector. From the point of view of psychology theories of motivation, the previous studies have only the content of goal or intention at their core (Deci et al., 1991) - meaning that the previous studies were only concerned with factors that promote (or not) the adoption of green buildings by building stakeholders. Some of the psychological theories in question are Maslow's hierarchy of needs; Herzberg's two-factor theory etc. (see Kelly, 2004; Curtis, 2010). It should be emphasized that the concept of motivation is founded in psychology – which explains human behaviour or actions (Popa et al., 2013), and as observed by Nurul Diyana and Zainul Abidin (2013), the action of building

Olanipekun, A. O. (2016). The levels of building stakeholders' motivation for adopting green buildings. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F.? Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 8-19

stakeholders to adopt green buildings is a psychologically motivated process – for instance, from intention to forethought and to action.

However, in addition to the core of goal or intention (which is to build green), there are different levels of motivation that lead to the achievement of the goal (Green building). This can be found in another psychology theory, the self-determination theory of motivation (Ryan and Deci, 2000a). The SDT of motivation proposed that the motivation for the performance of an action has different levels – and the difference in one level to another is the self-determination involved in the performance of an action by a person or a group of people (Amabile, 1993, Rigby et al., 1992). In an increasing order of self-determination, these levels of motivation range from external regulation, introjected regulation, identified regulation, integrated regulation and intrinsic motivation (see Pelletier, Tuson and Haddad, 1997; Pelletier et al., 1995).

However, the levels of motivation, as proposed by SDT of motivation has not been explicitly (if at all) applied to explain the motivations for adopting green buildings by building stakeholders, and according to Healy (2015), this could result to missed opportunities in the effort to increase the adoption of green buildings in the building sector. As a result, this paper introduces the levels of motivation, and how they apply to building stakeholders' motivation for adopting green buildings. In this study, building stakeholders are the professional roles (e.g. architect, skilled trades, cost consultants etc.) and the non-professional roles (project owners, tenants etc.) that can affect, or are affected by the sustainable construction (Feige, Wallbaum and Krank, 2011). It could be argued that different building stakeholders have different motives and/or interests per time (Hakkinen and Belloni, 2011); however, sustainability is a focal issue that is globally important to all stakeholders on an equal basis (Feige et al., 2011).

By way of structure, the introduction which provides a background and context is presented. This is followed by a review of literature, where the issues surrounding the motivation for adopting green buildings, and the link between the SDT of motivation (SDT) and motivation for adopting green buildings are presented. The next are the research method adopted, the findings and its policy implications. Lastly, the conclusions and areas of further research are suggested.

LITERATURE REVIEW

Issues in Motivating the Adoption of Green Buildings

The adoption of green buildings by building stakeholders is affected by myriad of challenges such as difficult and complex project delivery process (Zhang et al., 2012), high capital and transaction cost of green building (Qian et al., 2015), inadequate professional knowledge and expertise to fabricate and install green building features (Li et al., 2014) and the change-averse nature in the building sector – which is imbibed by many building stakeholders (Ahn et al., 2013). In order to overcome these challenges, and at the same time promote the adoption of green buildings, there is need to focus ultimately on motivating building stakeholders (Cole, 2011).

Many studies have consequently investigated building stakeholders' motivation for adopting green buildings in the building sector, and these are categorised into differently. The first is the government/polity factors, which refer to the intervention of the government towards promoting the adoption of green building through the force of the law (mandates and legislations) (Abidin and Powmya, 2014), and various voluntary programs such as incentive policies (Zhang et al., 2011). The second is the moral factors, which relate to the persuasion and/or inspiration of building sector stakeholders by the worsening environmental conditions

– thereby prompting actions such as green building (Abidin and Powmya, 2014). The third is the economic/market factors, which refers to the economic gains and high business potential of green buildings that potently attracts building stakeholders (Marker et al., 2014). The fourth is the information/education factors, which insinuate increased level of green awareness, especially through the rating certifications, that translate to the adoption of green building by building stakeholders (Potbhare, Syal and Korkmaz, 2009), while the last is the corporate factors, which represents the motivations for adopting green building or green practices by the building organisations. These include the organisational resources and readiness, reputation etc. (Abidin and Powmya, 2014; Love et al., 2012).

Despite the valuable contributions evidenced from the previous studies, the motivation for adopting green buildings by building stakeholders has only the content of goal or intention at its core - that is, the major emphasis are the motivations (factors) that lead to the achievement of a goal or the performance of an action (used in this paper). By extension, the emphasis is on the direction of actions in terms of which type of motivation direct actions towards achieving desired outcomes - and this aligns with many psychology theories of motivation such as Maslow's hierarchy of needs, Herzberg's two-factor theory, Goal-setting theory, Expectancy theory etc., where the major emphasis is the goal or outcome and the motivations leading to desired outcomes (See Curtis, 2010; Kelly, 2004). However, the motivation for adopting green buildings by building stakeholders has a goal or intention at its core (which is to build green), with an additional consideration that there are different levels (or amount) of motivation that lead to the achievement of the goal (Green building). This is founded in another psychology theory, the SDT of motivation (Ryan and Deci, 2000a), but yet unexplored towards promoting the adoption of green buildings among building stakeholders in the building sector.

Link between Self-Determination Theory (SDT) and Motivation for Adopting Green Buildings

The self-determination theory (SDT), a psychology theory, proposes that the motivation to perform an action varies in amount or level – and the difference in one level to another is the self-determination involved in the performance of an action by a person or a group of people (Ryan and Deci, 2000a). For instance, the level of motivation of a project owner that develops some green building projects, or inculcates certain green features in building projects because it will improve the flagship or the brand of the project owner in the open market is different from the level of motivation of the project owner that performed the same action because of government mandates or regulations. The level of motivation in the former reflects a case of personal endorsement and a feeling of choice on the part of the project owner, while the latter reflects a case of compliance with an external control. Hence the level of motivation in the former is more self-determined, or more self-regulated, while latter is controlled or externally regulated.

Despite the difference in their levels of motivation, the actions performed by the project owner in both examples are instrumental to achieving separable outcomes of flagship and brand in the open marketplace or avoiding sanctions for not following government mandates or regulations. When an action is performed by a person or a group of people as a result of its instrumental value, it is regarded as extrinsic motivation (Gagne and Deci, 2005), and can vary in the degree to which it is autonomous (Ryan and Deci, 2000a). This is in contrast to intrinsic motivation – which refers to the performance of an action by a person or a group of people because they derive spontaneous satisfaction out of the performance of such action (Vallerand, 2004). The adoption of green building or green practices in some quarters because it gives the feeling of solving what can be regarded as seemingly difficult task conforms to intrinsic motivation (e.g. See Woodruff, Hasbrouck and Augustin, 2008). The prospect of a

reward or sanction does not stimulate an intrinsic action. According to Amabile (1993), intrinsic motivation does not manifest because of some separable outcomes such as rewards, external prods or pressures, hence it is regarded as the least controlled motivation or the most self-regulated (Babiak and Trendafilova, 2011).

It could be seen that intrinsic and extrinsic motivated actions differ in their regulation process, yet both are instances of intentional (i.e., motivated) actions (Deci and Ryan, 2000a). This means there is a purpose for either of intrinsic and extrinsic motivated actions. This contrasts amotivation - which is an action performed by a person or a group of people without clear understanding or sense of purpose (Pelletier et al., 1997). Green building or green practice represents a significant change notion from the conventional building practice, particularly in the building sector. Hence the adoption of green building, or green practices by a person or a group of people may not be an action that lacks intentionality – therefore amotivation is expunged from this study. According to Gagne and Deci (2005), the levels of motivation as proposed by SDT of motivation posit a self-determination continuum (Figure 1). This ranges from amotivation (expunged), to external regulation, introjected regulation, identified regulation, and integrated regulation – all being the different levels of extrinsic motivation, and lastly to intrinsic motivation (Gagne and Deci, 2005; Vallerand, 2004). Clearly, the levels of motivation as proposed by SDT, apply, and explain the manner of adopting green buildings by building stakeholders.

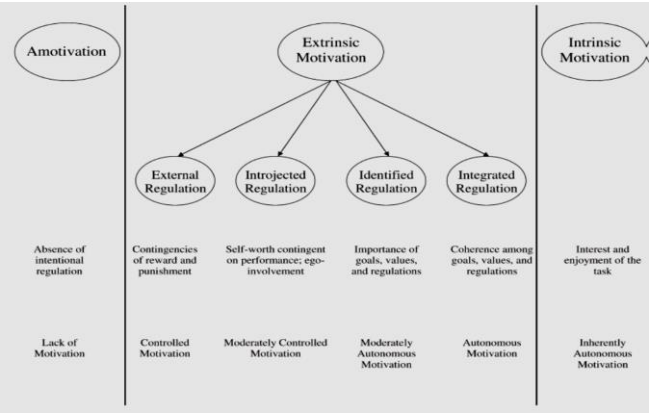

Figure 1: The self-determination continuum of the levels of motivation
Source: (Gagne and Deci, 2005)

RESEARCH METHOD: LITERATURE SYNTHESIS

This paper employs literature synthesis – which can be defined as combining a number of different pieces of information to build a conclusion (Howsawi, 2014). Specifically, the literature on the SDT of motivation, from the field of psychology, is used to inform the levels of building stakeholders' motivation for adopting green buildings, from the green building literature. There is no universal form or structure of literature synthesis; rather it is based on the key research question being investigated (see Henning, 1999). Consequently, the levels of motivation as proposed by SDT of motivation are described, and the corresponding explanations and predictions in the context of "motivating the adoption of green buildings" are prescribed. The Table 1 reveals the synthesized literature of 30 publications covering both fields of psychology (A) and green building (B).

FINDINGS

Levels of Building Stakeholders' Motivation for Adopting Green Buildings

This section describes the levels of building stakeholders' motivation for adopting green buildings in the building sector. The levels of motivation as proposed by the SDT of

motivation are initially described, in terms of meaning and context, and then followed by how they apply to building stakeholders' motivation for adopting green buildings. They include, and summarized in Table 2:

External regulation

Externally regulated level of motivation corresponds to the actions performed by a person or a group of people in order to attain some separable outcomes that are external to the actions performed such as the offer of a reward or threat of a punishment (Guay, Ryan and Deci, 2000). This means that the attached or the prospective separable outcomes are the motivations behind the performance of an action or actions (Vallerand and Blanchard, 2000). As revealed in many studies (e.g. Nurul Diyana and Zainul Abidin, 2013; Zhang et al., 2011; Chan et al., 2009), building stakeholders' motivation for adopting green buildings is mainly an externally regulated motivation. For instance, the study of Qi et al. (2010) revealed that it is the contractors' main motivation for adopting green building in China, while the incentive programs and policies has been strongly instrumental to motivating the adoption of green buildings by building sector stakeholders in many countries (Cidell and Cope, 2014; Liu and Xu, 2015; Lee and Koski, 2012).

Table 1: Summary of synthesized literature

Reference sources	Levels of motivation				
	ER	INTR	IDR	INR	IM
Liu and Xu (2015)	B				
Cidell and Cope (2014)	B				
Wang et al. (2014)				B	
Aliagha et al. (2013)		B			B
Moganadas et al. (2013)					B
Nurul Diyana and Zainul Abidin (2013)	B				
Samari et al. (2013)			B		
Lee and Koski (2012)	B				
Love et al. (2012)				B	
Boyle and McGuirk (2012)		B			
Babiak and Trendafilova (2011)		B			
Zhang et al. (2011)	B				
Chen and Chai (2010)					B
Qi et al. (2010)	B				
Chau et al. (2010)			B		
Chau et al. (2009)	B				
Barkoukis et al. (2008)				A	
Hasegwa (2008)					B
Woodruff et al. (2008)					B
Richardson and Lynes (2007)				B	
Jain and Kaur (2004)				B	
Tan (2004)					
Vallerand (2004)			A		
Guay et al. (2000)	A				
Ryan and Deci (2000a)		A			A
Vallerand and Blanchard (2000)	A				
Vallerand and Losier (1999)		A			
Pelletier et al. (1997)		A		A	A
Pelletier et al. (1995)				A	
Deci et al. (1991)			A		

ER- External regulation; INTR-Introjected regulation; IDR-Identified regulation; INR-Integrated regulation; IM-Intrinsic motivation; A-Psychology literature; B-Green building literature

Introjected regulation

The introjected regulated actions are the actions performed through internal pressures that are contingent on self-esteem, such as the feeling of pressure in order to avoid guilt or anxiety to attain ego-enhancements or pride (Ryan and Deci, 2000a). The study of Babiak and

Trendafilova (2011) revealed that 43% of executives, though in sport organisations, felt that being viewed as a 'good citizen' was one of the most influential motivations for addressing environmental issues. In addition, building stakeholders are pushed to adopt green buildings, particularly the eco-labelled ones, because they add flagship and brand to owners or owners' engagement (Aliagha et al., 2013). According to Pelletier et al. (1997), this level of motivation is no longer externally regulated, and the presence of external motivations is no longer required to perform an action. In fact, an executive partner of a global firm once reiterated that separable outcomes such as energy cost savings is not the main motivation for adopting green building, but the ego-desire to become global leader in sustainability and corporate social responsibility is the main motivation (Boyle and McGuirk, 2012). As an introjection regulated action, it is experienced as partially part of the self of the person or the group of people performing the action(s) (Vallerand and Losier, 1999).

Identified regulation

According to Vallerand (2004), this level of motivation means that a person or a group of people are motivated to perform an action because they have identified with the importance of such action and thus accepts its regulation as their own. When this happens, the adoption of green building by building stakeholders becomes an action performed with a sense of choice or volition (willingly) because they are aware and have identified with the importance and value of the action performed (Samari et al., 2013; Deci et al., 1991). This manner of adopting green building by building stakeholders is said to be motivated through identified regulation – which is more self-determined than introjected regulated actions (Deci et al., 1991). Samari et al. (2013)'s study revealed that building sector professionals that have identified with the importance of green building, particularly through environmental education, are able to adopt green building practices more easily. Similarly, green building users with green experience are able to identify with green building value and benefits, thereby willing to pay more for green development (Chau, Tse and Chung, 2010).

Integrated regulation

This is the level of motivation that a person or group of people performs an action because it is congruent with their values and needs (Barkoukis et al., 2008). In contrast to identified regulation, an action is performed not only because of its significance but because it is consistent with self-schemas the actors possesses (Pelletier et al., 1997). For instance in the UK building sector, many building stakeholders exhibit as personal value, a high level of environmental consciousness, and this has been their major motivation for adopting green practices (Wang et al., 2014). In organisations, ingrained green or sustainability values inform the implementation of necessary actions including building production (Richardson and Lynes, 2007; Jain and Kaur, 2004) – an example is a client organisation in Australia was able to develop a high rated green building because it conforms to the value of the company to achieve at least the minimum Green Star rating in its building development (Love et al., 2012). According to Pelletier et al. (1995), the actions motivated through integrated regulation closely aligns with the personal or organisational value of the actor, hence it is considered performance with a very high self-determined level of motivation. Nevertheless, an action is still being performed for its instrumental value with respect to some outcome that is separate from the action under this level of motivation (Barkoukis et al., 2008).

Intrinsic motivation

The actions that are performed by a person or a group of people purely motivated by the pleasure, positive experiences, and satisfaction associated with such are said to be intrinsically motivated (Ryan and Deci, 2000a). In sustainability science, many authors

(Aliagha et al., 2013; Moganadas et al., 2013; Chen and Chai, 2010; Woodruff et al., 2008) agree that intrinsic actions are relative to the attitude of environmental concern and/or counterculture bio-centric activism – which is the perception of a person or a group of people that they are integral part of the natural environment. Tan (2004)'s study found that the exemplification of the attitude of environmental concern, especially in the adoption of green building or green practices by building stakeholders, creates a feeling of satisfaction or pleasurable experience. Reiteratively, intrinsically motivated actions are not performed in order to achieve some valued outcomes such as rewards (Pelletier et al., 1997), but for the positive experiences associated with exercising and extending ones capacities (Hasegwa, 2008).

Policy Implications

The insights from the SDT of motivation can guide the design of strategies and policy interventions to improve building stakeholders' adoption of green buildings in the building sector. This can be solutions that introduce form or structure to the design process of policies for motivating the adoption of green buildings. Because of the in the levels of motivation as proposed by SDT, and also to ensure more effectiveness, policy interventions should be designed to focus on each of the levels of building stakeholders' motivation separately (See Potbhare et al., 2009; Rigby et al., 1992). Moreso that the level of success of policies or programs aimed at motivating the adoption of green buildings by building stakeholders is considerably determined by how policies are designed (Pearce, Dubose, Bosch, 2007).

Notable, many existing policy interventions aimed at motivating building stakeholders' adoption of green buildings are designed segmentally – such as instituting and focusing policy interventions local, state-wide or nationally (Lee and Koski, 2012). Policy interventions are also instituted to motivate different professional or non-professional roles in the building sector – whereby policies can be targeted at contractors (Dobson et al., 2013), differently from professional builders (Tinker et al., 2006). It is also not uncommon for policy interventions to be targeted distinctly at the constituent segments of a green building – including integrated design, energy performance, water conservation etc. (Pearce et al., 2007). Clearly the design of policy interventions to focus each level of motivation is in line with previous and existing practices.

In light of the above, particularly during the process of policy design, there is need for policy makers to identify the levels of motivation of building stakeholders who are the target of policy interventions aimed at motivating the adoption of green buildings per time, through interviews and/or surveys, and longitudinal observations and experiments (Seeliger and Turok, 2015, Zhao et al., 2015) so as to reveal the dominant level of motivation of building stakeholders as emphasized in Liu et al. (2012). The identification of the levels of motivation of building stakeholders, particularly the least self-determined levels of motivation, can ensure specificity in policy design – whereby for each level of motivation, identified green building practices are matched with outcomes that regulate or motivate building stakeholders, and perhaps in the right quantity or measure. In this manner, public accountability is justified in terms of prudent administration of policies for motivating the adopting of green buildings (Pearce et al., 2007).

According to May and Koski (2007), the separable outcomes that regulate the least determined levels of motivation such as legal procedures, grants, administrative assistances etc. are costly to implement and time consuming, and this usually generates extensive debates and indecision among policy makers (Circo, 2008). Policy interventions should therefore encourage the shifting from the less self-determined to the more self-determined levels of building stakeholders' motivation for adopting green building (i.e. identified regulation,

integrated regulation and intrinsic motivation) (Deuble and John de Dear, 2012) – which are more inherent in the values and attitudes of building stakeholders. Policies such as supporting and endorsing the activities of the (willing) building stakeholders (or early adopters), can help build up their green ideals and values to the level that they will become self-determining in their adoption of green buildings (Pearce et al., 2007).

Table 2: Summary of the levels of building stakeholders' motivation for adopting green buildings and their modes of regulation

Levels of motivation	Modes of regulation	Selected reference sources
External regulation	This level of building stakeholders' motivation for adopting green buildings is regulated by separable outcomes that are external to the actions performed such as rewards, threat of punishments etc.	Liu and Xu, 2015; Cidell and Cope, 2014; Nurul Diyana and Abidin, 2013; Lee and Koski, 2012; Zhang et al., 2011; Qi et al., 2010; Chan et al., 2009
Introjected regulation	This level of building stakeholders' motivation for adopting green buildings is regulated by internal pressures that are contingent on self-esteem such as the feeling of pressure in order to avoid guilt or anxiety to attain ego-enhancements or pride	Boyle and McGuirk, 2012; Babiak and Trendafilova, 2011
Identified regulation	This level of building stakeholders' motivation for adopting green buildings is regulated through identifying with the value and importance of green building practices	Samari et al., 2013; Chau et al., 2010
Integrated regulation	This level of building stakeholders' motivation for adopting green buildings is regulated by the "green" self-schemas, values or beliefs of the building stakeholders	Wang et al., 2014; Love et al., 2012; Richardson and Lynes, 2007, Jain and Kaur, 2004
Intrinsic motivation	This level of building stakeholders' motivation for adopting green buildings is not regulated. Instead green buildings are adopted by building stakeholders for pleasurable experiences and satisfaction. In addition, the feeling of autonomy, relatedness and competence catalyses intrinsically motivated green building	Aliagha et al., 2013; Moganadas et al., 2013; Chen and Chai, 2010; Hasegwa, 2008; Woodruff et al., 2008; Tan, 2004

Additionally, policies interventions should be design to instill "green or sustainability" culture in the daily professional practices of building stakeholders. This can be achieved through the type of education that target building stakeholders at the point of engaging in building practices (Huang et al., 2014) – for instance, developers can be required to undergo compulsory training on best practices that promotes sustainable construction as a condition for bidding for building contracts, while professionals in the building sector can be required as a matter of compulsion to undergo similar training before being licensed to practice. Policies such as this should be legislated – which is a longer term and more permanent means of instituting policies (Dubose et al., 2007). According to Schelly et al. (2012), acculturated green building practices within and outside the building sector conforms to the more self-determined levels of motivation e.g. integrated regulation.

Policies that promote community participation can also encourage the more self-determined levels of motivation – whereby a community of building stakeholders is organized under a uniform agenda, and as agents of change. Studies have shown that community participation encourages self-determined level of building stakeholders' (and actors outside the building sector) motivation for adopting green buildings (Moganadas et al., 2013; Schelly et al., 2012; Sadeghi-Tabrizi, 2010; Hasengwa, 2008). As participants of such community, building stakeholders consider it a moral and value adaptation to engage in green practices, rather than

for extrinsic benefits (Sadeghi-Tabrizi, 2010). Within such community cluster, role models or mentors – who are the more active participants, usually provide necessary guides and mentoring to other less active participants to the extent that it becomes moral to adopt green practices (Moganadas et al., 2013). Analogously, the building stakeholders' level of motivation for adopting green building can become more self-determined through the development of demonstration projects – which serves as niche that provokes value perception of green buildings among an establishment of community of building stakeholders (Berry et al., 2013).

Building stakeholders' level of motivation for adopting green buildings can become more self-determined through participatory environmental governance by policy makers. Known as voluntary environmental governance (VEGA) in some quarters, it is the involvement of both policy makers and building stakeholders (or private sector stakeholders) in a more collaborative environmental rule making and implementation (van der Heijden, 2013). According to Schelly et al. (2012), this approach encourages stakeholders to implement green practices out of the sense of responsibility, rather than for extrinsic reasons.

CONCLUSION AND FUTURE RESEARCH

In this paper, the adoption of green buildings has been highlighted as a motivation issue, particularly for the building stakeholders who are faced with many challenges in the process, and revealed the use of the psychology theory of self-determination to explain and predict the levels of building stakeholders' motivation for adopting green buildings. From the psychological point of view, building stakeholders' motivation for adopting green buildings is not only goal or intention orientated as depicted in the myriad of previous studies – whereby the main emphasis was the factors that promote (or not) the adoption of green buildings by building stakeholders. Rather, in addition to the pervasive goal or intention orientation, insights from the SDT of motivation reveal that building stakeholders' motivation for adopting green buildings varies in level – with each level differing from one another based on the self-determination involved in the adoption of green building.

External regulation, introjected regulation, identified regulation and integrated regulation are the different levels of extrinsic motivation. The last of the levels of motivation considered in this study is intrinsic motivation – which describes the pleasurable experiences or satisfaction that building stakeholders' derive from adopting green buildings. Often, intrinsic motivation goes with environmental activism, in which its exemplification by building stakeholders leads to the feeling of satisfaction. However the levels of building stakeholders' motivation are often overlooked by researchers in providing the background knowledge for motivating the adoption of green buildings in the building sector. More significantly, policy makers are also not giving cognizance to the levels of building stakeholders' motivation in the design of policies and programs for motivating the adoption of green buildings. To avoid missed opportunities in the theory of motivating the adoption of green buildings in the building sector, it is important to take the levels of building stakeholders' motivation into account in the various researches that seeks to create new means of improving the adoption of green buildings in the building sector. In practice, taking the levels of building stakeholders' motivation into account introduces more structure and accountability into the design of policies aimed at motivating the adoption of green buildings, particularly in terms of matching of identified green building practices with outcomes that regulate or motivate building stakeholders for each level of motivation. In addition, there is more explicitness about the more self-determined levels of motivation, and how building stakeholders' levels of motivation can become more self-determined through policy interventions.

The SDT of motivation is well grounded with about three decades of research to its credit, many of which have provided valuable insights into the concept of motivation in different spheres like educational learning, sports, employment etc. In the building sector, further insights can be generated by validating the levels of motivations proposed by SDT of motivation empirically from the views of building stakeholders of different classes. This will provide quantifiable information on the levels of motivation of respective building stakeholders that are targets of policy interventions aimed at motivating the adoption of green buildings per time e.g. developers.

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Identifying Success Factors in the Construction of Healthcare Facilities in Iran

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ABSTRACT

Building of healthcare facilities is considered a complex task owing to the inherent uncertainties. From feasibility study through design and construction, so many intricate factors should be considered by project managers to make healthcare projects successful. Lots of building components, diverse stakeholders' needs, progressive healthcare technology, specialized functions, different financing methods, and particular building codes and regulation make managing construction of healthcare facilities a challenging task for project managers. Therefore, understanding the criteria for successful delivery of these types of projects is critical for project managers. Although, evaluating success factors of general construction projects has attracted attentions in recent years, little research has been engaged that address specific nature of healthcare construction projects. This paper aims to identify success factors of healthcare facility projects by interviewing practitioners who have substantial experience in construction of healthcare facilities in Iran. The qualitative nature of the study creates an opportunity for experts to reveal their insights about projects success factors through open-ended interviews. The result can be used by project managers as a guideline to handle healthcare construction projects successfully.

Keywords: Healthcare Facilities, Healthcare Construction Projects, Iran, Success factors

INTRODUCTION

Construction industry has an important impact on Safety, health, environment and society (Cheong Yong and Emma Mustaffa, 2012). Success of construction projects have direct effect on mentioned parameters. One of the problems, in project management, is unawareness of success factors which lead to its failure. All projects have been developed for specific purposes so they could be called successful if they are completed in scheduled time, cost and quality. So, there is a need to clearly define success factors in construction projects. After defining these factors, the success rate of projects can be measured. No research was conducted in Iran regarding project's success factors. While initially success in projects are measured based on pre-determined factors. These factors could be different during the size and function of projects. Therefore knowing factors is the first step to measure project's success. The purpose of this research is to distinguish success factors of healthcare construction projects in Iran. This article tries to find main reasons of success through interviews with managers and civil engineers with at least 15 years of experience in contracting, consulting and employing companies and assess them.

LITERATURE REVIEW

Several researches have been carried out about success of construction projects in different countries specifically in Europe and Easters Asia. Study on the success factors of construction projects was first done by Rockart in 1982. On the things which really make the difference between success and failure. Defining success factors of a project is in reaching its goals which should be provided for the participants. (Sanvido et al.1992, Tiong and Cooke-Davies 2002). In projects success can be announced when it is completed according to the schedule, preplanned budget and needs of stockholders. Project's proper function, profitability for contractors and no claims are factors of project's success. (Akintoye and Takim 2002). Factors of project's success can be divided into two groups: hard, tangible and measurable objectives and soft mental and spiritual and less measurable ones. Time, cost and quality criteria are widely known as the triangle of project management while safety, environmental health and technical factors are also improving. Clients' satisfaction, proper communication

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among the elements of project and absence of dispute are factors that can guarantee a project's success. (Erling and Svein Arne, 2000 Chan, 2004; Erling et al., 2006). In academic literature clients' satisfaction is a variable in project's success during last decades in and by the time of completing the project evaluating client's satisfaction and project's success are very close to each other (Jugdev and Muller, 2006).

METHODOLOGY

At the beginning, the existing literature on success factors in projects was studied. Focusing had particularly been on the resources that identify success factors in different countries and health projects. Review of literature helped this research to recognize factors of project's success in other countries. Qualitative method has been used because the target of this research is to recognize success factors in healthcare projects. This method helps the researcher to focus deeply on the subject and identify its hidden angles. In order to focus on experiences of experts, interviewing has been chosen as the main data collection method. To identify success factors in Iran, 20 interviews have been conducted with experts involved in the construction industry of Iran with at least 15 years of experience. All of the interviewees have the experience in constructing healthcare projects and they have been chosen by Snow ball sampling method. The demographics of the interviewees are shown in Table 1. Interviews have been conducted in open ended manner so the interviewees feel at ease explaining their points of views. Then the interviews were transcribed. Gathered information regarding the subject is based on valuable experts' experiences. Qualitative analysis was done by coding method. In this method the researcher recognizes the theme by reading the interviews transcription. Gathered information is categorized in this fashion and each group has been integrated which would be discussed in data analysis part.

Qualitative Data Analysis

According to the gathered information, success factors in healthcare projects are divided into eight groups which are explained below. It worth mentioning, this information is context dependent and cannot be generalized to wider setting.

Table 1: The Demographics of the Interviewees

ROW	CODE	ROLE	Education	Field	Experience (year)	Organization Type
1	C1	Project Administrator	Bachelor	Civil Engineer	15	Client
2	C2	Physics	Specialist	Oncology	30	Client
3	C3	Project Manager	Bachelor	Civil Engineer	20	Client
4	C4	Project Manager	Bachelor	Civil Engineer	20	Client
5	C5	CEO	Master	Law	20	Client
6	C6	Project Manager	Master	Civil Engineer	20	Client
7	C7	Project Manager	Bachelor	Civil Engineer	17	Client
8	N1	Project Administrator	Bachelor	Civil Engineer	25	Consultant
9	N2	Project Administrator	Bachelor	Civil Engineer	18	Consultant
10	N3	Project Administrator	Bachelor	Civil Engineer	16	Consultant
11	N4	Project Manager	PhD	Architecture	20	Consultant
12	N5	Project Manager	Bachelor	Civil Engineer	17	Consultant
13	O1	Project Manager	Bachelor	Civil Engineer	25	Contractor
14	O2	CEO	Bachelor	Mechanics	35	Contractor
15	O3	CEO	Bachelor	Mechanics	36	Contractor
16	O4	Project Administrator	Bachelor	Civil Engineer	18	Contractor
17	O5	Project Manager	Bachelor	Management	17	Contractor
18	O6	CEO	Bachelor	Civil Engineer	35	Contractor
19	O7	Project Manager	PhD	Civil Engineer	16	Contractor
20	O8	Project Manager	Master	Civil Engineer	40	Contractor

Scope

Scope includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. Plan Scope is the process of creating a scope management plan that documents how the project scope will be defined, validated, and controlled. The key benefit of this process is that it provides guidance and direction on how scope will be managed throughout the project (Project Management Institute (PMI), 2013).

All project managers use project scope management throughout the project life cycle to identify and control all aspects involved in a project without a planned scope so practical deliverables are not possible. Importance of Scope in Project Management. Based on gathered information scope management project in healthcare construction projects could be evaluated under two category of pre-construction studies and feasibility studies. According to O1 one of the biggest owners' problems is not knowing the scopes of projects. Weak pre-construction studies of consulting companies are due to not knowing the details of projects and it has happened many times that there has been no concordance between the culture, climate and the assigned land. C1, C2 and C3 are all expert managers who are aware of early studies importance and they believe that it is one of the reasons of project failure. They all believe that project X (for privacy reason the real names of the projects are changed) is an obvious example.

Time

Time includes the processes required to manage the timely completion of the project is one of the most important factors in healthcare projects (PMI, 2013). Planning, scheduling, political reasons and lengthening of correspondences are four groups of factors that challenges time. N2 believes that project completion are only doable when it is done according to the schedule but N3, N5 and O5 consider precise planning more important than scheduling which is less important. N1 implicitly confirms the above mentioned but accurate determination of priorities and implementation of enforcement activities in more detailed and fragmentary in order to specify prerequisite for any activity are important factors to reach an accurate schedule. But all of the interviewees believe completion of projects in recent years has always been increasing and usually projects face delays. O3, a manager with more than 35 years, emphasizes political reasons increase the time of healthcare project completion and sometimes even suspend them. O6 and C7 mentioned decrease in profitability of projects as the impact of delay in project completion. C6 and C5 mentioned converting old office system

to automation to decrease time of correspondences. Although it doesn't seem helping to the reasons of projects success, in fact any requests by construction agents are under impact of corresponding time.

Cost

Cost includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget (PMI, 2013). Based on gathered information, plus the above mentioned factors, value engineering is also a parameter in success of project success. Most of interviewees believe that cost is the most important reason in project success (O4, O8, N3, C7, C2 and C4). O3 with high management and administrative experience in healthcare projects believes injecting credit to projects is one of the most effecting factors in project success. O2 believes the opposite and emphasizes credit injection without control over the cost, not only leads to project success but also is one of the factors that challenge the project success. C5 and C6 approve O2's idea and believe that low but controlled fund has better impact on project success than high and uncontrolled one. C4 mentioned project Y which was completed by value engineering which is an efficient parameter to reach success in projects. O7 confirmed C4's comments plus mentioning that using value engineering is not possible in all projects and a deeper look should be taken to the funding but he did not mention a method to replace value engineering.

Quality

Quality includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. Quality uses policies and procedures to implement, within the project's context, the organization's quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of the performing organization (PMI, 2013). Quality works to ensure that the project requirements, including product requirements, are met and validated. Based on gathered information quality parameter could be studied under seven groups: 1.Standards compliance 2.cost estimation 3.proper building methods 4.role of sub-contractors 5.machinery 6.technology 7.quality material.

O4 and C7 believe standards compliance satisfies the required quality of projects but C3, O6 and O7 reject this and believe standards compliance just leads to completing the project and does not have any roles in necessary quality. For reaching proper quality in healthcare projects, proper administrative and materials should be used. O8 with 40 years of experience in this field believes choosing proper minor contractors and up to date technology usage are important factors in project implementation. C4 and O1 mentioned the important role of proper cost estimating in reaching high quality and added improper cost estimating would lead to challenges regarding machines usage and the quality of the project is greatly threatens by wrong choices. O6 while confirming this topic declared by developments in knowledge, technology and variety in software had increased the mistakes in costs estimation in recent years. C2 is a well-known specialist who emphasizes on the quality of the project which has a direct effect on hospital working efficiency and people's health and decrease in quality sometimes leads to doubling the patients' illness. He pointed that in project Z lack of required quality in patients'' rooms worsened 5 patients' conditions.

Human Resource

Human Resource includes the processes that organize, manage, and lead the project team. Project team members may have varied skill sets, may be assigned full or part-time, and may be added or participation of team members during planning adds their expertise to the process and strengthens their commitment to the project. Moral factors, team work and knowledge are tree reviewable groups of human resources. The role of human resources is undeniable in success of a project (C3). Human resources could be parameter of success when they go along order, accuracy, honesty and working consciousness. Doing the work just for the sake of getting done would not help the project (O7). C5 and N2 while confirming O7's ideas added lack of motivation in human resources of a project is one of the concerns of contracting

companies. While confirming previous ideas mentioned project X in which lack of motivation by human resources led to delay. O1 referred to teamwork and its effect on working efficiency, believes wrong and sudden decisions and personal interest of some top executives are strongly inhibiting factors for reaching success. C6 rejected this theory and defended high executives and believes administrative health work dominates healthcare projects. C4 and O5 consider using experts as the easiest ways for reaching success and believe using inexperienced and irresponsible human resources is a parameter that is faced in healthcare projects. O8 agrees with this idea and expresses education is a fundamental and undeniable parameter and believes that using young, educated and well aware of new technologies human resources along experienced ones is a fast way to reach success.

Risk

Risk includes the processes of conducting risk management planning, identification analysis, response planning, and controlling risk on a project. The objectives of project risk are to increase the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project. Proper risk management could be one of the factors in success of projects. The importance of project risk management has been needed more and more but activist in construction industry are still facing the problem of risk being unknown and unidentified. Identifying the risks of a project and finding proper solutions could improve the success of the project (N4). C7 agrees with N4 and believes uncertainty of project could be decreased by ensuring of identification of risk.

Environmental

Since the emergence, human has dealt with nature and had always tried to control its destruction (N2). Humans have altered the nature along their needs and this alteration went on until the point that humans are the main reason of destruction of the environment and environmental protection while completing a project has an important role in its success but unfortunately it has been ignored (O2). O5 by approval of this view believes that the effects of administrating the projects should be considered in primary studies of project and proper solutions must be offered for these undesirable effects. C1 refers to project X in which improper design of wastewater treatment system of the project cause problems for the region's ecosystem. O7 believes before constructing healthcare projects their adverse effects on the environment should be studied to choose a location with the least harm to the environment.

External Matter

External matter could be studied under tree groups: politics, economy and rules and regulations. O8 has specific emphasis on rules and regulations and their effect on success of projects and gives several examples during his 40 years of experience in healthcare projects of how violating the rules and regulations led to project's failure. He believes funding problems have always been challenging for the projects in Iran and led to their higher uncertainty. C4 confirms O8 and adds the rules are unilateral in favor of employer is one of the factors of failure. C6 rejects C4 and O8 ideas and speaks of the complete rules and refers to less important role of politics in success of projects. C5 agrees with C6 regards the complete rules but believes political and economic factors are inseparable from the success of projects.

Conclusion

The results of the researches in Saudi Arabia, Jordan and Emirates are very close to the the results of the researches done in Iran. It seems that Middle Eastern countries suffer from similar problems. To minimize the occurrence of delays, proper knowledge about it should be given to the project team. Plus the fact that in case of delay occurrence, collaboration and cooperation between the functors of the project can reduce its negative impacts. Improper increase in funding of development projects with the support of oil revenues is not only not the solution but will also increase the problems and costs, in which case the need to make proper choices would fade and unnecessary costs would be imposed to the projects. Ignoring and incompetence of feasibility study, construction management methods, comprehensive design principles and value engineering just be leading to more time, higher costs and

reduction in quality. In Iran mismanagement problems have turned into a crisis which demands proper choices, reforms in management structure and in all aspects of the project from phase zero to operation. To reform management systems, selecting a simple worker or a manager must be based on their expertise and their commitment to work and success of the project would be the forefront of all things. Study phase, primary and detailed planning, recognizing employer and other stakeholders' demands should all be in a way that reduce the need for change in the operating phase as much as possible. As in delay each factor leads to the other one, even by minimizing one factor, delay could be avoided more and more.

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ICT Integration in the Transport System

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ABSTRACT

Transportation is a fundamental aspect of every nation's economy; allowing people to travel to and fro places within a period, also ensures efficient, effective delivery of goods and services. But recently, transport infrastructures of many nations are coming under significant and multiple pressures due to increased urbanization, rising global population, terrorism and conflicts, as well as climate change effects. ICT plays fundamental and transformative roles in the industry today. With the integration of modern ICT technologies, from modern control systems to sensor technologies, better transport management can be achieved. Also, by using embedded technology systems to create vehicle networks, a better system of transport can be put in place for timely and efficient human, goods and service delivery. The methodology used was secondary data collection where relevant publications and books were perused and utilized. It is recommended that both the public and private sectors of the economy should embrace this modern technology so as to eliminate the numerous problems associated with the conventional transport system. By so doing, economic growth and development can be sustained.

Keywords: Urbanization, ICT technologies, Control systems, Censor technologies, Embedded systems

INTRODUCTION

The Integration of Computer Systems in Transportation is the orderly application of computer and other communications technologies into the management of transportation especially land transport which is the form of transportation with highest passenger rate among other forms. The application of these ICT tools will provide efficient traveler information in order to increase safety and effective road transport systems. This integration involves vehicles, drivers, passengers, vehicle attendants (conductors), road transport workers and managers that synergize as well as the environment and linking with the complex transport infrastructure so as to improve the safety and efficiency of road transport system.

A recent report by the World Health Organization (W.H.O) in 2013 has it that approximately 1.24 million people die yearly on the world's roads and another 20 to 50 million sustain non-fatal injuries as a result of road traffic crashes. In the report entitled "Road Safety in the W.H.O African Region: The Facts 2013" on road traffic deaths in selected African countries says Nigeria accounts for the highest fatalities with 33.7 percent per 100,000 populations every year between 2000 and 2010. This places Nigeria as having the second worst traffic fatalities in the world. South Africa closely trailed Nigeria. She came second in Africa with 31.9 percent per 100,000 populations, followed by DR Congo, Ethiopia, Kenya, Tanzania and Uganda. In the same report, Africa was listed as the "least motorized out of the six continents in the world, but suffers the highest rates of road fatalities" of the 37 countries that the survey covered with death rates well above the average of 18 deaths per 100, 000 populations. The fatality figures for U.S.A and Britain are 15 and 7 percent respectively.

Altogether, the W.H.O (2013) report confirms the grim reality of the carnage on our roads. By all accounts, the survey calls to question the safety of roads in the country. It also highlights the recklessness of many of our drivers, the poor maintenance of our vehicles and our numerous dilapidated roads with attendant bad spots that have become deathtraps and dens for Robbers. Road accidents happen often in Nigeria commonly attributable to bad roads

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and non-compliance with road safety regulations such as driving under the influence of drugs and alcohol, using cell phones while driving , refusal to use seat belts, non-usage of pedestrian bridges, disobedience of road signs, etc.

The Federal Road Safety Commission (F.R.S.C) was created in 1988 to ensure highway safety for motorists and other road users. This agency determines and enforces speed limits for all categories of roads and vehicles, controls the use of speed limiting devices, co-operate with other related agencies in prevention of accidents on the highways and also enforcing laws on road users; safeguarding them from untimely or incurred deaths. A lot of challenges have hindered their performances in this regard over the years. Starting from inadequate manpower and logistics, lack of adequate and modern communication devices, insufficient personnel and rescue equipment, their inefficiencies have not abated the high fatality rates on our roads.

From their (F.R.S.C) records, between 2006 and 2013, the F.R.S.C recorded 41,118 deaths from road accidents in Nigeria. The 2014 F.R.S.C report highlights that about 7, 924 injury cases were recorded in the first quarter, 7,663 in the second quarter and 7, 093 in the third quarter. Of all these fatal injuries recorded in that report, about 1,848 persons lost their lives in the first quarter, 1,406 in the second quarter and 1,176 death cases in the third quarter. The outcome of the W.H.O survey corroborates the F.R.S.C's report that the rate of traffic deaths in the country is alarming. According to the agency, in 2009, deaths resulting from road accidents were 7,000 with 969 of them children. In 2010, according to W.H.O, Nigeria recorded 5,279 deaths from road crashes. Between January and June in 2011, 2,218 precious lives were lost in a total of 2,234 accidents while 3,000 persons died in road accidents between January and October 2012. Road accidents, no doubt, have particularly been on the upward swing in the cities than in the rural areas. The major hazardous roads are the Lagos/Benin highway and the Zariaga end of the Abuja- Okene highway in Kogi State where heartrending deaths have been recorded in recent times. There is no gainsaying the fact that many of the highways across the country have become deathtraps due to a combination of so many factors, amongst them: poor state of the highways and the recklessness of the drivers.

It has become glaring from both the W.H.O report and F.R.S.C statistics that road traffic deaths have become one of the worrisome problems that require urgent attention in the country. As the world population and economy grow, it is estimated that the volume of traffic in the world will increase from 8 million at present to 40 million by the year 2020. Without significant changes to the management of road transport systems, these scarring figures are likely to soar significantly. The traditional driver training, infrastructure and safety improvements may contribute to a certain degree to reduce the number of accidents but not good enough to curtail this menace. This research work "Integration of Computer into Transport" seeks to offer the best solution to the problems so far encountered in the current traditional transport system.

The Transport System and Electronic Information

Safety is one of the core driving forces behind the evolution, trend and implementation of the proposed system. The system will aim at improving and enhancing transport safety, mobility and infrastructure. Information technologies are represented in all fields of the society and science, including the traffic and transport. They are the base of intelligent systems.

It should be apparent that in order for the transport system to become sustainable, all that is necessary is for society to decrease the amount of transport they consume. This is much easier to state than it is to accomplish. Regulatory policies could be formulated to accomplish this end or nations could encourage voluntary actions to accomplish the same end. It goes

without saying that the former is very unpopular and the latter is unsuccessful. Because of this, ICT innovation in the transport system is seen as possible ways of accomplishing the same outcome. To this end, a simple model of the transport system that applies to a better transport system which involves the layer, actors involved and the target of the system is introduced(Table 1)

Table 1: A simplified layer model of the transport system

Layers	Actors involved	Target of ICT innovation
Layer 4. Persons and freight Persons (drivers), parcels, containers, bulk, etc.	Private car users Public transport users Freight transport users	Drivers' behavior: route selection, driving speed, reaction in driving, reduction of driving tasks. Passenger behavior in public transport: mode choice and route selection. Quick first aid after accident. Freight: routing and load matching.
Layer 3. Vehicles moving through the system Trains, cars, busses, vans, bikes, vessels, etc.	Owners of private vehicles Logistics providers Chain organizers Vehicle manufacturers ICT manufacturers Public transport companies	Size of flow, speed of flow, identification of obstacles, in-between vehicle distance in flow (longitudinal, lateral), collision avoiding.
Layer 2. Services on the infrastructure Public transport services, services for maintenance and transport management	Public transport companies Operators of links and nodes ICT system manufacturers Public authorities	Providing/preventing access of public transport services to persons Matching different services.
Layer 1. Physical infrastructure (links and nodes) Rail, road, airline, pipelines, waterways, etc.	Infrastructure providers Infrastructure owners Public authorities	Providing/preventing access of infrastructure links and nodes to vehicles

Impacts of interest for analysis are mainly generated in the layer of vehicle flow (3) and the layer including persons (drivers) and freight (4). The main differences between ICT applications in some of them are fixed (or semi-fixed) in layer 1 as they form part of the physical infrastructure, e.g automated guide ways (physical), on-road signing including variable messaging, surveillance systems, and on-road access and charging systems, while others are mobile in the sense that they are in-vehicle systems or personal (portable) systems. Another main difference between ICT applications resides in the type and number of layers required to implement the application. Thus, some applications make use of one layer, while others make use of two or three of them. If more layers are involved, particularly including layer 1, the technical complexity is greater, because of the additional infrastructure requirements. A situation of more layers also implies the involvement of a larger number of different actors, potentially leading to delay in the adoption of the innovations concerned.

ICT innovations in the transport system can also be categorized according to the roles of the information concerned from the following:

a. Information to support choices of car drivers and passengers, e.g. on-road information on upcoming congestion, routing advice from a navigation system, or the real arrival time of trains.
b. Information to reduce options or limit drivers' behavior, e.g. avoiding parts of networks, or limits to driving speed.
c. Information that alerts drivers or passengers without constraining behavior, e.g. various modes of advanced driver assistance, like collision avoidance and lane keeping systems.

d. Information that serves to take over drivers' decisions, fully or partly, like in electronic bonding of cars and in intelligent speed adaptation.

The above roles that information plays show different degrees of constraints upon drivers' free choices. For this to be fully effective, legal issues concerning responsibility and liability enter the scene and these still need to be settled, like responsibility and legal liability of drivers, ICT system manufacturers and the operators of network systems. This situation acts like a barrier and tends to delay the adoption of the innovations concerned.

ICT APPLICATIONS, AIMS AND EFFECTIVENESS

Certain technologies that aid effective transportation are developed such as Excessive Driving Reduction System, Congestion Relief System, Variable Message Signs, Advanced Traveler Information Systems, Intelligent Speed Adaptation (ISA), Dedicated Short Range Communication, Fatality Reduction Accident Sensors, In-vehicle Accident Sensors and Advanced Drivers Assistance.

Excessive Driving Reduction System

Excessive driving contributes to fuel utilization, as well as the generation of air toxics detrimental to urban and global environments. The technologies intend to decrease the need for travel or to increase the efficiency of travel. For it to be effective, signalization and navigation systems would be embedded.

Signalization

ICT can decrease fuel use by increasing the efficiency of the movement that does take place. This outcome can be accomplished through improved signalization. Such signalization can be phased in some areas and demand responsive in other areas, but the objective is to decrease the amount of vehicle standing time while the motor is running. Under the former the traffic signals are set so that signals in a series will change at a set frequency so that the vehicle does not have to stop. In the latter case the signals will change in response to a vehicle approaching a sensor in the roadway. Signalization–both phased and demand responsive – are widely applied. In a more advanced mode, signalization forms part of Vehicle Guiding Systems aimed at the creation of continuous flow at certain sections of roads without stops.

Navigation Systems

Geographic positioning systems (GPS) in conjunction with geographic information systems (GIS) offer the possibility of decreasing the amount of time spent on search behaviour by motorists. Assuming one is willing to input one's origin and destination to the system, the shortest route will be proposed. In an alternative mode, an increasing number of motor vehicles will undertake the way finding for you and minimize unnecessary travel. The use of mobile communication in route advising seems underestimated for private car use and deserves more attention. It is obvious that for privacy reasons, this kind of system is not yet popular among private car drivers. The situation is different for freight transport, where systems of tracking and tracing are being introduced in finding most efficient network connections, e.g. in the routing and bundling of freight.

Congestion Relief System

Congestion is a function of the interaction vehicles have with each other due to speed flow relationships when volumes approach capacity. It is not just vehicles going slow, or

vehicles traveling at high speeds, that lead to congestion, although these contribute to the problem but so much need to travel instead of using ICT facilities. The video surveillance response system helps in this regard.

Video Surveillance and Response

Several cities maintain a continuous monitoring of key network locations to determine if traffic is moving or encountering congestion. Such monitoring can be done with strategically located sensors or television cameras. If flow interruptions are apparent they are usually caused by a disabled vehicle. Once these events are perceived, a repair/assistance vehicle is dispatched to the location. Upon arrival at the problem site, the objective is to remove the obstacle to flow and offer assistance (tyre replacement, and so forth) or transport to the motorist.

Variable Message Signs (Informational Signing)

Electronic changeable message signs along the highway have proven to be of some assistance in communicating with drivers regarding major congestion points on the road ahead. Often these signs (sometimes called Amber Alert signs in the United States), give directions as to ways to avoid upcoming congestion points related to accidents, congestion, and the like. It is important that such signs not be used on a continuous basis since drivers tend to ignore them if they always have some type of message on them. A simulation study for different European city-regions on effectiveness of VMS (Variable Message Signs) on road network efficiency suggests quite modest results. Reductions in overall network travel times are 1-2% for the use of VMS in regular congested circumstances, provided that there is spare capacity in the network. Estimates for impacts on pollutant emissions and fuel consumption are similar to changes in overall travel time. Whereas the above changes are quite small, driver perceptions of the benefits turned out to be much higher. This points to a potentially important role for this application in the development of integrated transport strategies, because the provision of information may encourage the acceptance of demand management measures.

Advanced Traveler Information Systems

Personal information systems may take different forms and may be in-vehicle for car drivers and portable for passengers using public transport. Based on real-time information, the best route and connections (in public transport) are given. In advanced modes, opening times of facilities (shops, services, etc.) and the length of stays are used as an input, enabling an overall space-time optimization of activity chains. This system helps travelers to plan their activity and traffic chains.

Intelligent Speed Adaptation (ISA)

These systems also use in-vehicle electronic devices enabling one to automatically regulate vehicle speed. Like the previous technology, experiments indicate a higher effectiveness in less congested conditions (UK) (Liu and Tate, 2004). High speeds can be effectively suppressed; leading to a reduction of speed variation, but more slow moving traffic cannot be induced. In addition, it was found that ISA with full penetration could lead to a reduction of fuel consumption by 8%.

Dedicated Short Range Communications

These systems are based on information exchange between cars and may pertain to accidents, weather conditions, road construction and similar events. In more comprehensive options, technical performance of the car can be communicated with the serving garage. Also, by integrating navigation systems, information about empty

parking places and similar information can be transmitted to the driver. These systems partly rely on mobile communication between vehicles on the same route (oncoming and following traffic) and are still in the stage of development. "Early versions" are currently used in public transport (busses, taxies) and in freight transport.

Fatality Reduction Sensors

It is estimated that some 90% of all traffic accidents can be attributed to human failure, such as a lack of alertness or fatigue (Marchau et al., 2005). Vehicle radar technology is already available that warns drivers of obstacles in their path. The same technology could be tied into an on-board computer system and used to make it nearly impossible for the vehicle to crash into other vehicles or objects. It would do this by accelerating, decelerating, or stopping the vehicle. Today, advanced in-vehicles technology is available as options in up-market car models, such as Mercedes, Lexus and Citroën (NRC-Handelsbad, August 5, 2005). Network safety seems to be heading primarily in the direction of automated guide ways that would control the movement and speed of cars. Note that the technologies earlier discussed also serve to reduce fatalities.

In-Vehicle Accident Sensors

It is generally recognized that many seriously injured individuals can survive such incidents if they can be transported to a medical facility quickly. The use of ICT in this case is intended to ensure this. A number of motor vehicle models being manufactured today come with sensors attached to the air bag system. Once the air bags are deployed, a communication of this event is sent to a dispatcher. The dispatcher in turn can communicate with the driver or other occupants of the vehicle and determines if any type of assistance (repair vehicles, ambulance and so forth) is necessary. At this time several high-end models offer this service, however all models of General Motors in the US offer this. It should enable faster response to accident scenes than has been typical as before.

Advanced Drivers Assistance

In the context of improving safety the in-vehicle Automated Cruise Control (ACC) and Intelligent Speed Adaptation (ISA) are interwoven. Automated Cruise Control that primarily serves vehicle safety performs both the longitudinal and lateral control task. Citroën today installs a system that warns the driver as soon as he/she moves to another lane without using the signal, by drawing attention through moving his/her seat. The lateral control task works by infrared sensors that measure variation in reflection of the standard markers on the road surface. In the EU, much research is currently devoted to in-vehicle collision avoidance based on sensor systems replacing infrastructure measures. An ultimate configuration is a 360º car surround system as a "safety belt". The systems that are currently studied vary in terms of technology, e.g. different radar sensors, infrared and visible spectrum imaging, laser technology, and in terms of distances and speeds involved (Lu et al., 2005). Research into such systems is in progress today, but the systems are still in an experimental stage waiting for solutions that are more robust, i.e., not vulnerable to influence of weather/atmospheric conditions and interference with other electronic systems, and more acceptable in cost or price. For example, Lexus plans to introduce lighting systems that monitor speed, braking performance and weather conditions, and automatically adjust the amount and type of lighting as a warning (active lighting).

Quite some attention has been paid to the impacts of Intelligent Speed Assistance (ISA). We mention estimated safety effects of full automatic speed control devices up to a 40% reduction of injury accidents and 60% reduction of fatal accidents (e.g. Marchau et al., 2005). For

the Netherlands, estimates reveal a fatality and heavy injury reduction of up to 30 and 38% on roads with speed limits up to 90km/h. In addition, estimates of the impact of automatic positioning and collision avoidance systems indicate similar maximum reduction levels for particular systems on particular types of roads.

CONCLUSION AND RECOMMENDATIONS

Information and communications technology, no doubt, has come a long way towards enhancing the movement of man, goods and services which is the basis of transport. Modern transportation has gone beyond physical movements. ICT innovations in transport are intended to enhance the safety and efficient transport system which the conventional transport system does not offer. Even though the cost of providing these technologies may be high, the benefits are invaluable. A better environment, more safety, ease in necessary transport of goods and services and growth and development of economies will be achieved if the technology is integrated. Those countries that have long been using it have benefitted a lot from it. Those that are still foot-dragging should take a cue from them and enjoy the unquantifiable benefits that this system will bring.

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Low-Energy Building Strategies for a Sustainable Built Environment in Nigeria

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ABSTRACT

Incorporation of low-energy strategies into buildings is essential to achieving sustainable built environment in Nigeria. Low-energy strategies enhance reduction in energy demand and the use of cleaner energy for various purposes in buildings. The current energy crises witnessed in Nigeria has led to massive use of alternative back-up power sources in buildings for the purpose of space cooling, lighting and powering of appliances. This condition leads to increase in the burning of fossil-fuel which affects the environment negatively by increasing the release of greenhouse gases and also incurring high energy costs for the purchase of the fuel on the long run. Designing low-energy buildings to achieve high energy efficiency is a lead way to sustainable buildings which is important to achieving a sustainable built environment in Nigeria; it therefore becomes imperative that these strategies be incorporated in all building types in Nigeria. This paper reviews low-energy building strategies that can be incorporated in buildings within Nigeria in order to reduce operational energy demand. It also highlights potential benefits to sustainable built environment in Nigeria.

Keywords: Buildings, Built Environment, Low-energy, Nigeria, Sustainable

INTRODUCTION

The concept of sustainable development and building practices has gained more attention in most countries of the world in the last few decades because of the negative impacts buildings have on the environment. These negative impacts were result of increase in energy use to meet the various needs of cooling and heating in buildings, powering of appliances and equipment, construction and manufacture of building materials. The International Energy Agency, IEA (2013) stated that cooling and space heating accounts for over one-third of all energy consumed in building globally. This shows that comforts energy is high compared to other forms of energy use in buildings. The rapid population increase, urbanisation and economy growth in most countries of the world necessitate increase in energy demand and consumption in buildings which on the long run exerts negative impacts on the environment.

In the same vein, Nigeria is currently witnessing rapid growth in population with the current figure of 185,308,154 based on the latest United Nation estimates (Nigeria Population Worldometer, 2016). This increases energy demand for various purposes in buildings and for other economic activities. The Nigeria Vision 2020 intent is to position Nigeria to become one of the top twenty economies in the world by the year 2020 (Accenture, 2009); the vision needs increased energy to drive it to a realistic end. But the current electricity supply in Nigeria does not meet the demand to cater for various needs of the citizens. Figures released by the Federal Ministry of Power in Nigeria (Punch Newspaper, 2015) showed that the country' peak generation as of October 2014 was 3,512.5MW, against a peak demand of 12,800MW (Batagarawa, Hamza, Dudek & Tukur, 2015), (Adegbemi, Adegbemi, Olalekan, & Babatunde, 2013).

The Nigeria climate which is tropical in nature and characterised by high temperature further increases the need for energy use in buildings because of the high solar radiation received throughout the year which causes accumulation of heat in the building interiors. This condition causes thermal discomfort and increases the dependency on mechanical cooling aids such as air conditioners. In order to have energy for various purposes such as cooling,

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lighting, powering of appliances and to drive the economy, there is a massive use of back-up power generators that burn fossil-fuel because of inadequate power supply in the country. This action has a negative impact on the environment, and with the fact that the nation does not fully harness the available potential to generate power from renewable sources such as the sun, wind, hydro, amongst others; the negative environmental impact will be on the increase.

Incorporation of low-energy strategies to buildings in Nigeria will reduce energy demand and thereby achieve sustainable environment. Low-energy design strategies are methods to earn better energy performance in buildings for the delivery of a comfortable indoor environment and without negative impact on the outdoor environment. These include passive design strategies, use of onsite generated renewable energy and energy efficient technologies (U.S Federal Energy Management Programme 2001). It is believed that when energy is efficiently managed in buildings, the built environment can be sustained.

RESEARCH METHODOLOGY

This paper reviews literatures to elucidate information on the subject of low-energy strategies that can be incorporated to reduce operational energy demand in buildings and thereby achieve sustainable built environment in Nigeria.

BUILDING AND BUILT ENVIRONMENT SUSTAINABILITY

The built environment is the surrounding created out of the ingenuity of man for needs satisfaction and survival. Bartuska and Young (1998) defines the built environment as everything that is made, arranged or maintained by man to fulfil the purpose of needs wants and values. There is an interaction between the natural and the built environment which must be maintained and be balanced at all times to ensure continuous existence on the earth. Brophy and Lewis (2011) stated that building process impacts on the environment in diverse ways through energy consumption, material use, water use and waste generation. These in turn result into problems such as global warming, ozone depletion, loss of natural habitat and biodiversity, soil erosion and release of toxic pollutants. Moreover, Lehmann (2010) listed amongst others, some of the current and most significant environmental problems; these include global climate change, excessive fossil fuel dependency and growing demand for energy in cities. These environmental problems require quick response from all human endeavours in order to preserve and sustain the environment.

The built environment cannot be sustained without sustainable buildings. Sustainability in building requires minimising the consumption of resources such as energy, water and materials while maximising the health, safety and quality of life of occupants and the buildings (Ramah 2005). According to Lehmann (2010), sustainable buildings are buildings that are designed based on the holistic approaches involving five principles; these are:

i. Resource efficiency (reducing energy needs and materials during construction)
ii. Energy efficiency (reducing energy demand in building operation)
iii. Pollution prevention (minimizing pollution, environmental impact and damage to health)
iv. Harmonisation with environment (making the most of the site, reducing embodied energy and resource depletion)
v. Applying integrated and systemic approaches

The energy efficiency approach to sustainable building is of high importance to achieving sustainable built environment. This is because building contributes immensely to the negative impacts on the environment. The United Nation on Environment Programme (2009) proposes improving energy efficiency of buildings as the first target on policy options for reducing emissions from building sectors as buildings account for around one third of energy use and

over half of total greenhouse gas emission globally. Amongst the approaches for achieving a sustainable environment is the energy efficiency in buildings which include low-energy principles in which energy use in buildings can be reduced drastically.

Building Energy Use

Energy use in building is one of the most significant means of energy consumption and greenhouse gas emissions, thereby creating negative impact on the environment. Energy use is associated with the emission of greenhouse gasses which is responsible for global warming and consequently climate change. Peres-Lombared, Ortiz & Pout (2008) reported that there has been a steady increase in the global energy consumption of buildings which steadily emit greenhouse gasses; this has reached figures between 20% and 40% from both residential and commercial buildings in developed countries. Energy is a very crucial and critical resource that a building depends on to function adequately throughout its entire lifetime; energy is used in building to deliver comfortable conditions for occupants, to power appliances, to manufacture building materials and during construction (Rai, Sodagar, Fieldson & Hu, 2011). Tofield (2012) also noted that energy consumed in building during its life time comprises of embodied energy (energy used in building construction), energy-in-use or operational energy (energy used annually to operate the building) and energy used in demolition of building. Cooling and heating energy has been recognised as the most dominant source of energy use in building which is also referred to as operational energy (Tofield, 2012).

Buildings are responsible for a considerable proportion of global energy use (Ashden 2014) and UNEP (2009) reiterates that building sector consumes up to 40% of global annual energy and contributes up to 30% of annual greenhouse gas emissions. In a research conducted by Batagarawa, (2013) on energy use in an office building in Nigeria, cooling loads accounts for approximately 40% of the electricity consumed in the building, while lighting and powering of appliances accounted for 12% & 48% respectively. According to Rai, Sodagar, Fieldson & Hu (2011), building energy use accounts for almost fifty percent (50%) of the total CO_2 emission in the UK. In the same vein, the US Federal Energy Management Programme (2001) argues that buildings in the US consume about 37% of the primary energy and 67% of the total electricity used each year and also produce 9% of global carbon dioxide emissions. This shows that energy use in buildings is high and consequently leads to increased negative impact on the environment. Adoption of energy efficiency approach in buildings will drastically reduce energy demand and consumption.

Meaning of Low-energy Building

Adapting buildings to low-energy is one of the ways to make it energy efficient. Ashdeen (2014) stated that low-energy buildings use a mixture of passive techniques and active systems to deliver a comfortable environment with lowered energy use and related greenhouse gas emissions. Low-energy buildings have decreased energy demand and without deterioration of the indoor climate condition. Low-energy designs in buildings is the inventive use of the basic form and enclosure of a building to save energy while enhancing occupants' comfort as stated by the U.S Federal Energy Management Programme (2001). Low-energy building design combines energy conservation strategies and energy-efficient technologies which result in absolute reduction in the use of fossil- fuel based power. Moreover, building operational energy cost can be saved from low-energy buildings. This savings can be achieved through integrated design solutions.

A low-energy building has fabric energy efficiency that is effective in minimizing the energy needed for cooling and space heating (Tofeild, 2012). Furthermore, installation of renewable energy technologies should not be a substitute for building fabric energy efficiency, but rather

complement it to reduce overall demand for conventional fossil-fuel based energy. It should not compensate or offset operational energy where the fabric is poorly designed; this will lead to unnecessary waste. Low-energy design strategies make use of the building fabric or envelope such as wall, windows, floors and roofs through appropriate design, materials and construction methods to minimise buildings energy consumption, enhance environmental performance and the economy (U.S. Department of Energy Efficiency and Renewable Energy 1999). In the UK, different terms were used to describe low-energy buildings, these includes; low energy house, high-performance house, passive house/Passivhaus, zero carbon house, zero energy house, energy saving house, energy positive house and ultra-low energy house. It is essential to consider low-energy principles at the inception of a building design because it has been recognised as the cheapest way to cut greenhouse gas emissions (UNEP, 2009). Low-energy buildings should consume significantly less energy than the level specified in the building regulation and the key objective of such buildings is energy-efficient design in which minimal energy is consumed throughout the building life cycle (Pedirini, 2003).

Design strategies for low-energy Buildings

One of the principles of low-energy building strategies is the use of passive design strategies. Passive design is an approach to building design in which the building architecture is used to minimize energy consumption (Naresh, 2014). Passive design strategies include passive cooling, passive heating, passive ventilation and daylighting. Passive cooling strategies prevent the building from overheating by blocking solar gains and removing internal heat gains. It includes the use of fixed and operable external shading, thermal mass, low window to wall area ratio (s/w), thermal mass, passive ventilation, nocturnal cooling, stacked windows, passive evaporative cooling and earth-tempering ducts. Low-energy strategies also include appropriate use of building orientation and shape, high performance window, amongst others (Naresh, 2014).

Passive ventilation is another passive design strategy for low-energy buildings in which naturally occurring air flow pattern in and around a building is used to introduce outdoor air into the space. Daylighting as a passive design strategy displaces the electrical energy that would have been used to provide artificial lighting, it maximises the use and distribution of natural diffused daylight throughout a building's interior to reduce the demand for artificial lighting (Baker & Steemers 2005, Naresh, 2014). The active roles of the architect and building engineers during the inception stage of building design is very important so as to incorporate these low-energy design principles. The U.S Federal Energy Management Programme (2001) reported that in the application of low-energy design principles, consideration should be given to factors such as climate, building and space type, internal heat gains from occupants, light and electrical equipment, building size and massing, lighting requirement, hours of operation, costs for electricity and other energy sources. This will allow for the evaluation of buildings' energy requirement and performance as well as right decision making on the appropriate strategies that will produce the optimal energy saving.

Benefits of low-energy design in buildings

There are a lot of benefits to human and the environment when low-energy strategies are incorporated in all building types. There is a reduction in energy demand and consumption; emission of greenhouse gasses is reduced and environmental impacts are lowered. Moreover, low-energy buildings bring improved comfort, health and productivity, energy bills are cut by reduced operational energy and this leads to economic saving (Naresh, 2014). Income is also generated by the integration of renewable energy into buildings. In commercial building sector, low-energy buildings will enhance a more productive workforce, reduced maintenance cost and better rental incomes. The potential financial benefits of low-energy buildings far outweigh any extra initial cost of construction as noted by Tofield (2012). Therefore, low-

energy design strategies should be incorporated with other energy efficient technology and renewable energy in buildings in order to lower the emissions and the negative environmental impacts arising from buildings and thereby sustained the built environment.

In Nigeria, incorporation of low-energy design into buildings will drastically reduce dependence on fossil-fuel based energy and consequently leads to sustainable built environment. The passive design strategies can be employed from the building inception stage, which will reduce energy demand to operate the buildings. The nation has the benefits of harnessing solar energy from the high annual global solar radiation witnessed throughout the year to develop an integrated approach to building designs. This will help in solving the problem of mass use of alternative back-up power generators which releases greenhouse gases and thereby causing damage to the environment.

Conclusion

Adapting buildings to low-energy strategies is essential to having a sustainable built environment since buildings account for a large portion of the global energy use and greenhouse gas emissions. Building design is the first option and the cheapest means to achieving reduced energy demand in buildings, therefore passive design strategies should be considered and be incorporated at the initial stage of all building types. Low-energy strategies in buildings within Nigeria is essential to reduce the dependence on fossil fuel based power to supply energy needed especially operational energy for cooling, lighting and powering of appliances.

The Nigerian government and all the stakeholders in the building industry, especially the architects and the engineers should key in into the incorporation of the low-energy strategies for all building types in the country in order to sustain the built environment.

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An Assessment of the Role of Nigerian Architects towards Climate Change and Global Warming in the Built Environment

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ABSTRACT

The roles of architects-Nigerian architects-inclusive, in mitigating climate change and global warming in the built environment have been globally identified as invaluable. The extent to which this fact has been accepted in Nigeria is still in much doubt as evidenced by the built structures prevalent in the country; the construction techniques, materials, fenestration and orientation are such that they are not aligned with the local environment. Hence, there is the need for high fossil burning mechanical aids. Interviews, descriptive surveys and questionnaires were used to collect data on the perception of Nigerian architects on climate change and global warming. The data was subjected to statistical analysis using the SPSS (version 20). Findings from the questionnaire survey indicated very unsatisfactory and substandard roles played by the Nigerian architects, which can be attributed to insufficient Knowledge on their part especially as it relates to their roles in designing natural resource consumption intensity in buildings, creating huge opportunities for greenhouse gas reductions. This study concludes that the roles Nigerian architects have played so far can be emphatically improved upon by considering the character of the built environment as a factor which helps in mitigating climate change and global warming.

Keywords: Built environment, Climate change, Global warming, Greenhouse gases, Nigerian architects

INTRODUCTION

Climate change and global warming are perhaps one of the greatest challenges facing the planet today which has brought with it adverse economic, environmental and even health effects on communities where it is pronounced. At the UN Climate Change Conference of parties 21 (COP21) meeting in Paris, participants were of the view that African countries-Nigeria inclusive, are currently suffering from the effects of climate change. This has drastically affected food security, poses a threat to human lives and has caused the destruction of economic and social structures (COP21, 2015).

Climate change is primarily attributed to the trapping of greenhouse gases (GHG_S) within the atmosphere which normally should have escaped. Sassi (2006) in Edward (2006) strongly posits that the planet has warmed and cooled many times during the 4.65 billion years of its history, and at present the Earth appears to be facing a rapid warming, which most scientists believe results, at least in part, from human activities.

In Nigeria, the effects of climate change and global warming may not be too pronounced presently as it is in some parts of the globe, but with current trends, the situation may emphatically change in few decades to come as a result of the growing rate of industrialization, especially as the country is in the move to commence industrial production of commodities. Interestingly, many are afraid that tackling climate change and global warming may be too costly or impossible. However, studies have revealed actions such as the use of low energy materials will not only be cheaper than inaction, but could actually result in economic, environmental, and even health benefits while improving sustainability (Schaub, 2012).

Many studies (Maathai, 2006; UNFCC 2006; CCDI 2007; IPCC 2007, UNDP 2009 and Michael, Nnezi & Adeyemi, 2012) have confirmed that Africa contributes the least to global

Saliu, H. O. & Achimugu, L. (2016). An Assessment of the Role of Nigerian Architects towards Climate Change and Global Warming in the Built Environment. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F.? Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 39-46

warming with Nigeria having about 0.8% but the region is the most vulnerable and most adversely affected by climate change. Smith (2004) opined that the likely rise of sea level for this century is on average, about half a meter, which will have a significant impact. A large percentage of Africa's population is land- locked and coastal facilities are economically significant. In Nigeria for instance, more than 20 million people live along the coastal zone. Nigeria's extensive coastline is already being threatened by a rise in sea-level and human development. This combination contributes to degradation and loss of coastal wetlands and mangroves and increases damage from coastal flooding with serious consequences for fisheries, buildings and tourism.

According to Environmental impact assessment (2005), Commercial and residential buildings account for almost 40% of the primary energy and approximately 70% of the electricity in most parts of the world. The energy used by the building sector continues to increase primarily because new buildings are constructed faster than old ones are retrofitted. Electricity consumption in the commercial building sector doubled between 1980 and 2000, and is expected to increase by another 50% by 2025 (EIA, 2005).

It is saddening to note that current architectural practices in Nigeria tend to worsen the already very bad conditions. Currently, buildings hardly perform up to average without relying on mechanical aids as clearly buttressed by Maina (2010) that in Nigeria, the irony lies in the fact that architects have continued to design buildings and specify the use of mechanical devices like air conditioners. This act which is oblivious to such sobering statistics mentioned above is in the style, spirit, and industrial technology that identifies with Le –Corbusier's machine age architecture.

With considerable global interest and efforts being directed towards the effects of climate change and global warming, it is an established fact that architects-Nigerian architects inclusive - are working towards reducing the causative factors of these phenomena through design and construction processes. Although some practical steps such as more architectural education on the environmental impact of buildings have been taken, it is obvious, judging by the alarming rate at which the climate is changing and the ever increasing global temperature that much still needs to be done.

Architects over the years have reflected on the importance of having good quality environment. The quest for environmental values in architecture, for a harmonious balance between man and his environment is not a new approach. It is so much that for centuries, mankind adopted this approach out of necessity, particularly in vernacular architecture. However, since the industrial revolution, this has increasingly been abandoned in favour of universal architecture, which in many parts of the world, has led to energy intensive buildings.

The effects of global warming and Climate Change are increasingly becoming apparent. Notable in Nigeria today include, famine, diminishing rains, drying rivers and power rationing just to mention but a few. Faced with these dangers, the public and policy - makers alike must become conscious of the need to protect our environment. One response to these issues is to approach architecture in a way that respects the environment. (Oni and Akingbohungbe, 2013). It is in this light that the study sets out to assess the role of Nigerian architects in response to climate change and global warming in the built environment by considering the following objectives:

i. Study the concept and global effects of climate change and global warming in the built environment.
ii. Study the rate at which climate change and global warming has risen overtime.

iii. Evaluate measures adopted by the Nigerian architects to successfully impact and mitigate global warming.

THE CONCEPT OF CLIMATE CHANGE AND GLOBAL WARMING

Climate change is primarily the change in climate that is attributable to the trapping of greenhouse gases within the atmosphere, which normally, should have escaped. In a more recent development, Zoaka (2008) argues that the chief cause of this warming is thought to be the burning of fossil fuels, such as coal, oil, and natural gas, which releases into the atmosphere carbon dioxide and other substances known as greenhouse gases. As the atmosphere becomes richer in these gases, it becomes a better insulator, retaining more of the heat provided to the planet by the sun.

Researchers have employed different methodologies for carrying out studies to investigate global warming. Architecture2030 (2010) posited that the average surface temperature of Earth is just below I5 degree Celsius (59Fahrenheit degree) and believes that over the last century, this average has risen by about 0.6 Celsius degrees (1 Fahrenheit degree). Scientists predict further warming of 1.4 to 5.8 Celsius degrees (2.5 to 10.4 Fahrenheit degrees) by the year 2100. This temperature rise is expected to melt polar ice caps and glaciers as well as warm the oceans, all of which will expand ocean volume and raise sea level by an estimated 9 to 100 cm (4 to 40in), flooding some coastal regions and even entire islands. The EIA (2005) after carrying out an analysis on the changing climate also totally agreed with the aforementioned effects in addition to findings that some regions in warmer climates will receive more rainfall than before, but soils will dry out faster between storms. The potential consequences of global warming are so great that many of the world's leading scientists have called for international cooperation and immediate action to counteract the problem.

Emission of Green House Gasses (GHG_S) by the Buildings Sector

The building sector encompasses residential, commercial and institutional buildings. The sector accounts for 15.3 % of global GHG emissions, including 9.9% for commercial buildings and 5.4 % for residential; CO_2 accounts for nearly all emission as opined by Magdy (2011). Emissions from the building sector are predominantly a function of energy consumption for diverse purposes that are organized into three broad categories: public electricity use, direct fuel combustion, and district heating. Public electricity use include lighting, appliance use, refrigeration, air conditioning, and to some extent space heating and cooking (EIA, 2005).

Furthermore, environmental scientists have often argued that there is an important correlation between building emissions and socioeconomic development levels. In general, building emissions are higher in industrialized countries, both in per capita terms and as a percentage of total country emissions with variances due to climatic factors. Thus, development has an important effect on emissions from the building sector. This implies that building efficiency becomes more significant as countries become more prosperous.

Climate change and global warming timeline

Magdy (2011), stated that the timeline of the phenomenon of climate change and global warming is from 1870 to present and there has being a steady increase in concentrations of CO_2 in the atmosphere from the aforementioned period. Further studies by researchers were able to bring out the fact that for thousands of years, the CO_2 concentrations in the atmosphere have been fairly constant at about 280ppm (part per. Million) in the last 400 years. This corresponds with the start of the Industrial Age which witnessed increase in CO_2 to about 380 ppm (Zoaka, 2008). This was as a result of the use of machinery and factories that led to mass production, which in turn led to the development of numerous environmental hazards.

Architectural Practice and Climate Change

The Architect as a key player in the Building Industry plays a very vital role in combating the effect of climate change on the built environment. According to some researchers (Oni and Akingbohungbe ,2013; Omotoso, 2011 and Serigio, 2008) Architects as key players in the built environment can contribute to the reduction of the energy and demand on resources associated with construction and operation of buildings through the following strategies.

i. Incorporating existing buildings and structures into design schemes as much as possible instead of demolishing such buildings and structures to make way for new buildings.
ii. Collaborating with Mechanical and Electrical Engineers to design for reduced consumption of energy in buildings.
iii. Specifying recyclable, reusable, local, natural, durable and environmental friendly building materials.
iv. Creating high performance buildings that take maximum advantage of natural ventilation and lighting.
v. Planning cities, part of cities and neighbourhoods in such a manner that people can live and work and take leisure within a single environment.
vi. Preserving biologically rich landscapes in master planning.

According to (Ogunsote & Ogunsote,2010) some of the other means of combating climate change include; developing workplace strategies that merge efficiencies with people-focused design, sharing facilities such as copy centers, kitchens and conference rooms, designing meeting areas and large spaces multipurpose and adequate utilization of facilities. It is based on the above mentioned strategies that study assessed the role and practice of Nigeria architects in mitigating climate change in the built environment.

METHODOLOGY

The study adopted literature, alongside interviews and questionnaire survey to assess the roles of the Nigerian architects towards response to climate change and global warming in the built environment. The interviews were carried out on key respondents in an attempt to buttress findings from the literature while structured questionnaires were administered to members of Nigerian institute of architects (NIA) in three selected states in the North – Western branches in Nigeria.

A stratified sampling was used in which all the 400 private firms and institutions (Arcon register, 2015) that employ the services of architects in the branches were identified and analyzed as 318 Private firms and 82 Institutions. The names of the two different samples above were placed in two different bowls and shuffled thoroughly from where 50 percent of each sample (that is, 159 private firms and 41 institutions) were drawn out by the researcher using a random selection method. In the random method, each of the N population members was assigned a unique number. The numbers were placed in a bowl and thoroughly shuffled from where the researcher randomly selects n numbers, totalling 200. The 220 questionnaires were administered to the architects from each of the above selected samples and 200 were returned and used for analysis.

The questionnaire was designed to seek the respondents' opinions on the appropriateness of current architectural practices and the need to reduce the menace of climate change and global warming in the built environment. The questionnaire consists of two parts A and B. Section A consists of the respondents profile while section B generates data on the experiences of the architects on the effects of architectural practices on climate change and global warming. Data from the structured questionnaires were translated into numeric codes by the researcher, and data capture was done by statistical analysis using the SPSS (version

20) computer program. The analysis, presentation, and discussions of the findings from the questionnaires were presented in tables and charts.

RESULTS AND DISCUSSIONS

The result from the survey shows that about two thirds of the architects were master's degree holders largely working in government organizations with about 1-5 years practice experience. Whereas all the Ph.D. respondents 'work in government organizations and have 11-20 years duration of practice (Table 1)

Table 1 Cross Tabulation of Educational Qualification and Other Demographics

		Educational qualification of respondents				
		M.Sc. Number	Ph.D. Number	Others Number	B.Sc. Number	Total Number
Duration of practice	1-5 years	81	0	0	0	81
	6-10 years	54	0	0	0	54
	11-20 years	31	19	0	0	50
	21 years and above	15	0	0	0	15
	Total	**181**	**19**	**0**	**0**	**200**
Place of employment	Government	96	19	0	0	115
	Private Firm	40	0	0	0	40
	Self Employed	45	0	0	0	45
	Total	181	19	0	0	200

Awareness of the global effect of climate change on the built environment

The study examines the level of architect's awareness on the effects of climate change on the built environment which is considered very important in an attempt to seek a solution. The findings from the questionnaire revealed that an appreciative number of the respondents were aware of the danger of climate change and global warming to the built environment. Further investigation through interviews indicated that the awareness is due to media publicity and report from conferences on climate change. This clearly indicates that most architects practicing within the selected areas are conscious of the fact that climate change has an adverse effect on the built environment (see figure 4.1)

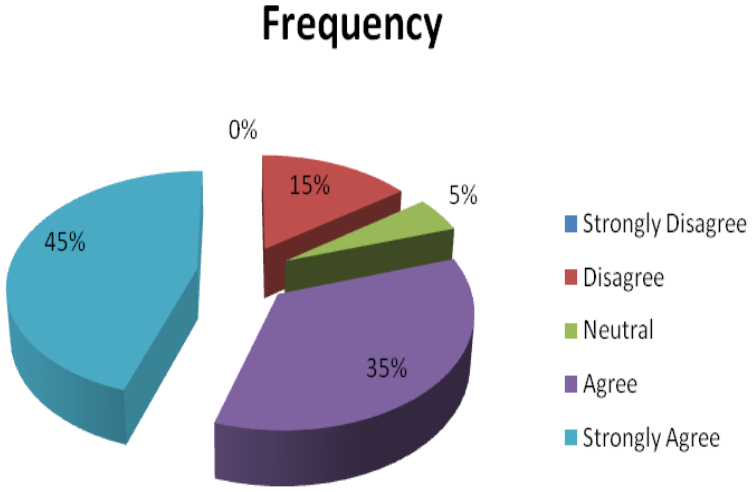

Figure 1 Awareness of the global effect of climate change on the built environment

Architects Response on the Mitigation of Climate Change.

The study seeks to establish the responses of architects in mitigating the effect of climate change on the built environment. Figure 2 below clearly shows that, 70.0% of the respondents rate architect's response on mitigation of climate change unsatisfactory. This finding is not surprising in any-way as interviews and observations indicated that the nature of buildings found in the Nigerian built environment relies more on mechanical aids for optimum operation thereby bringing about increased energy consumption in buildings, which in turn adds to the GHGs in the atmosphere.

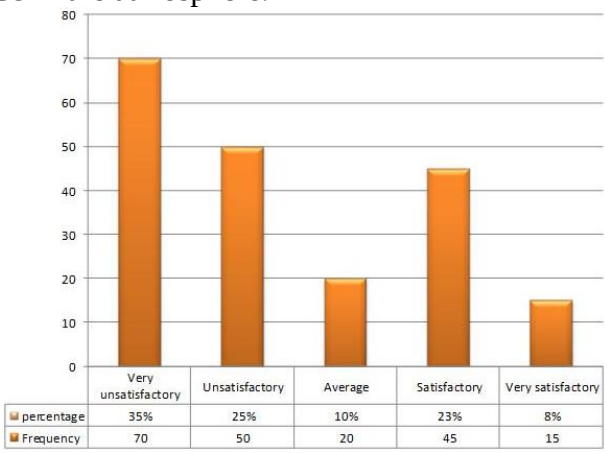

Figure 2: Architects Response on the Mitigation of Climate Change

Collaboration of Architects with Mechanical / Electrical Engineers and other professionals in the building industry to design for reduced consumption of energy in buildings.

The advent of industrial period was characterized by the use of machines in buildings that emits CO_2 to the atmosphere which still manifest throughout the twenty first century; thus, the study seeks to find out the level of collaboration of architects and other professionals (services engineers) in the construction industry. Interviews conducted revealed that most architects limit the scope of their work to the building alone without considering the effect of some of the appliance of machines that would be installed in it by other professionals. This is further buttressed from the analysis of the questionnaire as shown in figure 3 below:

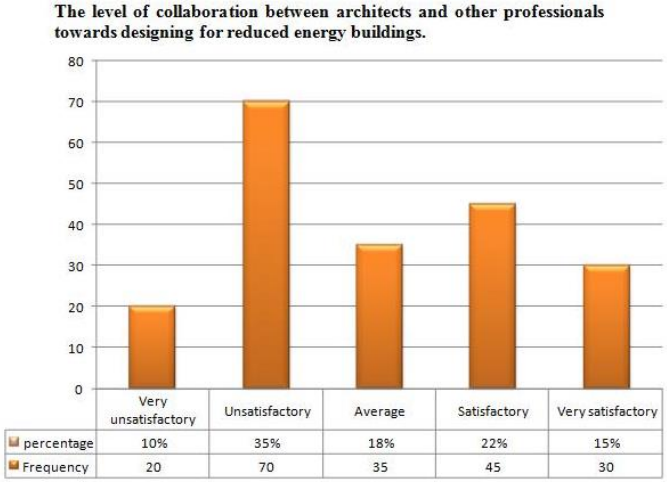

Figure 3: Collaboration of Architects with other professionals (Services engineers) in the building industry.

The Use of local and reusable sustainable building materials

The study discovered from literature that the use of local and re-usable sustainable building materials could reduce the effect of climate change in the built environment and as such,

opinions of architects were sought to know the level at which these materials are used in the building industry via questionnaires, interview and observation. It was found out that the Nigerian building industry largely depends on imported building materials and has totally neglected the use of indigenous materials that are environmental friendly. 70% of the respondents share the same view as seen from figure 4 below.

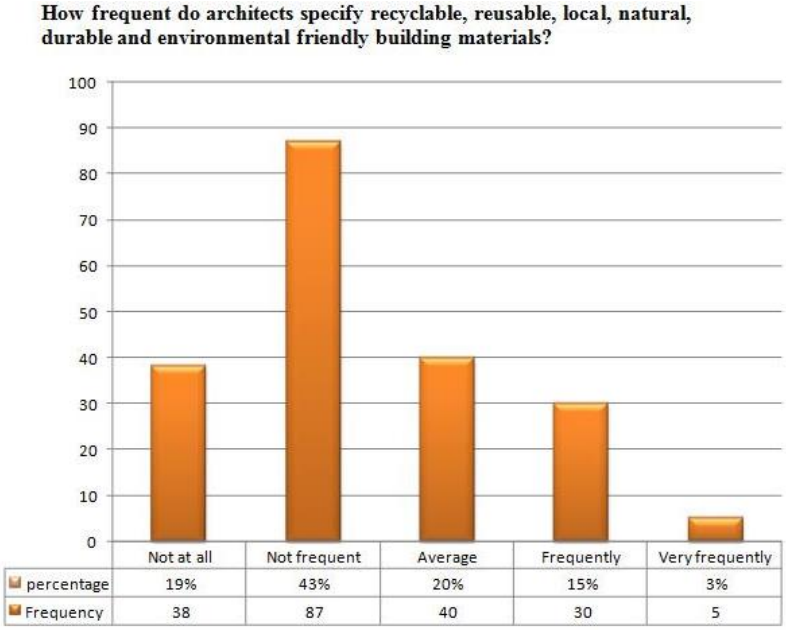

Figure 4: Architect frequent use of local or reusable sustainable building materials

CONCLUSIONS

This paper applied questionnaire survey, and consulted literatures on climate Change and global warming to assess the roles the Nigerian architects have to play in response to climate change and global warming in the built environment: all in a bid to mitigate its effects.

This research was able to buttress the latent fact that the building sector is a major causative factor of climate change and global warming and revealed that the roles the Nigerian architects have played so far can be best described as very unsatisfactory and substandard. From responses gotten, this unsatisfactory result can be attributed to insufficient knowledge on the path of the architects especially as it relates to the available opportunities for GHG reductions in buildings. The results show inadequate knowledge and disinterest of Nigerian architects as to how their change in practices alone can be a major factor in tackling the phenomenon of global warming in the built environment. Therefore, in the light of the aforementioned, it is important Nigerian architects are made aware of their responsibilities in the overall scheme of design and construction, as it relates to low energy buildings, by paying more attention to appropriate specifications, designs, and construction techniques, in order to help bring about minimal resource consumption and reduced pollution in the built environment.

Furthermore, seeing the astonishing facts from this study that the building sector contributes nearly half the greenhouse gases in the atmosphere, it is suggested that;

i. Awareness is created to help the populace make informed decisions concerning the concept of sustainability and how they live considering its measurable effect on global temperature which is responsible for happenings such as floods, droughts, desertification, among others.

ii. The architectural education program should be tailored to prepare fresh graduates towards carrying out and supporting the awareness and implementation of sustainable design. Government should do more in encouraging the use of locally available and Sustainable materials and techniques in building construction.

iii. Nigerian architects should design buildings by making massing, fenestration and orientations work with the local environment, so that buildings could take advantage of passive heating, cooling and natural lighting as this sets in motion the energy consumption pattern over the life of the structure.

iv. Finally, other factors and phenomena whose understanding and application could help tackle the effects of climate change and global warming should be investigated in further studies. These include; Climate change flexibility mechanism, Global warming and population, Nanotechnology and Nano-products at the construction site, as well as attaining Zero carbon city.

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Low Cost Approach to Energy Efficient Buildings in Nigeria: A Review of Passive Design Options

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ABSTRACT

Energy consumption in buildings accounts for approximately 45% of the world's total energy consumption, leading to a significant proportion of greenhouse gas emissions. This has led to an increasing effort towards reducing energy consumption. An example of such efforts is energy efficient buildings using passive design options. This paper assesses a low cost energy efficient strategy approach to achieving energy efficiency in buildings using passive design options in Nigeria. A critical review of various passive design options and their roles in reducing energy consumption in buildings will be conducted. This approach is necessary due to energy poverty, high energy cost, erratic power supply, over dependence on electrical generators for indoor thermal comfort and other factors. Research has shown that this method can reduce energy consumption in buildings by 40%-60% in comparison to conventional buildings. This paper shows that there is an urgent need for professionals in the building industry as well as other stakeholders to advocate passive design options in Nigeria as a viable step towards achieving high energy performance buildings. This paper concludes by emphasizing the need for Nigeria to start with a low cost energy approach to achieve energy efficient buildings in the short term while aiming for ultra-low energy buildings in the long term.

Keywords: Energy consumption, energy efficient buildings, passive design, thermal comfort

INTRODUCTION

Research showed almost two decades ago that buildings account for nearly 45% of the world total energy consumption (International Energy Agency, 1995). Moreover, the energy consumption in building has exceeded other sectors in different regions of the world. For instance, energy consumption in buildings in the United States is as high as 48% and 76% in terms of total energy and electricity respectively (Perez-Lombard, 2008). Hence, buildings account for a significant proportion of GHG emissions.

Several efforts have been put in place to mitigate the negative impacts of buildings on the environment (BRE, 2004). This has resulted in agreement targeted at developing key strategies and actions to make buildings more sustainable (International Council for Building, 1999; Barrett *et al.*, 1999; Construction Research and Innovation Strategy Panel, 2000). In addition, it has also placed an urgent demand on architects and other professionals in the building industry to design buildings using concepts that consume less energy. Energy efficiency measures have been identified as a viable means of reducing energy consumption in buildings. This method can decrease primary energy consumption in buildings by 40%-60% in comparison to conventional new buildings (Moore et al., 2013).

Despite evidences of climate change in Nigeria, adaptation and mitigation efforts are still rudimentary. Hence, Nigeria is currently faced with an enormous challenge of evolving performance standards, systems, codes and other regulatory means to mitigate, forestall and develop the built environment (Michael, 2013). More efficient use of energy has to be considered as one of the major options for sustainable development in Nigeria and globally (Akinbami and Lawal, 2009).

This paper was born from the need for Nigeria to consider achieving energy efficient buildings using passive design approaches as a viable step towards achieving sustainable buildings. This paper started by explaining the concept of energy efficient buildings and proceeded to identify strategies for achieving energy efficiency in buildings. The reasons why Nigeria should consider achieving energy efficient buildings in the short term using passive

Ochedi, E. T., Taki, A. & Painter, B. (2016). Low Cost Approach to Energy Efficient Buildings in Nigeria:A Review of Passive Design Options. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F.? Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 47-55

design options were also discussed. The paper later discusses the various passive design options that can be adopted in Nigeria to reduce energy consumptions in buildings. Finally, the findings were summarized and recommendations were made based on the findings.

LITERATURE REVIEW

Energy Efficient Buildings

Energy efficiency refers to using less energy to achieve results otherwise achieved with a certain quantity of energy. It means using energy in a way that reduces the amount required to provide building services (Etiosa, 2009; Chung et al, 2006). It also refers to using less energy to produce the same amount of services or useful output. Energy efficient buildings have been defined as those that strive towards the lowest possible energy requirements with reasonable utilisation of resources through the use of energy efficiency measures (Radhi, 2008).

Energy Efficiency Strategies

Moore et al., (2013) identified a two-level strategic approach developed for the design of energy efficient buildings for the world's four major climatic zones. These are the "Easy Efficiency Strategy" and the "Advanced Efficiency Strategy".

Easy Efficiency Strategy

This approach can reduce primary energy consumption in buildings by 40%-60% in comparison to conventional new buildings or by 70%-80% in terms of existing building stocks. This approach focuses on passive options, which are in low cost compared to the advanced strategy. This strategy is necessary in the short term as it is not adequate to achieve long-term climate protection targets (Moore et al., 2013). This strategy relies majorly on the building envelope through the use of the building orientation, material specification, and other design approaches to reduce energy consumption in buildings.

Advanced Efficiency Strategy

This strategy can achieve energy savings of "up to 90% compared to new building standards" (Moore et al. 2013, p. 1297). Further improvements using active renewable energies can decrease net energy demand to 0% and even beyond.

Passive Design

Passive design has been defined as "design that works with the environment to exclude unwanted heat or cold and take advantage of the sun and breezes, therefore avoiding or minimising the need for mechanical heating or cooling" (Cairns Regional Council, 2011, p.6). It relies on natural processes for cooling or heating to accomplish balanced thermal interior conditions. To achieve indoor comfort conditions in hot climates, focus should be on minimising heat gain into the interior spaces while at the same time enhancing the removal of excess heat. This is the basic principle of passive cooling (Kamal, 2012). In a tropical climate like Nigeria, buildings should be designed to maximise natural lighting and cooling. Moreover, shading, proper building orientation, appropriate building materials and other approaches should be used to discourage both heat gain and storage in buildings.

Major efforts towards achieving energy-conscious design in hot climate regions of the world have centred on the recommendation of passive techniques as the primary means of achieving comfort (Ochoa and Capeluto, 2008). Cairns Regional Council (2011), identified the following major principles for achieving passive design for buildings in tropical climates: avoid heat gain, encourage natural ventilation, make use of natural light and create cool outdoor areas.

Why Energy Efficient Buildings?

Several factors are responsible for advocating energy efficient measures, especially passive design approaches for Nigeria. Among these are the signs and effect of climate change, high energy demand and consumption and housing deficits

Signs and Effects of Climate Change

The effects of climate change as experienced in other parts of the world are now evidenced in Nigeria. A study of Nigeria's metrological data has shown some signs of climate change in the country. Some of the signs of climate change include anomalies in the onset and cessation

of the rainy season, variation in temperature, high impact rainfall, flash floods, disappearance of hail and rising sea levels (Nigerian Metrological Agency, 2012). There is an urgent need for Nigeria to put up adequate measures against the effect of climate change. Part of these measures is to design more sustainable buildings.

Energy Poverty, High Energy Demand and Consumption

Rapid increase in world energy use has raised concerns in terms of supply problems, depletion of energy resources and substantial environmental impacts. It has been projected that energy use by emerging economies (South East Asia, Middle East, South America and Africa) will increase at an average annual growth rate of 3.2% and will surpass that of developed countries (North America, Western Europe, Japan, Australia and New Zealand) at an average growth rate of 1.1% (Pérez-Lombard et al., 2008).

Only about 40% of over 140 million people in Nigeria have access to electricity. A large percentage of households, businesses depend on generators to power their electrical installations. This can be very expensive and a source of environmental pollution (Etiosa, 2009). To achieve comfort in most buildings, generators are required almost on a daily basis due to inadequate supply of electricity. Those who cannot afford the cost of running generators are left with no alternative. There is ample opportunity to reduce energy poverty through energy efficient techniques. This has the potential to enhance comfort in buildings and also free some percentage of the available energy for those in need. This opportunity is yet to be explored due to many reasons among which is the fact that most buildings were not designed for comfort using this approach.

The inadequacy of the power generated in the country to meet energy demand calls for energy efficient culture. Fossil fuels (oil and gas) are the major sources of energy in Nigeria. Hence, for every kWh of energy used, there is a corresponding emission of greenhouse gas into the atmosphere. Despite the energy poverty in Nigeria, the rate of energy consumption is still high and energy policy in the country has undermined the relevance of energy efficiency. Energy efficiency strategies are yet to be properly developed in Nigeria (Etiosa, 2009).

Housing Deficits

It has been projected that Nigeria requres approximately 40 million houses in order to meet its housing deficit in 2020 (Ademiluyi and Raji, 2008; Ademiluyi, 2010; Ogu and Ogbuozobe, 2011). To prevent further impact of buildings on the environment, the goal to overcome this housing deficits must involve sustainable approaches.

The tenure of almost every state government in Nigeria is always marked with the construction of housing units for civil servants which is aimed at reducing housing demands. Previous housing units have been built with little, if any sustainable measures. This paper is intended to guide and create awareness in Nigeria on the need to incorporate sustainable approaches, especially energy efficient techniques to the design and construction of subsequent intervention in housing provision.

METHODOLOGY

A literature review on energy efficient buildings and energy efficiency strategies was conducted in order to identify a suitable strategy that can be adopted in Nigeria. Moreover, reasons for advocating energy efficient measures for buildings in Nigeria were also reviewed. This method was chosen to evaluate the relevance of passive design options in reducing energy consumption in buildings and the need to adopt this method for the tropical climate of Nigeria. Various passive design options were discussed in order to pin down the roles of passive design techniques in achieving energy efficiency in buildings.

FINDINGS AND DISCUSSIONS

Climate is the most important factor in determining the method of achieving energy efficiency in buildings. Other factors include the availability of local building materials, energy efficiency technology and know-how, existing policies and the price of energy (Moore et al., 2013). Hence, each climatic region is to develop approaches for achieving energy efficiency in buildings. For Nigerian climate, which falls under the tropical region, the following passive design options are suggested:

Avoid Heat Gain

As stated earlier, avoiding heat gain is one of the major principles of achieving passive design in buildings. The focus is to reduce heat gain to the barest minimum. To achieve this, factors such as building orientation, building material selection, shading, glazing, insulation and thermal mass will be considered.

Building Orientation

The building should be positioned on site to take advantage of the movement of the sun and the prevailing winds. This also involves the arrangement of rooms in the building. For instance, sleeping areas should be located on the eastern side to take advantage of good morning light. East-facing rooms will also be cooler in the evening and during the night due to the sun path. Recess on walls and fins in addition to other architectural elements should be encouraged to direct cool breeze to the interior spaces. A good understanding of the site will aid a proper orientation of the building for maximum efficiency and thermal comfort.

Building Material Selection

To achieve comfort in buildings in the tropics, building materials with low thermal mass should be selected and used for the construction of buildings. Materials with low heating capacity helps to minimize heat absorption and storage. Neves (2006) argues that some heavyweight materials like stone that possess high effusivity and low diffusivity can be applied to internal spaces in hot-humid climates. These materials can absorb some of the thermal energy present indoors in order to improve indoor thermal comfort conditions. Light colour materials should be chosen, especially for the external walls and roof, as they are very useful in reducing heat flow into the buildings. Simulation results based on a study conducted by Muselli (2010) shows a reduction in cooling energy consumption between 26% to 49% using low-cost white opaque reflective roofs (50m2). A study by Cheung et al. (2005) indicates that a 30% reduction in the solar absorbance of external walls can achieve up to12.6% savings in annual cooling energy demand. Materials that have heat reflective surfaces can be used to reduce heat gain and storage, thereby improving thermal comfort in buildings.

Shading

Shading is an important technique in achieving passive cooling in buildings. Solar shading is an important approach in developing countries because it is cost effective and easy to implement (Kamal, 2012). Shading of buildings and outdoor spaces can lower temperatures during hot periods, improves comfort and save energy. Effective shading design techniques can block up to 90% of the heat generated by direct sun from heating the surface of buildings (McGee, 2013). Shading devices such as overhangs, awnings, louvers shutters, pergolas, which can be part of the building or placed close to the building, can serve as efficient means of achieving passive cooling. Proper window overhangs or awnings are an effective option to optimize south-facing windows and openings during summer. A proper site analysis will aid the placement of shading devices to minimise heat gain and storage. The length of the shading devices (especially overhangs and fins) is an important factor in shading design. Research has shown that the longer the shading devices, the greater the reduction in terms of cooling energy and peak cooling load (Cheung et al., 2005). A study has shown that horizontal shadings of 1.5m long overhangs can achieve 4.06% decrease of cooling electric consumption and a saving of 1.95% of the total electric consumption of a basecase building studied. In the same investigation, vertical shadings (fins) of 1.5m long produced a decrease of 3.92% of the cooling electric consumption and a reduction of 2.20% of the total annual electric consumption (Yu et al., 2008).

Roof shading through the use of concrete cover, plants, canvas, earthen pots and other methods are effective means of reducing heat gain in buildings. Concrete and galvanized roof covers protect the building from direct radiation. These are not very efficient as they hinder the release of heat into the atmosphere at night. Deciduous plants and creepers are good alternatives as evaporation from the leaf surfaces can lower the roof temperature thereby improving thermal comfort in buildings (see Fig. 1). Inverted earthen pots arranged in a closely packed fashion on a flat roof provides a form of insulation, which prevents heat flow

into the building. Some disadvantages of this method are that it makes the roof not usable for other purposes and maintenance of the roof space may be difficult (see Fig. 1).

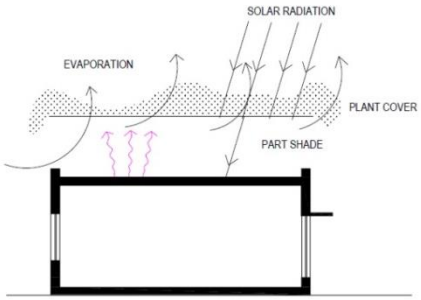

Figure 1.Roof shading using plant cover
Source: Kamal, 2012, p. 87

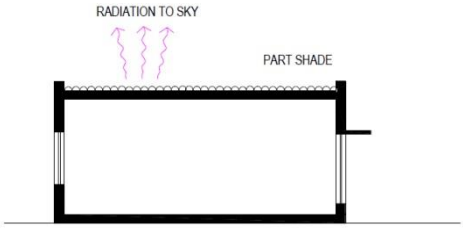

Figure 2.Roof shading using earthen pots
Source: Kamal, 2012, p. 88

An alternative means is to use broken ceramic tiles as the topmost layer of the roof which, helps to reflect incident radiation. Removable canvas cover (especially when painted white) can be mounted at a close distance to the roof to minimize heat gain during the day and removed at night to improve cooling in the building (Kamal, 2012). Roof eaves should be as wide as possible to provide shading for the external walls.

Trees and vegetation and the use of textured surfaces are other means of achieving shading in buildings. Planting of trees and vegetation around the building helps to create a cooler environment owing to the ability of plants to release moisture which cools the air. External air temperatures can be reduced over 50^{o}C through the use of ground cover or lawn around buildings rather than paving (Cairns Regional Council, 2012). See Fig. 3 Textured surfaces have some portions shaded which increase the surface areas of the walls where they are used. This leads to surface coefficient which makes the surfaces stay cooler and cool down faster at night (Kamal, 2012).

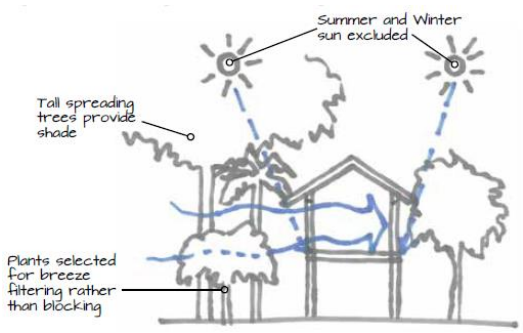

Figure 3. Shading using trees and vegetation
Source: Cairns Regional Council, 2012, p. 11

Glazing

Glazing technologies have recorded significant advances in recent years. Some of the advances include solar control glasses, insulating glass units, low emissivity (low-E) coatings, evacuated glazing, aerogels and gas cavity fills in addition to various improvements in frame and spacer designs (Robinson and Hutchins, 1994).

Where it is difficult to prevent heat gain using external shading devices, advance glazing technologies through the use of treated glass, can be employed to enhance cooling in buildings. For instance, double glazing can reduce heat conduction coefficient of glass and also decrease energy consumption when compared with single glazing based on the same solar heat coefficient. Supergrey glazing, electro glazing, low-E glazing or reflective glazing can increase the reflection of solar radiation to enhance cooling in buildings (Yu et al., 2008).

Insulation

Insulation is a material or combination of materials, which if installed properly, help to reduce the rate of heat flow by conduction, convection and radiation due to its high thermal resistance (Sadineni et al., 2011). Insulation is one of the most effective means of reducing heat gain in buildings. It can be installed in the walls, ceiling and roof to control the rate at which building loses or gain heat.

There are two types of insulation: bulk insulation and reflective insulation. In the tropical regions, reflective insulation installed under the roofing sheets, for instance can be very effective at it does not allow the trapping of heat inside the building. Bulk insulation can be effective when the goal of insulation is to prevent loss of cool air from the building.

Thermal Mass

Thermal mass refers to the ability of materials to absorb, store and release heat energy. Materials such as concrete, brick and tiles that require a lot of heat energy to change their temperatures are said to possess high thermal mass. On the other hand, lightweight materials such as timber have low thermal mass.

Cooling requirements for spaces in buildings depend on convection from internal gains (lights, equipment and people) and the nature of interior surfaces. Owing to the release of significant proportion of internal gains into the interior surfaces, the thermal storage properties of the building and the convective coupling determine building's cooling requirements (Braun, 2003). Thermal mass helps to control the flow of heat energy into buildings thereby reducing energy consumption for heating or cooling.

While thermal mass is preferable in temperate climates due to significant changes in temperature between night and day, low thermal mass is more suitable for tropical climates. If construction materials with high thermal mass are used in the tropics, adequate shading should be provided to reduce heat gain. Moreover, proper insulation should be installed internally minimise heat transfer (Cairns Regional Council, 2012).

Encourage Passive Cooling (Ventilation)

Passive cooling has been defined as "removal/restriction of heat from/to the building environment by using the natural process of rejecting heat in the ambient atmosphere by convection, evaporation, and radiation or the adjacent earth by conduction and convection (Muselli 2010, p.945). It entails maximizing natural ventilation through the use of design in order to reduce heat gain and the need for energy-intensive cooling technologies. Passive ventilation has been described as the cheapest way to cool buildings (McGee, 2013). If the cool outdoor air is properly harnessed through conscious design efforts, cooling can be achieved in some buildings in the tropics without the need for mechanical cooling. Cooling through convection by surrounding air, which serves as a heat sink has been used to achieve comfort condition indoors in hot humid locations (Liping and Hien, 2007). A study conducted by Tantasavasdi et al, (2001) shows that it is possible to achieve thermal comfort through natural ventilation in buildings in Bangkok suburb for 20% period of the year.

This can provide huge savings in terms of energy. To design for effective passive cooling in buildings, some factors are to be considered as the design stage.

Passive ventilation requires a driving force, and sufficient number of openings (fenestration) to produce air flow (Harvey, 2009). Wind is the driving force for passive cooling. Hence, the building orientation should take advantage of the prevailing winds to achieve cooling.

Adequate openings should be provided to improve air flow through the buildings. Windows that reduces the rate of air flow should be discouraged. Design should incorporate verandas, courtyards, atria and other related concepts to enhance wind flow. Design should achieve

cross ventilation, if possible in relevant spaces as this will maximise air flow through the building.

Internal partitions can hinder air flow in buildings. Hence, their use should be minimised in order to maximise air flow within interior spaces. Some spaces can be liked together through the use of archways and curtains or blinds provided for flexibility in use.

Convection air flow should be created through design to remove hot air from buildings. Eave and ridge vents should be provided to let-in cool air and to remove hot air respectively. This process sets up a circulation process that helps to cool interior spaces (Cairns Regional Council, 2012). See Fig. 4

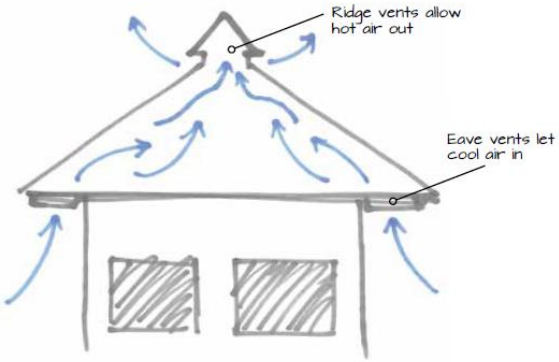

Figure 3. Shading using trees and vegetation
Source: Cairns Regional Council, 2012, p. 11

Encourage Natural Lighting

Natural lighting which is sometimes called day-lighting refers to dependence on sunlight to provide daytime interior lighting. Buildings that are designed to admit maximum amount of natural light into workplaces will save considerable amount of energy required to light those spaces during the day. "Day-lighting can provide 40-80% savings in lighting energy use in perimeter offices, 20-33% savings in combined lighting + cooling energy use, and up to 90% saving deep in room using fiber optics" (Harvey 2009, p. 146).

The efficiency of daylight can be improved through the use of light colours on floor, walls and horizontal surfaces. In addition, internal walls and ceilings should be properly aligned to take advantage of light reflection from light sources. To maximise the benefits of day-lighting, design incorporate strategies to control and heat gain. Design options include protecting glass from direct sun and providing proper insulation to minimise heat transfer. Skylights, atria, light shelves, light tubes, clerestory windows and similar installations can be used to admit natural light into interior spaces as well as enhance its effectiveness (see Cairns Regional Council, 2012).

CONCLUSION

Substantial savings in energy consumption by buildings can be achieved through energy efficient approaches using passive design options. Several passive design options for achieving energy efficiency in buildings were discussed. Passive design options are highly sensitive to climatic factors. Hence, designers should have better understanding of the microclimate of the building site in order to maximise its benefits. Passive design techniques should be advocated to reduce high energy poverty, demand and consumption in the country.

The adoption of passive design approaches in Nigeria will definitely reduce over dependence on mechanical cooling which at most times depends on electrical generators which has adverse effects on the three pillars (environmental, economic and social) of sustainable development.

Architects and other designers in the building industry should consider passive design options as an integral part of building design. Efforts should be put in place to encourage all stakeholders to embrace this concept which is relatively low cost but with many benefits.

Future interventions in mass housing especially by the State and Federal Governments on Nigeria should incorporate this concept to create learning effects.

Nigeria should focus on the application of passive design options to maximise its benefits while aiming at ultra-low energy buildings in the long term.

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Socio-economic Consideration of Housing Transformers and Non-transformers in Selected Government Estates in South-Western, Nigeria

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ABSTRACT

Residential buildings in government estates in Nigeria were often built without consultations with the end users, who usually indulge in transforming the houses. This paper carryouts a comparative study on Transformers and Non-transformers in three study estates in South Western Nigeria. Various variables were considered. Data was collected through structured questionnaires administered on 474 transformers and 360 non-transformers. Results were analysed and findings indicated that 57% of the respondents that transformed their building (transformers) are self-employed while 45.5% of those that do not transform their buildings (non-Transformers) are Civil/public servants. This implies that these estates originally occupied by civil/public servants are now mostly occupied by self-employed with more access to funding. On marital status, a preponderance of married persons among the respondents in the study area that transformed their buildings (81.9%) while 40.4% did not transform. This implies that marital status influenced the tendency to transform building since there will be the need to accommodate more household. This study reveals that initial occupants of the study estates are civil/servants but gradually being display by private employed with higher income and had access to more funds. The need to educate the occupants of the study estates were negative influences of indiscriminate building transformation on residential environment is one major recommendation emphasized in the study.

Keywords: Abandoned, Adaptation, Budget, Environment, Performance

INTRODUCTION

Residents of government estates in Developing countries are in the habit of transforming their buildings, since these houses do not conform to their expectations (Tipple 2000). The residential buildings in government estates often times were built without consultation with the users, who usually indulge in making unauthorized alterations, since the houses do not conform to their expectations (Tipple 2000).

Habraken (1975) asserted that no one could live satisfactorily within a fixed environment in which they have no input. Previous studies have revealed that there was shortage of government residential buildings in Akure, Ibadan and Lagos. The few available ones are in poor physical conditions and / or do not conform to the expectations of occupants. Consequently, the result is manifested in growing number of overcrowded houses, increasing pressures on infrastructural facilities, environmental degradation, among others (Tipple 1991).

Continued housing transformations which are triggered by the search for livelihoods among households in formal urban settlements and which are not strictly guided by statutory urban planning are likely to, increase livelihood opportunities at the house level. On the other hand, they can also cause public health problems such as residential and occupational health hazards to the general public (Sheuya, 2004).

While the transformation process can improve the local economy of the estates by accommodating informal sector activities in the houses and plots, this can also contribute to settlement degradation in terms of reduced internal accessibility; an increased burden on the limited infrastructure and services such as water supply, sanitation facilities, and solid waste collection and management system. These, in turn can contribute to noise pollution, poor

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lighting and reduced open spaces (Sheuya, 2004).

Residential buildings in government estates in Akure, Ibadan and Lagos only retained their original characteristics due to various activities of the users, which were not accommodated by the original designs. This phenomenon gives rise to significant physical transformation that has taken place in these buildings.

Nigerian government at various levels could not meet the housing need of the people (National Housing Policy, 2004). Even the few ones provided could not meet the expectations of the occupants (Tipple,2000). However, some facilities needed were not provided and some not needed were provided (FGN, 2001).This has made the residential estates to be haphazardly developed to the detriment of the users (Agbola, 1998).This brought about unplanned environment, which made the residential estates physically and functionally not alien with the existing physical planning regulations. Furthermore, most of the physical transformation taking place on the residential estates was not officially approved by planning authorities thus, leading to continuous destruction of unauthorized extensions by appropriate planning authorities. Substantial amount of money earlier invested in carrying out the physical transformation were lost (Nwuzi 1995).

LITERATURE REVIEW

The rapid rate of urbanization in Nigeria is noted to account for the depreciating quality of housing in the country's urban centres The urban centre suffer deterioration in infrastructure and services (Oladapo and Olotuah, 2007). Physical transformation of buildings which usually not authorized had been going on in urban centres of Nigeria. Olarewaju (2004) confirms that within a twenty year period, 1974-1993, residential property changed from 70.94% of the total land use to barely 39% in central Lagos. Similarly Nwuzi (1995) discovers that 76.5% of houses in Diobu, Port- Harcourt were converted and structurally modified from residential to non-residential uses without authorization.

While continued housing transformation which are triggered by the search for livelihood, among households in formal urban settlement and which are not strictly guided by statutory urban planning are likely to increase , they can also cause public health problem such as residential and occupational health hazards (Sheuya 2004). Harrison (1982) was of the concept that while western cities are thinning out, as people move to the suburbs, third world cities are growing denser, infilling their empty spaces and building layers of unsafe structures.

With the Nigeria population growth rate of 2.8%, which is one of the fastest in the world, and rapid urbanization which proportionally rose to 43.3% in 2000 (Report of Presidential Committee on Urban Development and Housing 2001), in the face of massive requirements for housing needs which are estimated to be in the region of demand for 200,000 houses per annum (Mortgage banking Association of Nigeria ,2005). Sheuya (2004) has envisaged that continued housing transformation must be panacea for bridging the gap.

The early works of physical transformations concentrated on the notions of allowing residents to have inputs into their housing situation (Steinberg 1984, Benjamin 1985, and Beinart, 1971).Tipple (2000) asserted that every house is a work in progress and that physical transformers express not just housing needs but that desire for identity, a sense of belonging and a search for status among neighbours. Previous study on Housing Transformation by Tipple and Ameen (1996) in Bangladesh; Tipple and Salim (1999) in Malaysia ; Kardesh (1999) in Egypt; Arimah (1999) in Lagos; Muuzi (1995) in PortHarcourt and Sule (1986) in Calabar, numerous reasons were deduced as to why transformation were carried out. From the simple reason of adding more space to existing structure, to fencing, search for additional income among others, most of the physical transformation were not authorized by relative

public agencies.

Housing transformation is a feature of urban centres of both developed and developing countries. Evidence from literature suggests that substantial transformation of old dwellings even take place in developed cities like New York, London and Toronto, where big Asian communities reside (AI-Naim and Mahmud, 2004).These transformations are effected in their indoor environment in order to acquire spaces that are more habitable. Others involved converting rooms into working space for extra household income.

Mahmud (2003) observed that it is common practice among Asians in Europe to convert rooms into corner shops. For instance, the Indian Sikh families all over England are noted to modify garage into bedrooms or workshop for garments especially by the Sylherty women (a province in Bangladesh) in East London. This transformation by the occupants is economically motivated, to meet their cultural and religious needs.

One major difference in these cities as compared to the third world is climatic factors. The ecological setting makes the physical pattern of these European houses different from their African and Asian counter part as they lack open courtyards within their traditional dwellings. Majority of these low-income earners live in the council or municipality housing units, where by rules are strict and impose with high penalties. Accordingly, such physical transformations are not as flexible as individually owned traditional dwellings (Mai 2008).

The study area is the South-Western, Nigeria which geographically comprises six states namely: Lagos, Ondo, Ogun, Oyo, Osun and Ekiti. The South-Western, Nigeria is located in the tropical rain forest zone (see fig 1); however, the part close to the Atlantic Ocean (the coastal region) shares sub-equatorial climate and receive a high annual rainfall of over 1520mm (Udo 1978). The interior which is the greater part shares Guinea or tropical climate; it has a clearly marked dry and wet seasons and received an annual rainfall of between 1000 and 1250mm (Udo, 1978) The major ethnic group in South-Western, Nigeria is Yoruba, the people share the same culture in respect to language, lifestyle, housing and etc (Udo, 1978). Out of the six states making up the South-Western, Nigeria, three states of Lagos, Oyo and Ondo were selected and the study was carried out in government estates that were first constructed in each of the towns Lagos (Ikeja Housing Estate), Ibadan (Old Bodija Housing estate) and Akure (Ijapo Housing Estate)(Adegbehingbe & Fadamiro 2006).

The south-west region of Nigeria is the most urbanized in the country with 40 percent of the nation's 329 urban centers located there in 1991. The most urbanized states were Lagos, and Oyo with population constituting 93.7 percent, 69.3 percent of their population being urbanized in 1991(CCA 2001).

The Study Area: South-Western, Nigeria

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METHODOLOGY

Relevant data were obtained by photographic means and field observation to have accurate three dimensional views of the study estates, to capture the extent of physical transformation that took place. The research variables included income, type of building, household size, education level, type of tenure, home based enterprises, other uses for transformed buildings, types of facilities provided in the building within the estate and involvement in the construction and design of transformed buildings. Data obtained from field survey were analyzed statistically at three levels. The first level was univarate analysis using descriptive summary measure and frequency distribution analysis of the variable .Bi – variate analysis which included chi-square test and correlation analysis was the second level while multi-variate regression analysis was employed as the third level.

The primary data were sourced from field surveys using case studies which are residential building survey (extent of physical transformation) and structured questionnaires as the principle research tools. The questionnaire was employed to collect first hand data directly from some household heads that transformed and those that did not transform their building and also the design professionals in charge of the management of the study estates. In addition, relevant research data were obtained by photographic means and field observations to have a nearer accurate three dimensional view of the study area.

The Ikeja GRA had 714 housing units, Old Bodija housing estate had 815 housing unit while Ijapo housing estate had 600 housing units, and since only the household-head were interviewed the three estates selected comprising 2129, constituting the research population. From 2129 housing units, 40 percent of the housing units were selected. In addition, the three public institutions managing the estates were visited to obtain relevant information and maps.

The primary research instrument used was research questionnaires. Three types were employed in this study: The first involved three sets of well-structured multi-choice questionnaires. The first set was used to collect data from occupants of residential buildings in government estate that have extended and altered their buildings (Table 1.0). Information sought included occupation, income, type of building, household size, educational level, and criteria for allocation, type of tenure, source and procedure for payment for the occupied building, age of building. Eight hundred and fifty respondents were randomly selected from the three housing estates of Ikeja, Old Bodija and Ijapo, from which four hundred and seventy four questionnaire were retrieved and analysed.

Table 1 Sampling size of respondents for questionnaires on occupants of selected residential buildings on government estates that have transformed their buildings

S/No	Housing Estate	Town / State	No of Respondents retrieved& analyzed
1.	Ikeja Housing Estate	Ikeja, Lagos State	133
2.	Old Bodija Housing Estate	Ibadan, Oyo State	201
3.	Ijapo Housing Estate	Akure, Ondo State	140
	Total		**474**

Source: Adegbehingbe (2011)

The numbers of questionnaire administered on transformed buildings were presented in table 1.

Figure 1: Map of South-West-Nigeria showing States where study areas are located.

FINDINGS AND DISCUSSIONS

Occupation of Respondents

This paper examines the personal and socio-economic characteristics of the respondents (those that transformed their buildings and those that did not) in the three study estates. These include occupation, gender distribution, marital status, income level, household size, educational level, type of building occupied and tenure. The analysis is done, not only in terms of frequency counts of the characteristics for the selected housing estates, but it examined and compared characteristics of those that transformed their building with those that did not.

Table 2 shows the frequency distribution of the occupants that transformed and those that did not transform their building, according to their occupations in the selected housing estates

Occupation Type	Respondent who transformed their buildings		Respondent who did not transform their buildings	
	Frequency	% of respondents	Frequency	% of respondents
Unemployed	12	2.5	13	3.9
Civil/public servant	150	31.6	157	45.4
Self employed	270	57.0	137	39.6
Others	42	8.9	53	11.2
Total	**474**	**100**	**360**	**100**

Source: Adegbehingbe (2011)

Out of the 474 respondents that transformed their building, the table showed that 270 (57%) were self-employed. This is followed by Civil/ Public Servants, with a score of 150 (31.6%). The result of the ANOVA (Table 3.0.) revealed that the distribution of occupants into different categories of occupation varied significantly. This implied that, the majority of the respondents that transformed their buildings were self-employed.

Table 2 Further showed that out of the 360 respondents that did not transform their building, 157 (45.4%) were civil/public servants; this is followed by those who were self-employed accounting for 39.6%. This implied that the majority of the respondents that did not transform their buildings were civil / public servant. This may be due to accessibility of more funding by those who are self-employed.

Table 3 ANOVA for the various occupation types of the respondents

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Occupation type	9445.887	8	1180.736	25.230	0.000
Error	842.373	18	46.799		
Total	10288.261	26			

Source: Field survey (2007)

Gender Distribution of the Respondents

Analysis of the sex of occupants of the selected Housing estates that transformed and those that did not transform their buildings as shown in Table 4.0 revealed that 352 males (74.3%) and 122 female (25.7%) transformed their building, while 120 male (28.6%) and 240 female (71.4%) did not transform their building. Since the household heads were interviewed, this result confirmed that male households' heads that transformed are more than female household head. The result of the paired T-test conducted on the gender distribution showed that there is significant difference in the percentage population of male and female respondents (P<0.05) (Adegbehingbe 2011)

Table 4 Gender distribution of the respondents

Sex	Respondent who Transformed their building		Respondent who did not transform their buildings	
	Frequency	% of respondents	Frequency	% of respondents
Male	352	74.3	240	28.6
Female	122	25.7	120	71.6
Total	**474**	**100**	**360**	**100**

Source: Adegbehingbe (2011)

Marital Status of the Respondents

The study analyzed the marital status of the respondent that transformed and those that did not transform their buildings. From the result in Table 5.0., out of the 474 respondents which transformed their buildings, 388 (81.9%) were married. This is followed by 56 (11.8%) that were single. For those that did not transform, 287 (80.4%) were single and 38 (10.6%) were married. Also, the result of analysis of variance ANOVA (Table 6.0) revealed that only the married occupants distinctly differed from other marital status among the respondents in the study area. This indicated that marital status is a factor necessary for transformation since there will be need for more space to accommodate more household members (Adegbehingbe 2011).

Table 5 Marital status of the respondents

Status	Respondent who Transformed their building		Respondent who did not transform their buildings	
	Frequency	% respondents	Frequency	% respondents
Single	56	11.8	287	80.4
Married	388	81.9	38	10.6
Widow	6	1.3	22	6.2
Widower	7	1.5	5	1.4
Divorced	4	0.8	3	0.8
Separated	13	2.7	5	0.6
Total	474	100	360	100

Source: Adegbehingbe (2011)

Table 6 ANOVA for the distribution of respondents' marital status

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Marital Status	6627.867	5	1325.573	4.855	0.012
Error	3276.393	12	273.033		
Total	**9904.260**	**17**			

Source: Adegbehingbe (2011)

Income Stratification of the Respondents

The distribution of the respondents into different income strata is presented in Table 8. From the table, 77.7% of those respondents who transformed their houses belonged to

the high and upper middle income brackets, whereas 83.5 percent of those who did not transform their houses conversely belonged to the low and lower middle income strata. This indicated that the higher the income the tendency for occupant to transform their building. The result of the Analysis of Variance as shown in Table 8.0 however showed that there is no significant difference in the percentage distribution of respondents into the different income strata (P>0.05). From the results of the Chi-square test, income level of the respondent has a strong association with the type of building occupied by the respondents (P<0.05) (Adegbehingbe 2011).

Table 7 Income Stratification of Respondents

Income Class	Respondent who Transformed their building		Respondent who did not transform their buildings	
	Frequency	% respondent	Frequency	% Respondent
Low	27	5.7	132	38
Low middle	79	16.7	158	45.5
Upper middle	180	38.0	53	11.5
High	188	39.7	17	4.9
Total	**474**	**100**	**360**	**100**

Source: Adegbehingbe (2011)

Table 8 ANOVA for the respondents' percentage distribution into income strata

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Income Class	5720.423	4	1430.106	2.355	0.124
Error	6073.227	10	607.323		
Total	**11793.649**	**14**			

Source: Adegbehingbe (2011)

This paper has a detailed analysis along with interpretations and discussion of the socio-economic consideration of presented Housing transformers and Non-Transformers (respondents) of the selected study housing estates and also examined and compared characteristics of those that transformed their buildings with those that did not.

The occupation of the respondents revealed that majority that transformed their building are self employed (57%), which then confirm that the study estates which were originally occupied by public servants are now mostly being occupied by self employed who are supposed to have more access to fund. Majority of respondents that did not transform (45.4%) their building is civil/public servants (Adegbehingbe 2011).

There was a preponderance of married persons among the respondents in the study area that transformed their building (81.9%) and single persons that did not transform (80.4%). Male that transformed (74.3%) and female that did not transform (71.6%). This confirms that sex and marital status of occupant have effect on building transformation. This confirms necessity to accommodate more people. Majority of the respondent that transformed their building are highly educated (69.0%) while those that did not transform their buildings are also educated. This shows that no notable difference between educational background of transformers and non-transformers. This is due to the fact that access to original buildings on the study estates are for educated occupants (Adegbehingbe 2011).

The result of multiple regression analysis identified marital status (b=0.55), income (b=0.29) and educational level (b=0.193), as the most significant variables that determine the degree of transformation or alteration of buildings on the study estates.

RECOMMENDATIONS AND CONCLUSION

In view of the above research findings, the following recommendations are offered as possible means of improving housing conditions: In the short term, there is an urgent need to increase the number of staff of the planning approval authority in the housing corporation responsible for the management of the study estates, especially those in the contravention section. They should make sure that no modification or alterations are made in a building until these had been approved by the appropriate authority. There is an obvious need to educate the occupants of the study estates on the negative influence of indiscriminate building transformation on the residential environment.

The design professionals in housing corporation responsible for the management of the Estates can reduce the need for housing transformation by ensuring provision for services areas, end users involvement , make use of functional architectural designs, ensure structural flexibilities and appropriate legislative control. If occupants are not satisfied with their houses, there should be alternative housing or availability of other measures to redress the inadequacies by the government.

When approval for transformations is considered, it is recommended that necessary account of the effects of the proposed development on the household should be considered. It is recommended that economic and environmental implications should be considered along with planning and structural consideration.

There is the need to regularly conduct technical audits of all structures on the estates to ascertain their structural stability. Building like's human beings, have life span (Ben –Eboh 2008). There should be more stringent measures to ensure that those showing sign of failure are promptly brought down to make way for new ones.

Government should adopt an essential permissive attitude towards those who transformed their buildings with details to improve the use of space and minimize interference with neighbours especially with respect to ventilation and day light.

Housing transformation is taking place without statutory development control. In other words, it is unguided and is directed by market forces and individuals interests. To guide against this, it is suggested that the state and local government at the appropriate levels should work together with community members to formulate zoning and land use guidelines. In this way, most of the challenges posed by housing transformations including high incidences of plot boundary conflicts and management of solid wastes could be solved efficiently and effectively.

Residential buildings in government estates in Nigeria are often transformed by addition of structures or modification of existing spaces since these buildings do not in most cases conform to the expectations of occupants. Residential buildings were often built without consultations with the end – users who usually indulge in transforming their houses. This study carried-out the analysis of physical housing transformation of residential buildings in selected government estates in south-western, Nigeria in which the socio-economic characteristics of occupants that transformed their buildings were compared with those that did not transform.

It has been established that original owners of the buildings who are civil servants were being displaced by those who were self-employed and had access to more fund and even purchased the buildings. The study has been able to established that sex has no effect on building transformation but marital status has great influence; this study has clearly shown that occupants of the residential buildings transformed their houses mainly to provide comfortable conditions safety and security elements that were lacking in the buildings.

Lack of provision of service areas within the study area is evident from this study and it accounts for numerous home-based enterprises in the study area.

Furthermore, it was observed that transformed building was being used for purposes other than residential. These transformed buildings were used for other purposes due to non-functional architectural designs and inadequacies noted in layout plans.

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Evidence of Climate Change and Adaptation Strategies among Grain Farmers in Sokoto State, Nigeria

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ABSTRACT

This study examined the evidence of climate change and adaptation strategies among grain farmers in Sokoto state. This paper focused at finding out the farmers' knowledge of climate change and adaptation strategies. Rainfall and temperature data for 30 years were sourced from the Sokoto Rima Basin Development Authority's Rainfall Reading Office, Goronyo and Nigerian Metrological Services (NIMET) Oshodi, Lagos and used for this study. Purposeful sampling technique was used in the selection of 385 respondents. Farmers' perception and adaptation strategies to climate change were obtained by means of structured questionnaire administered to the sampled grain farmers. The results were summarized by means of frequencies and percentages and presented in tabular forms, trend lines and bar charts. The study revealed that farmers' perceptions of climate change issues are in line with the analyzed climate records for the area; the annual rainfall totals favour the cultivation of millet; there is late onset of rain and frequent agricultural drought which affects grain production in the area. This study recommends that the research institutes should produce better adapted varieties of millet and other grains and government should subsidize the seeds to the farmers. Furthermore, there should be adequate provision for irrigation, weather forecasting and other agricultural technological infrastructure, modern knowledge on climate change adaptation and strengthening of the extension services. The study concludes that the climatic characteristics of the study area affect grain production and that adaptation strategies have significant contribution on grain production in the area.

Keywords: Adaptation strategies, Climate Change, Evidence, Grain farmers and Sokoto state

INTRODUCTION

Climate change has become the primary environmental threat of the 21st century. It is now on the global political agenda as never before. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) affirms that climate change is no longer in doubt, IPCC (2007). Although extreme violent weather has occurred throughout history, recent upsurge in climate related hazards is confirming the argument for global warming and climate change, Odjugo and Ikhuoria (2003). The evolving climate change coupled with increasing temperature has been observed to plunge some localities. The IPCC (2001*)* projected that climate change resulting from increased greenhouse gases concentrations has the potential to harm societies and ecosystems, agriculture and forestry, water resources etc. All stages of agricultural production from land clearing and preparation, through crop growth and management to harvesting, storage, transportation, and marketing of agricultural products are subject to the influence of weather and climate. Societies have a long record of managing the impacts of weather and climate related events. Thus, this research focussed on recognising the evidence of climate change in the study area and the grain farmers' adaptation strategies to climate change.

LITERATURE REVIEW

Meaning and Causes of Climate Change

"Climate change is a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, which persists for an extended period typically decades or longer", IPCC (2007). Climate change, in the

Ikpe E, Sawa B. A., Ejeh, Udeh L, Meshubi O. Adekunle & Oladimeji J. S. (2016). Evidence of Climate Change and Adaptation Strategies among Grain Farmers in Sokoto State, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F.? Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 65-74

most general sense –encompasses all forms of climatic inconstancy (that is, any differences between the "long-term" statistics of the meteorological elements calculated for different periods but relating to the same area), regardless of their statistical nature or physical cause, Maunder (1994). Climate change implies a new mean climatic state or climatic normal, Ayoade (2003). The most crucial things about the concept of climate change is not only the time periods involved but also the degree of variability that the change is subjected to as well as the duration and impact of such variability on man and the ecosystem.

Climate change is caused by two basic factors namely natural processes (biogeographical) and human activities (anthropogenic). The natural processes are the astronomical and extraterrestrial factors. The astronomical factors are the eccentricity of earth's orbit, obliquity of ecliptic and orbital procession. The extraterrestrial factors include solar radiation quantity (sunspot) and quality (ultra violet radiation change). A high solar quality and quantity and period of perihelion (when the earth is nearest to the sun), result in heating up of the earth surface which lead to global warming. Volcanic eruptions also lead to both global warming and cooling. Through volcanic eruptions, lot of gases, vapour and particulate matter are emitted into the atmosphere. Such emissions influence the atmospheric chemistry thereby creating short –term cooling and long- term heating of the atmosphere. Prominent examples of such eruptions of great magnitude were Krakatoa eruption in 1883, Mount Agung in 1963, Mount Pinatubo in 1992 and Republic of Iceland in 2011. Researchers (Buba, 2004; Porbeni, 2004; DeWeerdt, 2007 and Odjugo, 2007) have shown that for the past few decades, anthropogenic factors like transportation, industrialization, urbanization, burning of fossil fuel, agriculture, water pollution, changes in land cover and deforestation among others are the major contributing factors to the depletion of the ozone layer and its associated global warming and climate change. Man is at the centre of climate change through activities that add to the amount of greenhouse gases in the atmosphere, Akpodiogaga and Odjugo (2010).

Meaning of Adaptation

The IPCC (2007) defines adaptation as the "adjustment in natural or human systems to a new or changing environment". Adaptation to climate change is a process through which people reduce the adverse effects of climate on their health and well-being and take advantage of opportunities that the environment provides, Saka (2008). Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptations.

Evidence of Climate Change in Nigeria

Reports from recent literature point to climate change in Nigeria. Ahmad and Ahmed (2000), IPCC (2001), Nigerian Environmental Study/Action Team (NEST, 2003) and Hengeveld and Fergusson (2005) provided indicators that one could use to assess the evidence of climate change in a region. These include increasing temperature, increasing evapotranspiration, decreasing rainfall amount in the continental interiors, increasing rainfall in the coastal areas, increasing disruption in climate patterns and increasing frequency and intensity of unusual or extreme weather related events such as; thunderstorms, lightning, landslides, floods, droughts, bush fires, unpredictable rainfall patterns, sea level rise, increase desertification and land degradation, drying up of rivers and lakes and constant loss of forest cover and biodiversity. A further support of the evidence of climate change in Nigeria by Odjugo (2005; 2009) is the increase in rainfall amount in the coastal areas since the 1970s, and a constant decline in rainfall amount and duration in the continental interior of the semi-arid region of Nigeria. The increasing temperature and decreasing rainfall in the semi-arid region of Northern Nigeria-Sokoto, Katsina, Kano, Nguru and Maiduguri may have resulted in the increasing evapotranspiration, drought and desertification in the region as reported by Odjugo and

Ikhuoria (2003) and Adefolalu (2007). Constant loss of forest cover and biodiversity in Nigeria is linked to global warming and climate change, NEST (2003); Ayuba *et al*., (2007).

The increasing temperature and decreasing rainfall have led to frequent drought and desertification. The Sahara desert is observed to be expanding to all directions trying to engulf the Sahellian region of Africa with annual expansion of 1-10 km, Odjugo and Ikhuoria (2003); Yaqub (2007). Odjugo and Ikhuoria (2003) also observed that Nigeria north of 12^0N is under severe threat of desert encroachment and sand dunes are now common features of desertification in states like Yobe, Borno, Sokoto, Jigawa and Katsina. The migrating sand dunes have buried large expanse of arable lands, thus reducing viable agricultural lands and crops' production. This has prompted massive emigration and resettlement of people to areas less threatened by desertification. Such emigration gives rise to social effects like loss of dignity and social values. It often results in increasing spate of communal clashes among herdsmen and farmers and such clashes resulted in the death of 186 people in six northern states of Nigeria between 1998 and 2006, Yugunda (2002); Yaqub (2007).

In Nigeria, many rivers have been reported to have dried up or are becoming more seasonal, while Lake Chad has shrunk in area from 22,902 km^2 in 1963 to a mere 1304 km^2 in 2000. This shows that what is left of Lake Chad in the year 2000 is just 5.7% of 1963, Odjugo (2007). Awake, (2009) also confirms the fact that Lake Chad has shrunk by 95% since the 1960s. Lake Chad and so many rivers in Nigeria, especially in Northern Nigeria, are in the danger of disappearing. Available evidence also shows that climate change has impacted on agriculture and health in Nigeria, Mshelia (2005); Adefolalu (2007).

Already, Nigerian urban centers have been feeling the impacts of climate change with incessant annual flooding that affect large areas and large number of people. For example, in 2010, flood in Northern Nigeria affected 2 million people in Jigawa State and another 40, 000 people were displaced in Sokoto State where Usmanu Dan Fodio University was forced to close down for weeks as a result of bridge collapse associated with the flood. Similar floods were reported in Lagos where 689 people were to be relocated in Ajegunle as a result of flood, Yekken (2011).

Agriculture and Climate Change

Agriculture is perhaps the most sensitive to climate change related issues of all human economic activities. Changes in the world's climate will bring major shifts in food production. In spite of recent technological and scientific development, weather remains a key variable in agricultural production. Weather and climate affect agriculture and determine the adequacy of food supplies. Climate determines whether or not rainfed agriculture will be successfully cultivated in a given area. Weather and climate act both as a resource and a constraint to agricultural production. The resource value of weather has to be optimized while the hazards posed by weather have to be managed, Ayoade (2002). It is common knowledge that farmers in Sub-Saharan Africa, including Nigeria are struggling to cope with the current climate variability, Chakeredza *et al* (2009).

METHODOLOGY

Study Area

Goronyo is a local government area (LGA) in Sokoto state, Nigeria. It is located along Latitude 13^0 27'11" North and Longitude 05^0 40'35". Its headquarters is at Goronyo, on the bank of the Sokoto River. It has an area of 1, 704km^2. Goronyo is in the dry Sahel, surrounded by sandy savanna and isolated hills. With an annual average temperature of 28.3°C, Goronyo, on the whole is a very hot area. However, maximum daytime temperatures are for most of the year generally under 40°C and the dryness makes the heat bearable. The

hottest months are February to April when daytime temperatures can exceed 45°C. The rainy season is from June to October. The annual rainfall is between 500mm in the north and 800mm to the south. The area's lifeline for growing crops is the floodplains of the Goronyo dam system which are covered with rich alluvial soil, Sani (2005). Goronyo is essentially an agricultural area with traditional mode of production predominating with more than 90 percent of the population engaged in subsistence farming. The main crops produced in the LGA are millet, guinea corn, maize, rice, beans etc.

Climatic data used in this study are daily rainfall and temperature records of Goronyo (1981-2010), and Goronyo's grain farmers' perception and adaptation to climate change. The grain farmers' perception helped to know the sensitivity of farmers to the changing climate and their adaptive strategies to climate change. The daily rainfall and temperature records for the stated period were obtained from the Sokoto Rima Basin Development Authority, rainfall reading office, Goronyo, and Nigerian Meteorological Services (NIMET), Oshodi, Lagos. While farmers' perception and adaptation strategies to climate change were obtained by means of structured questionnaire.

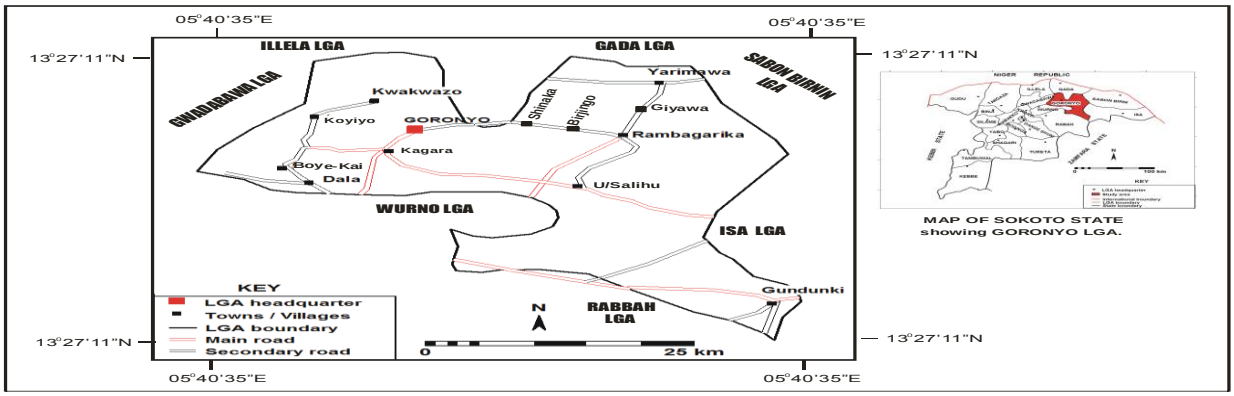

FIG. 3.1: GORONYO LGA SHOWING TOWNS / VILLAGES
Source: Modified from Administrative Map of Sokoto State, 2008

Materials for the Study

The respondents for the questionnaire were the grain (sorghum, millet and maize) farmers in the eleven (11) wards in the LGA. The number of questionnaire used was based on the population of the study area. To determine the sample size for this study, Krejcie and Morgan's (1970) method of determining sample size was adopted which states that, for an area with a population between 75, 000 - 999, 999, the sample size to be used is 382. Since the population of the study area is 182, 296 which fall between these ranges, the sample size of 382 is in order. However, 385 respondents were used to have equal representation in each ward, but only 382 were returned.

Sampling Technique

Purposeful sampling technique was used to determine the respondents after which simple random sampling was used to administer the questionnaire among the eleven wards of the LGA. Purposeful sampling, according to Bernard (2002) "is the deliberate choice of an informant due to the quality the informant possesses." The three hundred and eighty five (385) questionnaires were shared proportional to the population of each ward, but due to the non-availability of population figures for each ward from the 1991 and 2006 census results, the questionnaire was distributed equally among the eleven (11) wards, with 35 questionnaires in each ward. For the purpose of administering the questionnaire, grain farmers above thirty (30) years of age and who must have lived at least twenty (20) years within the study area were identified through the "Sarkin Noma" (Head of the Farmers) and the village Heads. This was done by asking the farmers of their age and how long they have lived in the area. Thereafter the questionnaire was issued. The reason for this decision was

that those within the age bracket have the information needed about climate change. The researcher was assisted by field assistants.

To present the various agricultural adaptive strategies used by the farmers to cope with climate change, percentage analysis was used. The data was summarized and presented in tables, charts, percentages.

FINDINGS AND DISCUSSION

Table 1: Rainfall and Temperature Characteristics of Goronyo, 1981 – 2010

Years	Total Annual Rainfall (mm)	Total Annual Number of Rain Days	Onset Dates	Cessation Dates	Annual Length of Rainy Season (days)	Mean Max. Temperature (^{0}C)	Mean Min. Temperature (^{0}C)
1981	556.9	21	20th May	30th Sept.	133	34.8	21.5
1982	519.7	18	20th May	31st Oct.	164	35	22.1
1983	620.7	20	31st March	20th Sept.	173	35.4	22.5
1984	263.4	12	10th May	5th Oct.	148	35.7	22.8
1985	434.8	22	15th May	30th Sept.	138	35	22.9
1986	439.4	19	31st May	5th Nov.	158	35.2	23.1
1987	285.77	24	15th May	30th Sept.	138	36.1	22.2
1988	520.6	16	5th June	5th Sept.	92	35	22.9
1989	376.5	16	15th June	20th Sept.	97	34.3	22
1990	508.7	20	10th May	5th Oct.	148	35.5	22.9
1991	480.64	23	30th April	10th Oct.	163	35	22.8
1992	423.26	18	15th May	15th Oct.	153	34.1	22.3
1993	397.3	18	25th May	30th Sept.	128	35.4	22.6
1994	905.2	22	5th June	25th Oct.	142	35.1	22.7
1995	336.8	18	25th April	30th Sept.	158	36	22.5
1996	692.25	22	30th April	20th Sept.	143	36	21.8
1997	641	30	25th April	31st Oct.	189	38.9	22.2
1998	658.5	19	25th April	25th Sept.	153	35.7	23.1
1999	592	21	5th June	10th Oct.	127	35.5	22.4
2000	407.7	18	15th June	15th Oct.	122	34.9	22.1
2001	721.7	22	20th April	25th Sept.	158	35.5	22.6
2002	568.5	21	5th June	20th Oct.	137	35.8	22.7
2003	344.14	14	20th April	30th Sept.	163	32.4	22.8
2004	649.5	25	30th April	5th Oct.	158	36.4	22.5
2005	609.2	26	5th May	10th Oct.	158	36	23.1
2006	740	24	20th May	5th Oct.	138	35.9	22.8
2007	636.4	25	10th April	25th Sept.	199	35.9	23.3
2008	514.6	30	30th April	10th Oct.	163	32.1	22.7
2009	567.3	28	5th May	5th Nov.	184	36.5	23.9
2010	1,496.5	24	5th June	31st Oct.	148	36	23.1
Mean	**563.6**	**21**	**11th May**	**7th Oct.**	**149**	**35.4^{0}C**	**22.6^{0}C**

(**Source**, Field survey 2012)

Onset Dates of the rains in Goronyo

The linear trend and trend line equation for the onset dates of the rainy season in the study area are shown in fig.2. It clearly indicates a decreasing trend in the onset dates (that is, the rains are now coming late). The earliest onset date of rain in the study area within the 30 years of study as shown in table 2 is 31st March, (1983). While the late onset date within the 30 years of study is 15th June. The mean onset dates within the thirty years of the study is 11th May.

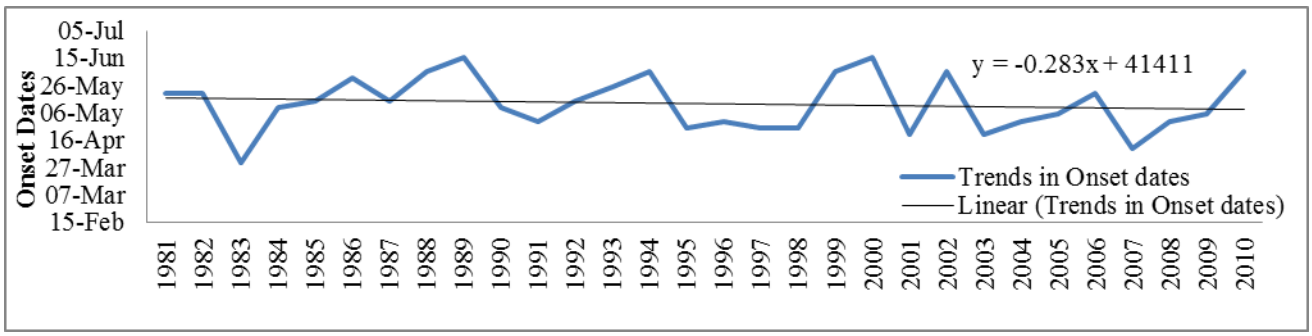

Fig. 2: Trends in Rainfall Onset Dates at Goronyo (1981 – 2010)
Source: Field work, August 2012

Cessation Dates

The earliest cessation date in Goronyo occurred on 5th September (1984), while the latest cessation date occurred (twice within the 30 years of study) on 5th November (1986 and 2009). The average cessation date of rainfall in Goronyo within the thirty years of study is 7th October. As shown in table 1, cessation dates in the study area within the 30 years of study occur between 5th September and 5th November. These periods of anomalies, that is early cessation may affect the production of grains in the study area.

Length of Rainy Season

The linear trend and trend line equation for the length of rainy season is shown in figure 3. From this figure, it is observed that the trend line for the length of rainy season is increasing. The linear trend line equation for the length of rainy season is y = 0.858x + 135.5. This positive trend line equation further indicates that the length of the rainy season is on the increase in Goronyo. The highest length of rainy season within the 30 years of study was recorded in 2007 (199 days out of the 365 days of that year), while the shortest length of rainy season was recorded in 1988, with 92 days. The mean length of rainy season (days) is 149 days.

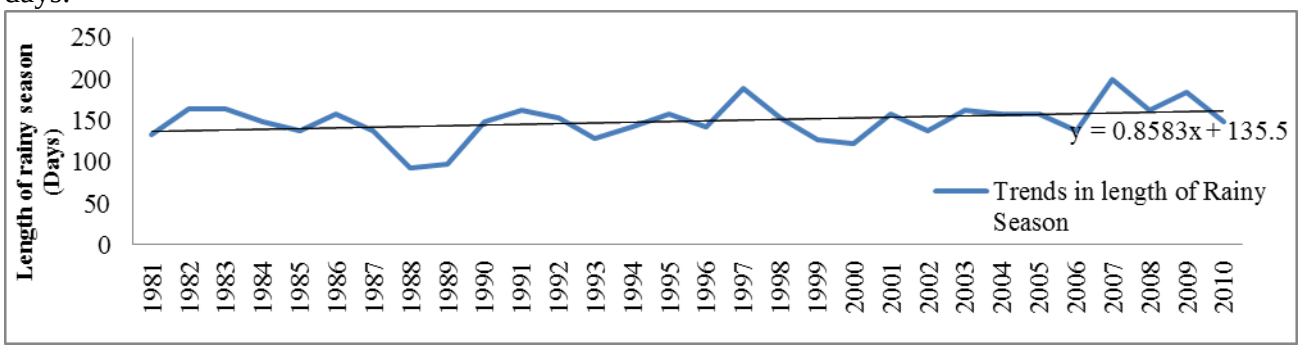

Fig. 3: Trend in Length of Rainy Season at Goronyo (1981 – 2010)
Source: Field survey, August 2012

Number of Rainy Days

Table 1 indicated an upward trend in the number of rainy days. The annual number of rainy days in Goronyo ranges between (12-30 days). The highest annual total number of rain days is 30 days and was recorded in 1997 and 2008. While the lowest number (12 days) occurs in 1994. The mean annual number of rainy days in the study area is 21 days. Researches shows that millet requires the minimum of 60-70 days of rain for effective cultivation and yield, sorghum requires 80 rainy days and maize 80-100 rainy days. Going by the records of rainy days presented in table 1, the length of the rainy season in Goronyo may not favour the cultivation of crops having tap root system such as millet, sorghum and maize. Hence, the need for an adaptive strategy to climate change scenarios in Goronyo. Amongst the three crops- millet, sorghum and maize, the number of rainy days pattern in Goronyo favours millet production most. This is why millet remains the favourite crop and most cultivated among the grain farmers in Goronyo because characteristically, millet is better adapted than most other crops to dry infertile soils, high temperatures, low and erratic precipitation, short growing seasons and acidic soils with poor water-holding capacity.

Annual Rainfall

Trends in the total annual rainfall of Goronyo for the period of thirty years are presented in figure 4

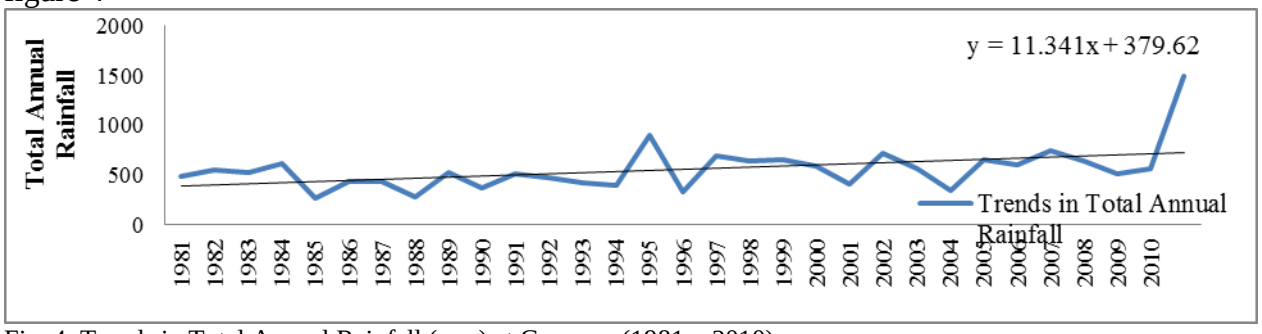

Fig. 4: Trends in Total Annual Rainfall (mm) at Goronyo (1981 – 2010)
Source: Field survey, August 2012

The trends in fig. 4 show an increasing annual rainfall amount. The best fit trend line equation is y = 11.34x + 379.6. The positive equation implies that annual rainfall is on the increase. More so, in table 1 the highest rainfall was recorded in 2010 (1,496.5mm), while 1984 had the least rainfall (263.4mm). The mean annual rainfall during the period of the study is 563.6mm. This amount is lower than the minimum required for the cultivation of sorghum and maize in the study area. Millet requires the minimum of 300mm of rainfall, sorghum 400-600 and maize 500-750mm. It then implies that millet yield was low in the years where annual rainfall was 300mm. Following the annual rainfall record in table 1, 1984 and 1987 are bad years for millet production as the annual total was less than 300mm for millet production. While 1984, 1987, 1989, 1993, 1995 and 2003 were bad years for sorghum and maize production.

Major Adaptation Strategies to Climate Change by Farmers

It is no doubt that adaptation strategies can reduce the impacts of climate change and increase benefits. As shown in figure 6, crop rotation, mixed cropping, use of improved seed varieties, shifting cultivation, access to water for irrigation, use of organic and inorganic fertilizer, access to credit loan are the major adaptation strategies to climate change adopted by farmers in Goronyo.

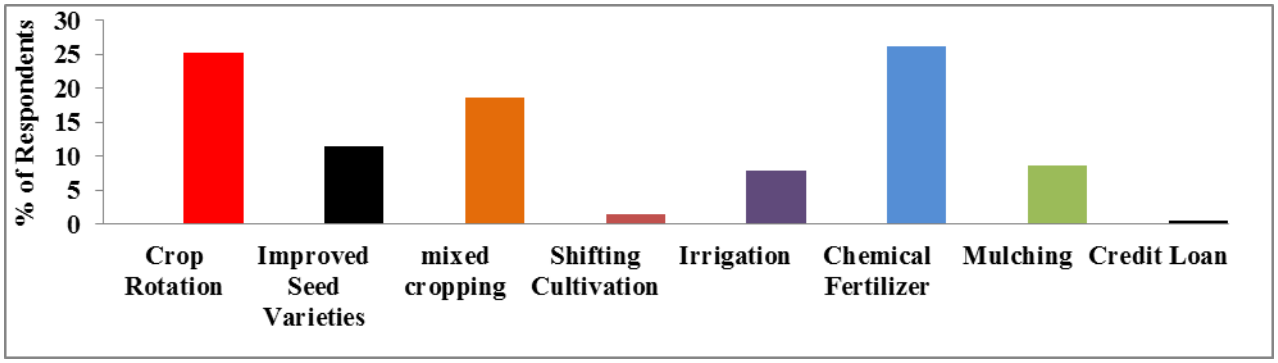

Fig. 5: Farmers' Strategies to Adapting to Climate Change in Grain Production
Source: Field survey, August 2012.

The questionnaire administered on the grain farmers contained a list of adaptation options for the farmers to choose from and then open ended questions for the farmers to itemize other viable adaptation strategies in the study area. The questionnaire was uniformly applied in the eleven wards of the study area. As strategies to adapting to climate change in grain production, 25.2% of the farmers practice crop rotation; 18.6% practice mixed cropping; 15.5 percent uses improved seed varieties; 1.5 percent use shifting cultivation; 7.8 percent use irrigation/fadama farming; 32.2% use chemical fertilizer (chemical fertilizer helps to improve crop yield); 3 percent use mulching with crop residue and animal dung; 0.2 percent use credit loan as a means of diversification of the economy for livelihood and only 0.5 percent stated that no adaptation method is best fit.

CONCLUSION

The study has achieved to a reasonable extent the aim of carrying out this study on the evidence of climate change and adaptation strategies among grain farmers in Goronyo LGA of Sokoto state. Over the 30 years examined, rainfall is characterized by large inter-annual variability. The annual total rainfall favours the cultivation of millet than sorghum and maize. In addition, the study also revealed that the length of the rainy season in Goronyo is too short for the effective cultivation of grains without employing adaptive strategies. Summarily, the characteristics of rainfall and temperature in the study area are not consistent. Major Adaptation strategies of farmers in Goronyo are: Crop rotation, mixed cropping, use of improved seed varieties, shifting cultivation, intensification of irrigation or fadama farming and use of organic and inorganic manure among others. The study also showed that a decrease in rainfall is likely to push farmers to delay their planting dates. Factors that enhances the farmers' adaptive capacity to climate change includes: the farmers' farming experience, the farmers' ability to perceive changes to weather and climate indices, access to credit loan etc.

RECOMMENDATIONS

Following the findings made in the study within the 30 years covered, the following recommendations are made:

i. Since the annual rainfall totals favours the cultivation of millet, grain farmers should focus more on millet cultivation so as to maximize millet yield in the area.
ii. Grain farmers should adopt viable adaptation strategies such as: improved seed varieties, Irrigation farming (since the study area is close to the Goronyo dam), credit loan, mixed cropping, crop rotation, shifting cultivation etc
iii. Government policies should therefore ensure that farmers have access to improved seed varieties, chemical fertilizer, water for irrigation and affordable credit as these increases the resilience of farmers to climate variability.

iv. The Goronyo dam should be developed and opened up for farmers' use as most of the farming activities in the study area is carried out around the Goronyo dam area, mostly maize cultivation.

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Analysis of Public Perception of Climate Change and Its Impact on Health and Environment in Zaria City and Its Environs

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ABSTRACT

This study assessed the public perception of climate change and its impacts on health and environment in Zaria city and its environs. The objective of the paper was to find out the level of awareness by the public on climate change and its impact on health and the environment. Simple random sampling technique was used in the selection of 400 respondents in the study area. The public perception of climate change and its impact on health and environment were obtained by means of structured questionnaire. Results were analysed and presented in tabular forms, percentages and pie charts. This study revealed that 82% of the respondents are well aware of the dynamics of the local climate. Age, gender, occupation and the educational level of the respondents affected their knowledge of climate change. The electronic media (television and radio) is the major source of awareness of climate change. Based on the findings of the study, some recommendations were made which include the need for a comprehensive environmental education by the government and non- governmental organizations to educate the public on the causes and effects of climate change on health and the environment; studies on climate change, adaptation and other environmental issues should be integrated into the primary and secondary school curriculum among others. This study concluded that climate change has negative impacts on health and the environment in the study area.

Keywords: Climate change, Environment, Health, Public perception and Zaria

INTRODUCTION

Global climate change has become one of the most visible environmental concerns of the 21st century. Climate change endangers human health, affecting all sectors of society, both domestically and globally. The environmental consequences of climate change, both those already observed and those that are anticipated, such as sea-level rise, changes in precipitation resulting in flooding and drought, heat waves and degraded air quality, will affect human health both directly and indirectly. Addressing the effects of climate change on human health is especially challenging because both the surrounding environment and the decisions that people make influence health. The World Health Organization defines "environment" as "all modifiable physical, chemical, and biological factors external to the human host, and all related behaviors that are critical to establishing and maintaining a healthy livable environment," Interagency Working Group on climate Change and Health (IWGCCH, 2010).

There is abundant evidence that human activities are altering the earth's climate and that climate change will have significant health impacts both domestically and globally. While all of the changes associated with this process are not predetermined, the actions we take today will certainly help to shape our environment in the decades to come. Some degree of climate change is unavoidable, and we must adapt to its associated health effects; however, aggressive mitigation and adaptation actions can significantly blunt the worst of the expected exposures. Climate change and health issues transcend local and national borders, and climate change health impacts in a community are likely to affect health in the neighborhood as well. Famine, drought, extreme weather events, and regional conflicts—all likely consequences of climate change—are some of the factors that increase the incidence and severity of disease,

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as well as contributing to other adverse health impacts, making it imperative to address climate change-related decision making at local, regional, national, and global levels. The complicated interplay of these and other factors must be considered in determining the scope and focus of both basic and applied research on climate change and health. Climate change, in the most general sense –encompasses all forms of climatic inconstancy (that is, any differences between the "long-term" statistics of the meteorological elements calculated for different periods but relating to the same area), regardless of their statistical nature or physical cause, Maunder (1994). Climate change may be due to natural changes or to persistent chemical changes in the composition of the atmosphere or in land use. Climate change is the end product of a changing climate. Climate change is said to exist when the level of climatic deviation from the normal is very significant over a long period of time (preferably centuries) and such deviations have clear and permanent impacts on the ecosystem, Odjugo (2009).

Perception is a process by which organisms interpret and organize sensation to produce a meaningful experience of the world. It is the process by which we receive information or stimuli from our environment and transform it into psychological awareness, IPCC (2001). According to Merriam-Webster dictionary (2014) Perception is "awareness of the elements of environment through physical sensation. It is the ability to understand or notice something easily". Perception is our recognition and interpretation of sensory information. Perception also includes how we respond to the information. Doss and Morris (2001) opine that the perspectives of the local people, the way they think and behave in relation to climate, as well as their values and aspirations have a significant role to play in addressing climate change. In spite of this, traditional people are only rarely considered in academic, policy and public discourses on climate change, though the impact of impending changes of climate is greater on them, Adefolalu (1986). It is interesting to see that people infer about a certain situation or phenomenon differently using the same or different sets of information. Knowledge, interest, culture and many social processes seem to shape the behaviour of an actor who uses the information and tries to influence that particular situation.

The Intergovernmental Panel on Climate Change, IPCC's (2007) Fourth Assessment Report summary for Africa describes a trend of warming at a rate faster than the global average, and increasing aridity in many countries. Climate change exerts multiple stresses on the biophysical as well as the social and institutional environments that underpin agricultural production, IPCC (2007). "The great moral dilemma posed by climate change is clearly revealed in the differences in risks posed to health and survival, both between and within populations, and between present and future generations. The risks to human health provide one of the strongest signals of the profound significance of climate change as a threat to the planet's life support processes. There is much evidence that climate change is proceeding faster, and with more unexpected manifestations, than predicted by climate scientists a decade ago (e.g. Rahmstorf et al. 2007; Steffensen et al. 2008). Various positive feedback processes (able to accelerate the warming) are occurring, as "tipping points" are reached. Examples include the melting of Arctic sea-ice, which reduces the albedo (reflectance) of the Arctic surface, and the increase in atmospheric water vapour (a greenhouse gas) due to warming-enhanced evaporation. Hence, risks to human health may rise sooner and more widely than has been anticipated, as in the latest Assessment Report of the Intergovernmental Panel on Climate Change", IPCC (2007).

"Research on the health effects of Climate Change has focused largely on direct physical health impacts, principally death and injury from extreme-weather events, impacts of increased temperatures and heat waves, spread of vector-borne disease, air quality and respiratory illness, and changes in food and water quality and availability. The WHO

estimates that Climate Change already accounts for more than 60,000 deaths globally from climate-related natural disasters every year, along with at least another 100,000 deaths from malaria, malnutrition, and child diarrhea. It is anticipated that there will be changes in airborne pollutants, leading to increased respiratory problems. The incidence of some infectious diseases, such as gastroenteritis, is predicted to rise, and there will be changes in the distribution and intensity of mosquito-transmitted diseases, such as malaria, yellow fever, and dengue fever. Research has suggested that the risks of diarrheal disease may be augmented by the increased temperatures that result from Climate Change. One study showed that for every degree of increase in temperature, the rate of hospitalization of children with diarrhea increased by 8%. It has also been predicted that gastrointestinal infections, which are already common in our community, are likely to increase with higher temperatures. The more vulnerable members of our community will be most affected by climate-related illnesses. These include the elderly, who cope less well with changes in temperature, and young children, whose developing lungs are susceptible to ambient air pollution"- Asekun-Olarinmoye E. et.al (2014).

The potential child-health impacts of severe weather include drowning, gastrointestinal disease, malnutrition, and psychological trauma. Health indicators in children, such as infant mortality rate and under-five mortality rate, are already unacceptably high in Nigeria. More importantly, the prevalence of childhood malnutrition in rural areas has been reported to be much higher than in urban settings in Nigeria. The health impacts of Climate Change on children, especially rural children, who are most often marginalized, will be an additional burden, Asekun-Olarinmoye E. et. al (2014).

One of the greatest impacts of climate change is the worsening condition of extreme weather events like drought, flood, rainstorms, windstorms, thunderstorms, landslides, avalanches and tsunamis, among others, Odjugo (2001). Odjugo (2008) noted that the frequency and magnitude of wind and rainstorms did not only increase, they also killed 199 people and destroyed property worth N85.03 billion in Nigeria between 1992 and 2007. Odjugo (2010a) shows that climate change has led to a shift in crops cultivated in northern Nigeria. Climate Change would also directly or indirectly affect population and human settlements in Nigeria. In general, about 15% of the country's population is presently affected by climatic variation and sea level changes. With climate change, between 50% and 60% of the population would be affected. The excessive heat, increasing water stress, air pollution and suppressed immune system occasioned by climate change will result in increasing incidence of excessive death due to heat exhaustion, famine, water related diseases (diarrhea, cholera and skin diseases), inflammatory and respiratory diseases (cough, and asthma), depression, skin cancer and cataract, Odjugo (2010b) & Deweerd, (2007).

METHODOLOGY

Study Area

Zaria is located at approximately 11° 3¹ north of the equator and on longitude 7° 42¹ East of the Greenwich meridian and at about 660m above sea level. It is the second largest city in Kaduna state after Kaduna town. Zaria is one among the 23 local government areas in Kaduna state. It is surrounded by Sabon Gari local government area (LGA) to the north, Soba LGA to the east and Giwa LGA to the west. The climate of the study area is a tropical savanna climate, with distinct wet and dry seasons (Aw climate Koppens classification). Zaria experiences six (6) months of rainy season and six (6) months of dry season. The rainy season is from May to late October, while the dry season is from early November to April, this is as a result of the interplay of the two dominant air masses within the region i.e. the tropical continental air messes (cT) and Tropical maritime air masses (mT) (Iguisi and

Abubakar, 1998 in Yusuf and Shuaibu 2012). The mean daily maximum temperature is at the peak in April and about 39ºC while the mean minimum temperature rises from its lowest value in December to January to its highest in July to August (Ojo, 1982 in Yusuf and Shuaibu 2012).

The soil type of the study area is alluvial soil, also the area constitute dark vertisol referred to as "fadama" soil (Hausa) this soil is classified as hydromorphic soil. The region generally falls within the Guinea Savannah vegetation. The climax climatic vegetation of the area ought to be northern Guinea Savannah, but because nearly all vegetation within the stream system has been degraded due to man's activities such as intense cultivation, fuel wool felling, the real climax vegetation is almost absent. The drainage system focuses on River Galma and Kubanni River. River Galma is a major tributary of River Kaduna and Kubanni River, on which Ahmadu Bello University Dam is situated.

Sources of Data and Sampling technique

Questionnaire was the main source of primary data for this study. The number of questionnaire used was based on the population of the study area. To determine the sample size for the study, the Krejcie and Morgan's (1970) method of determining sample size was adopted which states that for an area with a population between 75,000 - 999,999 the sample size to be used is 382. Since the population of the study area is 408,198 persons by the 2006 census, which falls between these ranges, the sample size of 382 is in order. Meanwhile, 400 respondents were used. Interview and personal observation were also used to source for data. Simple random technique was used to administer the questionnaire to the 200 males and 200 females in the study area. Analysis and presentation of information from the questionnaire was done using percentages, charts and tables.

FINDINGS AND DISCUSSION

Awareness of Climate Change

It is true, that the issue of climate change is no longer news but a reality as its signs are all around us today. Awareness is having a knowledge or understanding of a subject, issue or situation. Adaptation to climate change requires that the public first notice that the climate has altered. The public then need to identify potentially useful adaptations and implement them. Table 1 shows the public awareness to climate change issues.

Table 1: Public awareness of climate change issues

Awareness	Respondents	Percentage
Yes	328	82
No	72	18
Total	**400**	**100**

Source: Field Survey 2008

The above table shows that 82% of the public are aware of climate change issues in Zaria and its environs.

Table 2: Age and knowledge of Climate change issues

Age (year)	Climate change (%)	Global warming (%)	Ozone depletion (%)	Green house gases (%)
Less than 20	75	62.5	43.8	62.5
20 – 29 years	92	92.8	88	88.8
30 – 40	82	78.6	78.6	75
41 – 50	69.5	78.3	69.6	73.9
51 and above	75	75	62.5	62.5
Chi square test	0.000*	0.000*	0.000*	0.000*

Note* significant at 0.05

Source: Field Survey 2008

The age of the respondents affects their knowledge of climate change. Those that are between the ages of 20-40 years are better informed about climate change issues as shown in table 2.

Table 3: Education and knowledge of Climate change issues

Education	Climate change (%)	Global warming (%)	Ozone depletion (%)	Green house gases (%)
None	40	40	46.6	26.6
Primary	63.3	60	70	66.6
Secondary	71.8	68.8	78.1	75
Tertiary	94.2	94.2	93.1	94.2
Traditional	83.3	80.5	72.2	75
Chi square test	0.000*	0.000*	0.000*	0.000*

Note* significant at 0.05

Higher level of education is often hypothesized to increase the probability of adopting new strategies (Adesina and Forson 1995). Indeed, education is expected to increase one's ability to receive, decode, and understand information relevant to making innovative decisions (Wozniak 1984). The educational levels and levels of awareness of the respondents are presented in table 3.

Table 4: Occupation and knowledge of global climate change issues

Occupation	Climate change (%)	Global warming (%)	Ozone depletion (%)	Green house gases (%)
Farmers	82.6	60.8	60.8	56.2
Traders	76	80	68	44
Students	78.9	84.2	78.9	84.2
Professionals	77.7	77.7	77.7	66.6
Civil servants	92.5	87.5	90	87.5
Others	94.4	88.8	83.3	88.8

Source: Field Survey 2008

Table 4 illustrated that occupation affects ones knowledge of climate change. Farmers and civil servants are better informed about climate change issues.

Table 5: Gender and knowledge of global climate change issues

Gender	Climate change (%)	Global warming (%)	Ozone depletion (%)	Green house gases (%)
Male	83.9	76.9	75.5	69.9
Female	82.4	66.6	64.9	61.4
Chi square test	0.000*	0.000*	0.000*	0.000*

Source: Field Survey 2008

The survey revealed that gender affects ones knowledge on global climate change issues as males are better informed about climate change issues in the study area.

Sources of Awareness on Climate Change

Of the many sources of information available to the respondents on climate change related issues in Zaria city and its environs, electronic media is the most important, followed by the school, printed materials and personal observation. This is displayed in table 6.

Table 6: Sources of information on climate change issues

Sources	Respondents	Percentage (%)
Interacting with friends	30	7.5
School	50	12.5
Printed materials	40	10
Electronic media	112	28
Personal observation	40	10
All of the above	108	32
Other sources		
Total	**400**	**100**

Source: Field Survey 2008

Table 7: Public Perception Of The Impacts Of Climate Change

Perception	No. Of Respondent	Agreed (%)	Disagreed (%)	Undecided (%)
Rainfall Amount Fluctuates Year In Year Out	400	77	18	5
Temperature Getting Warmer	400	70	21	9
Number Of Rainy Days Have Reduce	400	67	22	11
Rain Episodes Are More Stormy	400	63	21	17
Floods After Rain Are More Common	400	74	21	5
Harmattan Period Is Now Shorter	400	47	38	13
The Changing Climate Has Led To Crop Infestation And Diseases By Pest	400	67	17	16
High Temperature Encourages The Breeding Of Mosquitoes And Easy Spread Of Diseases	400	70	20	10
Excessive Heat, Increasing Water Stress Etc. Resulting From Climate Change Causes Famine, Water Related Diseases, Inflammation And Respiratory Diseases.	400	75	15	10

Source: Field Survey August 2012

The public perception on weather and climate change indices was analyzed; 77% of the respondents perceived that rainfall amount fluctuates; 70% noticed that temperature is getting warmer; 67% observed that number of rainy days have reduced; 63% noticed that rain episodes are more stormy; 74% agreed that floods after rain are more common and only 47% stated that the harmattan period is now shorter; 67% agreed that the changing climate has led to crop infestation and diseases by pest and 64% believed that high temperature resulting from climate change encourages the breeding of mosquitoes and easy spread of diseases.

FINDINGS AND DISCUSSION

i. Majority of the public (82%) are well aware of climate change issues.
ii. Public perceptions of climatic variability are in line with climatic data records reviewed in the literatures.
iii. The study further revealed that age affects knowledge on global climate change issues as those between 20 - 40 years have better knowledge and practical experience of climate change issues.
iv. More so, education and occupation is a major determinant of the level of awareness of global climate change issues as those with tertiary education, students and civil servants are better informed about climate change issues.
v. Electronic media is the main source of awareness on climate change issues.
vi. Climate change affects the biophysical and socio-economic aspects of the environment.

RECOMMENDATION

Following the findings of the study, the following recommendations are made:

i. Since the electronic media is the main source of awareness on climate change issues, the government and relevant organizations should utilized the advantage of the public media to educate and inform the general public on climate change issues and its devastating impacts on human health and environment.
ii. Studies on climate change, adaptation strategies and other environmental issues should be integrated into the primary, secondary and tertiary curriculum.
iii. Further studies of the science of climate change and its potential impacts in Nigeria is important in creating awareness and providing the background information for targeting policies adequately

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Mitigating Effect of Green Infrastructure on Environmental Degradation in Nigeria Urban Centres

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ABSTRACT

The importance of maintaining a healthy and sustainable environment cannot be overemphasized. Over the years, human have continued to deplete the natural environment at a faster rate than it can be replaced. Desertification, problems of pollution, loss of green areas, improper solid waste disposal systems have become recurring decimal in Nigeria urban centres. This degradation has been attributed to ignorance, poverty, overpopulation and greed amongst other. A major contradiction of the 21st century is the exceptional economic growth and technological advancement which, while benefiting many people have unleashed inexorable social and environmental impact on humanity. While cities continue to grow, there is the need to plan and effectively manage this growth so that human relationship with the built environment will not continue to degrade the environment. This paper through an elucidating literature review examines the roles of green infrastructure at tackling the challenges of environmental degradation in Nigeria. Green infrastructure consists of spatially or functionally connected areas which maintain ecological coherence as an essential condition for healthy ecosystems. This paper proposed that the purpose of effective green infrastructure planning and management is not only to reconnect species populations but also to mitigate further environmental degradation and as well enhances the quality of life in the built environment.

Keywords: Environmental degradation, Green infrastructure, Natural resources, Sustainability, Urbanization

INTRODUCTION

The concern about environmental degradation to a large extent stems from the universal concern about sustainable development arising from natural resource exploitation and utilization. Although high population increase and economic developments has been fingered as a factor in environmental degradation, so much weight has been given to the social problem of depleting the green spaces as a major factor in environmental degradation (Egger, 2006; Gutman, 2007; Fadamiro and Adedeji, 2014). Challenges of environmental degradation is today becoming more prominent not only among developing countries of the world but, ubiquitous globally. Indeed, the intertwining relationship between urbanization, the problem of sustainable development and urban green resource exploitation is crucial as it is paradoxical.

However, the need to control environmental degradation in Nigeria is to achieve a sustainable environment which is in line with Goal 15 in the newly developed Sustainable Development Goals (SDGs) so that Nigeria will also conform to the global quest for developing nations sustainably. Very prominent among the definitions of sustainable development is that of the World Commission on Environment and Development (WCED, 1987) which sees sustainable development as the developments that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Also, Haggag and Elmasry (2011) referred to a sustainable development as a socio-ecological process characterized by the fulfillment of human needs while maintaining the natural environment. The idea of sustainable development involves enhancing the quality of life, thus allowing people to live in a healthy environment, with improved social, economic and environmental conditions (Ortiz et al, 2009). However, the advancement in technology,

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exceptional economic growth and the quest to cater for the rapid human population growth have unleashed inexorable social and environmental impact on humanity in Nigeria and other nations of the world. This therefore requires urgent approach to stabilize the environment and institute measures which can make the built environment to develop sustainably and tackle further degradation.

Green infrastructure has been suggested as a viable ecosystem network that is capable of creating environment that is cool, clean and habitable for different species of plants and animals as well as comfortable built environment. Countryside Agency (2006) in the UK asserted that green infrastructure comprises the provision of planned networks of linked multifunctional green spaces that contribute to protecting natural habitats and biodiversity, enable response to climate change and other biosphere changes, enable more sustainable and healthy lifestyles, enhance urban liveability and wellbeing, improve the accessibility of key recreational and green assets, support the urban and rural economy and assist in the better long-term planning and management of green spaces and corridors.

This article therefore emphasized that effective green infrastructure planning and management is capable of mitigating further environmental degradation and can provide viable strategies for achieving sustainable environment in Nigerian cities. Specifically, the article attempts to answer the following research questions pertaining to environmental degradation in Nigeria: 1) what are the causes and consequences of environmental degradation in Nigeria? 2) How can green infrastructure respond to challenges of environmental degradation and provide ecological networks for developing Nigerian cities sustainability? This research is potentially significant due to the emphasis in the global fight for environmental sustainability, and the Nigerian environment lacking prompt strategies at combating environmental disasters. The study was carried out through desktop research methods; these include searching for relevant documents and research articles from peer reviewed journals over the internet, gathering and collating relevant information from published and unpublished articles, consulting journals database resources like the Hinari initiatives and others freely available on the internet. Information gathered were reviewed, discussed and presented descriptively with appropriate recommendations and conclusion.

Study Area

Nigeria, a country located in West Africa with a population of about 150 million people and an area of 923,000 square kilometers, lies between 04 16^0 and 13 53^0 North of Latitude and 02 40^0 and 14 41^0 East of longitude. The country is bordered in the west by The Republic of Benin and in the East by Chad. It also shared border with the Niger Republic in the North and in the Southern part by Cameroun. It has 36 administrative states, a Federal Capital Territory (FCT), It has 774 Local Government Authorities (LGAs) and 6 main geo-political zones (Muhammad, Salisu and Umar, 2014).

Nigeria is rich in biodiversity as the country is well endowed with a variety of plant and animal species like many other nations of the world. There are about 7,895 plant species identified in 338 families and 2,215 genera (Federal Government of Nigeria, FGN, 2010). To take advantage of the biodiversity as well as the rich vegetation which ranges from the mangrove and thick forests in the South, followed by Savannah and the Sahel in the middle belt and the North respectively, Nigerian Economy is dominated by Agriculture. The paradox of Nigerian Agricultural economy is such that while it is producing food for the economic growth, the desire to expand agriculture has brought serious degradation to the environment.

SUSTAINABLE DEVELOPMENT GOALS

The Sustainable Development Goals (SDGs) was adopted on September 25th 2015 when countries of the world gathered to review the formal Millennium Development Goals (MDGs) which ended in 2015. The Sustainable Development Goals, officially known as *Transforming our world:* the 2030 Agenda for sustainable development are an intergovernmental set of aspiration goal with 169 targets. These set of goals are targeted to end poverty, protect the plant, and ensure prosperity for all as part of a new sustainable development agenda. There are 17 goals in all some which are: No poverty, affordable and clean energy, climate action, zero hunger, good health and well-being etc. Each goal has specific targets to be achieved over the next 15years. Specifically, Goal 15 is sub-titled LIFE ON LAND: *protect, restore and promote sustainable use of terrestrial ecosystem, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss*. This goal is of great relevance to the topic under discussion. If environmental degradation is appropriately tackled, this will contribute positively to the achievement of goal 15 in the Sustainable Development Goals.

Understanding Environmental Degradation

The United Nations, UN (1997) refers to environmental degradation as the deterioration of the natural environment through human activities and natural disasters. The term environmental degradation implies that environmental resources such as land, soils and vegetation are reduced to a lower rank taking into account the fulfilment of given demands. Following this definition, Reed (2007) defined environmental degradation as the reduction in value of the environment to meet its ecological and socio-economic needs. It includes issues such as deforestation, desertification, land degradation, loss of biodiversity, various levels of pollution, climate change, sea level rise and ozone depletion. Also, Omofonmwan and Osa-Edoh (2008) submitted that environmental degradation implies "abuse of the environment" due to improper resources management. The emphasis of these definitions is on proper accountability in the management of earth's abundant natural resources and the systematic uses so that earth resources will not easily go into extinction and can be available for the coming generation.

Although environmental degradation is not a new concept, but it is rapidly gaining more attention now than before because environmental problems are now occurring at a much faster rate, therefore not leaving enough time for the environment to recover and regenerate (Owolabi, 2012). Apart from its effects in Nigeria, environmental degradation is causing great havoc globally with the effects becoming much pronounced in developing countries especially due to the fragile economy strength and development in such areas. Statistical evidence of the effects of environment degradation by the United Nations have estimated that, of the 8.7 billion hectares of arable land, pastures and forests worldwide, nearly 2 billion of them have been degraded over the past 50 years, of which 18% are of forest land, 21% are of pasture land and 37% are of arable land (Haaften et al., 2004 cited in Muhammad et al., 2014).

Concept of Green Infrastructure

Green Infrastructure is a concept originating in the United States in the mid-1990s that highlights the importance of the natural environment in decisions about land use planning. Since then, the concept has spread rapidly through UK, Europe and other continents of the world. Howard, cited in Mell (2011) stated that the UK sees green infrastructure develop through the ideas of garden cities and the protected designations of green spaces. While in Europe, the development of green infrastructure has been linked with the development of the

urban greening agenda and the need to develop integrated green space effectively within high density landscapes (Beatley, 2009). However, in contrast to the UK and Europe, Benedict and McMahon (2006), affirmed that the North American green infrastructure development has its foundations in landscape conservation.

Green infrastructures are resilient landscapes that support a multitude of ecological, economic and social functions without compromising the sustainability of a resource base. They may comprise a number of different landscape elements that vary in size, composition, and function (Mell, Roe and Davies, 2009; Mazlina, Zalina and Khalilah, 2015). What characterises green infrastructure resources are their ability to meet a wide variety of needs – sometimes termed 'ecosystem services - in diverse urban, urban-fringe and rural locations (See Table 1). Green infrastructures have been proposed to promote access and connectivity, function sustainably across different spatial areas, be planned strategically and holistically, support diverse ecological, economic and social needs, and to promote a more holistic approach to landscape management (Benedict and McMahon, 2006; Davies et al., 2006; Kambites and Owen, 2007). Recently, green infrastructure development has started gaining prominence in Nigeria even though; this development is still very slow compared to the situations in the developed world. Many states in Nigeria are emphasizing the need to green up the environment. For example, there are designated sites in Lagos, Oyo, Rivers and Kano states where green infrastructure projects can be appreciated.

Table 1: Classification of Ecosystem services of Green Infrastructure

PROVISIONING	REGULATING	SUPPORTING	CULTURAL
Provision of food	Climate	Soil formation	Recreation
Fresh water	Water	Primary productivity	Ecotourism aesthetics
Medicine	Carbon sequestration	Nutrient cycling	Educational
Fiber	Erosion control		Spiritual
	Diseases regulation		

Source: Millennium Ecosystem Assessment (2005)

Consequences of Environmental Degradation in Nigeria

Nigeria's cities are often criticized as having sprawling, low-density development, over-use of non-renewable natural resources, social inequities, including poverty and economic hardship and pollution of air, water and soil (Balogun et al., 2011; Isah, 1998). Therefore, environmental sustainability has faced critical problems in Nigeria. Several factors ranging from increasing population, demolishing of natural resources, environmental pollution, unplanned land use and several others are responsible for this (Balogun et al., 2011). The need for corresponding development that can take care of the rapid population growth and the over dependence on agricultural activities in Nigerian economy has seriously degraded both the natural and the built environment. Environmental degradation of varying types and degree are very rampart in Nigeria. Muhammad et al. (2014) noted that coastal erosion, water pollution and marine biodiversity loss are typical in the southern coastal areas of Nigeria while the central states suffers from salinization and acidification of soils and sediment discharge on lower Niger-Benue catchments. Deforestation, salinization and loss of plant diversity are most widespread in all parts of Northern Nigeria. The increasing intensity of agricultural activity due to population growth may be the most important factor influencing this process.

Unkempt environments, poor road network, lack of proper refuse disposal, smoke from refuse burning are very ubiquitous in most Nigerian cities (See figures 1 and 2). Whereas these environments can be landscaped sustainably, they are often neglected and these increased degradation of the built environment and consequently impeding the sustainability of the natural environment. Regionally, cases of flooding, rainstorm, oil spillage, drought, erosion and many other dysfunctional environmental phenomenons have become routine

occurrences in Nigeria (Dipeolu, 2015). For example, the routine floods in the South Western Nigeria (See figure 3), the deep erosion in the South Eastern Nigeria, the extreme weather conditions that generate heat and drought of the desert in Northern Eastern Nigeria, have all been traced to the excessive depletion of most forest areas in Nigeria and these poses threat to quality environment (Balogun et. al., 2011; Fadamiro and Adedeji, 2014; Dipeolu, 2015;). In Niger Delta region, the cumulative practice of environmental degradation arising from pollution of land, gas flaring, oil spillage and release of various carbon contents during oil exploration (See figures 4a, 4b & 4c) have contributed a lot to climate change and other challenges in the environment. Instead of leaving these challenges to continue to threaten human existence, green infrastructure projects implementation can urgently rescue the sustainability of the built environment from collapsing.

Figure 1: A view of degraded buffer area along Lagos/Ibadan expressway
Source: Author's field work, 2010

Figure 2: A view of refuse burning on an open space along Lagos/Ibadan expressway converted into dumping site by residents.
Source: Author's field work, 2015

Figure 3: Lagos Floods, Ajegunle –Ikorodu Express Road at Ajegule
Source: Etuonovbe, (2011)



Figure 4a *Figure 4b* *Figure 4c*

Images of Environmental Degradation through oil spillage in Niger-Delta Region of Nigeria
Source:http://www.post-nigeria.com/how-the-senate-has-dealth-with-environmental-damage-as-a-result-of-oil-spillage/

Responses of Green Infrastructure to Environmental Degradation Challenges

Carbon Sequestration

This is the process of removing excess carbon dioxide (CO_2) from the atmosphere through engineering processes, chemical processes and biological or agricultural processes. Carbon sequestration is required so as to slow the atmospheric and marine accumulation of greenhouse gases (Which are the major constituents of global warming inducing agents) which are released by burning of fossil fuels into the atmosphere. In agricultural sequestration, plants absorb carbon dioxide during growth and release oxygen which is needed for man effective respiratory system. It simply implies that the more the green spaces in the environment, the less the amount of carbon dioxide that will be present in such an environment since there will be rapid competition for the few available carbon dioxide for the survival of the green plants in such environment (Tzoulas et al., 2007; Mazlina et al., 2015; Dipeolu, 2015).

Abatement for Air Pollution

Availability of green infrastructure facilities within urban centre aids adequate abatement for air pollution. Many impurities within the atmosphere are easily trapped by green infrastructure facilities like grasses, street trees, community forest, city farms, woodlands and other functional green spaces within the urban centre. Green infrastructure facilities (as abatement for air pollution) will be needed especially in areas where there are huge amount of fuel burning activities, major traffic ways, industrial compounds and various manufacturing sites laden with heavy power generating equipments.

Access to Tree Corridors

Green infrastructure like street trees, create opportunity for the provision of sidewalks, trails, and private streets, connected to transit stops and an interconnected street network. This consequently provides mobility options and helps to reduce pollution by reducing vehicle trips. It also encourages walking, bicycling, and other mobility options within the urban centres.

Restoring Lost Urban Environmental Greening

Urban environmental greening is an integrated citywide approach to the planning, care and management of all vegetation in a city to secure multiple environmental and social benefits to urban dwellers. It is the practice in which a significant percentage of urban environments are allowed to maintain adequate vegetal cover such as trees, shrubs, vines, flowers, grasses and other form of (vegetal) ground cover (Sorensen, 1997; Dipeolu, 2015). Effective green infrastructure enhances the restoration of the initial lost environmental greening which had occurred as a result of the need to cater for economic, industrial and human population explosion. As the green spaces increase in the built environment, it contributes to having facilities that enhance sustainability in the built environment and brings gradual reduction environmental degradation.

Improves quality of life in the built environment

Green infrastructure plays a very prominent role at improving the urban environment. It is a viable strategy to create access to nature within the built environment as it encourages rapid urban environmental greening by maintaining green open spaces and enhancing appreciable vegetation cover in the built environment. Past literatures have linked natural settings and green spaces to have positive effects on human health. Most of these studies confirmed that activities around green spaces produced positive psychological and physiological effects for human restoration from directed attention fatigue (Kaplan, 1995; Lau and Yang, 2009; Tzoulas et al., 2007; Mell, 2010; Mazlina et al., 2015).

Improves quality of air in the built environment

Plants and trees have a positive impact on the air human being breathe. Plants produce oxygen as a by-product into the environment which human being need oxygen to survive. Highways produce carbon, first by the construction process, but more significantly over time is the carbon produced by combustion of petroleum-based fuels by the vehicles using the highways. Highways are great air pollutants. But plants and especially trees have a much more positive impact on air quality (Coder, 1996). In addition, trees, plants and lawns have huge impacts on temperatures and energy use, especially in urban areas. A landscape lowers local air temperatures by transpiring water and shading surfaces. Because trees lower air temperatures, shade buildings in the summer, and block winter winds, they can reduce building energy use and cooling costs.

Possibility of Green Roofs on Buildings

Green roofs are building roofs that uses living plants as the exposed surface. They are very prevalent in Europe and in the United States but are just been introduced to Nigerian building industry. The advantages to a green roof are that it can reduce energy use by moderating temperature on the roof and surrounding areas. It also can systematically reduce storm runoff volume and peak flow rate by holding and releasing storm water slowly. A green roof can also restore the ecological and aesthetic value of urban open space by replacing a stark conventional roof with a green, softer roof line (PLNA, 2013). With more green roofs in Nigerian environment, it implies more green spaces, more access to nature and consequently more quality of life in the built environment.

CONCLUSIONS AND RECOMMENDATIONS

Man's capability to transform his environment can bring the benefits of economic development and an opportunity to enhance the quality of life. But this same power, incorrectly applied, can also cause very serious harm to the natural environment and consequently to human life. Due to anthropogenic activities, the earth surface is being significantly altered in some manner and man's presence on earth and his use of land has had a profound effect on rather all meteorological/climate parameters (Balogun et al., 2011). There should be no delay in tackling the task of solving these environmental problems, as this degradation has cumulative impact. Delayed remedial action will cost considerably more and the damage will become irreversible. (Chaudhary, 2011).

This article has seen green infrastructure as a network of multifunctional greens pace, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities. Through proactive planning, design and management it has been shown that green infrastructure can reduce carbon, promote renewable energy, improve air quality, control flooding, serve as wind breaker, moderate local micro-climates, enhance biodiversity, improve water management, facilitate more sustainable modes of transport, promote healthy communities, contribute positively to the quality of place and control further environmental degradation. Effective

green infrastructure planning and implementation is therefore considered to be very relevant in achieving Goal 15 in the Sustainable Development Goals.

In light of this, the study recommends that Nigerian government at all levels should be more proactive in implementing policies for effective green infrastructure planning and management, more orientation programs for citizens on proenvironmental attitudes towards sustaining the built environment and professionals and other stakeholders should be encouraged to collaborate with the government to win the current war against abuse of both the built and the natural environment. With this appropriately utilized, environmental degradation challenges in Nigeria can be sufficiently tackled.

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Assessment of Carbon Monoxide Levels in a Commercial District of Akure, Nigeria

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ABSTRACT

The importance of having acceptable indoor environmental quality in building interiors have been well established in rating systems like BREEAM and LEED. However, in a developing nation like Nigeria, where rating systems are under consideration and adequate provision for power is a challenge, retailers in commercial buildings tend to provide power generating sets on their own, more so the influence of vehicular traffic on indoor environment is also of concern to researchers. In the development of a green building rating system for Nigeria, models need to be developed as to the patterns of carbon monoxide (CO) levels in commercial buildings in the country. The purpose of the quantitative study is to assess the level of CO in the terraces of buildings in the Obanla district of Akure in October 2015. Eighty commercial cum residential buildings was assessed in the Ijomu, Obanla commercial axis in Akure, the capital of Ondo State, using dSense Portable CO Meter - a hand held CO monitor, on a once a week measurement, for a month. The implication of increased exposure of CO levels usually from generator fumes and vehicular traffic could lead to reduction in the oxygen carrying capacity of the blood. Results showed that the average one hour measurements for eighty positions were 1.225ppm for week one, 1.775ppm for week two, 1.475ppm for week three and 4ppm for week four. These average levels are lower than the WHO indoor air requirement of 30ppm for 1 hour and the USEPA (NAAQS) 35ppm outdoor air 1 hour average.

Keywords: carbon monoxide levels, green building rating system and indoor environmental quality

INTRODUCTION

World Congresses of States especially the United Nations, UN Conference on Sustainable Development, Rio+20 (UN, 2012; the Earth Summit, 2015) have raised concerns on the sustainability of the environment, such issues as depletion of renewable and non-renewable resources, pollution of air, water and land, soil degradation and high level of waste generation have been of concern to researchers (Day, 2004; Roaf, Fuentes & Thomas, 2007).

In advanced nations, the concept of green buildings and rating of buildings' have been explored as a practice that can reduce impacts of the building industry on the environment (Brophy & Lewis (2011); Atkinson, Yates & Wyatt (2009). One of the basic principles of the established Building Research Establishment Environmental Assessment Method (BREEAM) is the health and Wellbeing aspect, which aggregates up to 15% of the rating for any building (Sleeuw, 2011, p.6; Potbhare, Syal, Arif, Khalfan, & Egbu (2009, p.110). Furthermore, levels of pollutants such as carbon monoxide (CO) and particulate matter level, all contribute in one way or the other towards rating the interiors of buildings. Other factors considered are carbon dioxide (CO_2) level, light level, humidity and temperature of building interiors. Also these environmental issues have raised concern(s) on the productivity and health of users in the interior of buildings and thus have increased the health risk of users of buildings, particularly the presence of CO sometimes leading to death of occupants, specifically where power is sourced through petrol electricity generators.

In developing nations such as Nigeria and Akure South Local Government Area precisely, research into assessment of CO levels are limited, especially in relationship to buildings, hence the importance of this work.

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LITERATURE REVIEW

Carbon Monoxide Levels and Health of Building Occupants

The purpose of the quantitative study is to assess the level of CO in the terraces of buildings in the Obanla district of Akure in October 2015 between 9am and 10am on selected days, this time was based on the previous work by Adegoke, Balogun, Odiase & Tate (2015, pg. 21), the authors observed 8am – 10am as one of the two peak periods of ambient CO concentration in Akure metropolis. Also, Farayola & Egunjobi, (2015, pg. 46) also noted that "CO concentration levels were significantly higher during the day than in the night" and concentrations of CO was observed to be higher in more densely populated areas than in the less densely populated areas. The Obanla research area is one of the down town, traditional area of Akure. The Ondo State Building and Subdivision Regulations (1984, Section 77-79) specifies that where natural ventilation is not feasible, mechanical means of ventilation can be procured for buildings to improve the health and safety of occupants. Section 80 of the regulations (Op. Cit), informs about noxious vapours, but no specifics about carbon monoxide (CO) is discussed in the regulations. The research questions raised are: What is the CO level in the terraces of buildings in Obanla – Oke Ijebu area of Akure down town? Is the air quality of these buildings in compliance with in country and international requirements?

Table 1: Comparative carbon monoxide exposure levels from different standards

S/N	Organization	Period	CO levels	Notes
1	ASHRAE	8hrs	9ppm	Standard 62.2 (2013)
2	USEPA	8hrs	9ppm	NAAQS (outdoor air)
		1hr	35ppm	NAAQS (outdoor air)
3	ACGIH	8hrs	25ppm	Threshold limit value
4	NIOSH	8hrs	35ppm	Recommended exposure limit
		15min	200ppm	Short term exposure limit
5	OSHA	8hrs	50ppm	Permanent exposure limit
6	WHO	24hrs	6ppm	Indoor air
		8hrs	9ppm	Indoor air
		1hour	30ppm	Indoor air
		15min	87ppm	Indoor air
7	NBC (2006)	1hour	200ppm	Car garages and connecting spaces
		8hrs	50ppm	Car garages and connecting spaces

Source: NBC (2006), Carbon monoxide levels and standards (n.d.)

Figure 1: research area bounded by Oke Ijebu Street, Obanla Street and Oba Adesida Road, Akure, Courtesy of Google Maps (2015)

Carbon monoxide is an odourless, colourless gas and it is a bye product of burning gasoline and natural gas. Common sources of CO are usually from automobiles, coal, oil and electricity generators. The site of action of CO is the haemoglobin in blood to which the

carbon monoxide attaches, leading to a loss of its oxygen carrying capacity and subsequent toxic effects" (Connell, Hawker, Warne & Vowles, 2005, p.8). CO is hazardous to persons with heart or circulatory problems, or people with damaged lungs or breathing passages (ASHRAE, 92.1, pg. 29)

Environmental Sustainability

The Encyclopaedia of life support systems describes sustainability in terms of "protecting the planet's life support systems to ensure longevity for humans and other species". The term 'development' was further explained as "progress in social well-being or improvement in the quality of life". While working towards this progress, it is important to take note that the ecological system is both global and finite, thus "observing nature's limit is important in order to prevent an irreversible depletion of the life support systems" (Bell & Cheung, 2002). Sustainable development is that which "meets the needs of the present without compromising the ability of the future generations to meet their own needs" (World Commission on Environment and Development (WECD, 1987). This is by far the most widely quoted definition of sustainability.

Kwami and Adi (2012) advices that governments, professionals and educational institutions should embrace sustainability in their programmes in order to advocate for social, humanitarian and environmental factors to be paramount in their day to day responsibility towards the people. Sustainability is seen as a panacea to everyday problems such as excessive rainfall leading to flooding which displaces people, disrupting businesses and family relations, a vivid example is the flooding in Kano State, Nigeria where residents in declared risk zones where further affected due to lack of enforcement (Nabegu, 2014, p.25), whirlwind and tornadoes in the United States, excess heat on sunny days and sometimes in the night causing discomfort, the cases of urban heat island in our city centres due to activities of humans (Taha, 1997, p.101), drought in the northern part of Nigeria, erosion leading to deep gullies in the eastern part of the country and ocean encroachment in the coastal state of Lagos, Nigeria. Sustainable design considers the urban fabric, thus designers makes it a point to deliver only buildings that fit local context (Bay & Ong 2006, p.226).

Green Building Rating System

There is a growing awareness of the term green buildings and green building rating systems in emerging nations (Potbhare, V., Syal, M., Arif, M., Khalfan, M.M.A. & Egbu, C., 2009, pg.100). In Africa, South Africa and Egypt are countries that have existing green building councils and rating systems (GBCSA, 2016; EGGBC 2016). However, in Nigeria, the development is at best still at the discourse level within the professional bodies, for example, several conferences such as Architects Colloquium have focused majorly on sustainable development for the economy (Adabamowo & Kusimo, 2008; Prucnal-Ogunsote, Okwoli & Ude, 2011).

A green building is a building that considers and then reduces its impact on the environment and human health (Yudelson, 2009). A green building in the United States and Canada is generally considered to be one certified by the Leadership in Energy and Environmental Design (LEED), green building rating system of the U.S. Green Building Council (USGBC) or Canada Green Building Council (CaGBC). Buildings generally consume too many resources to be overlooked laments Porter (2004), thus green buildings are designed to use considerable less energy and water than a conventional building and have fewer site impacts and generally higher levels of indoor air quality. Sensible House (2013) concretizes the idea of green buildings under five sub headings: energy, materials, health, water/landscape, design.

The establishment of a Green Building Council for Nigeria can be jump started by setting up a multidisciplinary committee at the level of the Nigerian Institute of Architects, Architects Registration Council of Nigeria, and other Registration Councils of the built environment disciplines; the Town Planners Registration Council, Council for the Regulation of Engineering in Nigeria, Council for the Registration of Builders, Quantity Surveying Registration Council of Nigeria, Surveying Registration Council of Nigeria, Chartered Project Management Institute of Nigeria. This idea by Ogunsote et al (2011) suggests firstly setting up web portal managed by various disciplines in the academia, the building industry and government agencies, the web portal of the Green Building Council should be hosted by the World Green Building Council website. The Stake holders according to US Green Build 2015 Expo flier usually includes: architects, engineers, interior designers, landscape architects, builders, code officers, building owners, contractors, developers, educators/schools, facility managers, financial service providers, government agencies, green building thought leaders, utilities.

Green building rating systems are defined as "tools that examine the performance or expected performance of a whole building and translate that examination into an overall assessment that allows for comparison against other buildings" (Fauler & Rouche, 2006). The aim of any building environmental assessment system according to Adegbile (2013) is to set criteria against which to rate a building and then to provide a score or descriptive rating for that building. This rating shows the building's environmental credentials which usually have commercial implications in terms of promoting sustainability image. Fowler and Rouch (2006) in the executive summary to the report for the General Service Administration (GSA) of the United States of America, advises that using a green building rating system allows for comparison with other GSA Buildings, other Federal Buildings and the US Building market and also as a means "to track GSA's progress towards designing and operating the best buildings for their occupants". In addition, the report assumes that "the rating systems reflect the values and priorities of the developers and countries". Maton (2013) suggested adoption of the LEED system of rating buildings in Nigeria because of the flexibility of LEED. Also Adegbile (2013) suggested the use of LEED in Nigeria, more reasons might need to be put forward towards the adoption of LEED in Nigeria, acceptance of LEED hook line and sinker may be a simplistic solution to the problem. Ultimately, sustainability will be measured based on local conditions (GRIHA, 2014). Green building rating systems promotes the use of simple techniques, passive energy principles that makes buildings more suitable for users for example; orientating the longer side of buildings in the East – West direction, the use of courtyards, atrium and cross ventilation (Brown & Dekay, 2001). Technological solutions is also encouraged; making use of alternative to grid power through photovoltaic (PV) cells, Task lighting, light control devices (Oyedepo, 2012), rainwater collection (Brophy & Lewis, 2011).

METHODOLOGY

The study made use of data collected through on site measurements as primary source, while secondary data was collected through published journals and standards. On selected days at exactly 9am, on the spot assessment using the dSense Portable CO Meter – a hand held CO monitor was used to collect data. This was recorded in a memo pad and later transferred to a Microsoft excel table which was later analysed using descriptive tools; tables and graphs.

The purpose of the quantitative study is to assess the level of CO in the terraces of buildings in the Obanla district of Akure, the terraces were selected as an initial aspect of the work and subsequent studies would be based on interiors of selected non-residential buildings. Furthermore, the terraces were selected because of the issue of access. It is easier to gain

access to terraces of commercial buildings, since it is considered as a semi-public space, this is because potential customers have the liberality to pause for a moment, deciding whether there is a need to enter the shops or not.

Precautions: as advised by CO meter operation manual (n.d.)

i. Allow CO meter to run self-test in a neutral environment, free of CO, since high CO may cause failure in passing self-test
ii. It is important to have backup batteries should in case low battery indicator comes up during the test
iii. Keep the meter away from electronic interference, which may cause erratic reading

FINDINGS AND DISCUSSIONS

The points that are known to constitute possible higher levels of CO can be studied to detail. Such as the Car park exit point into Oke Ijebu Street from the public car park area, the motorcycle repair/ park point and the vehicular inlet area to Obanla street from Oke Ijebu Street.

Table 1: Purpose of building in the study area

S/N	Building Types	Quantity	Percentage
1	Commercial	49	61.25
2	Commercial/residential	31	38.75
Total		80	100

Two types of buildings were found in the study area: commercial buildings amounted to 61.25% (Table 1) and residential rooming buildings with the rooms closer to the streets converted to commercial purpose 38.75%. Two buildings were under construction and was not included in the project.

Table 2: Building floor levels in the study area

S/N	Building Types	Quantity	Percentage
1	Bungalows	62	77.50
2	One Storey	16	20.00
3	Two Storey	2	2.5
Total		80	100

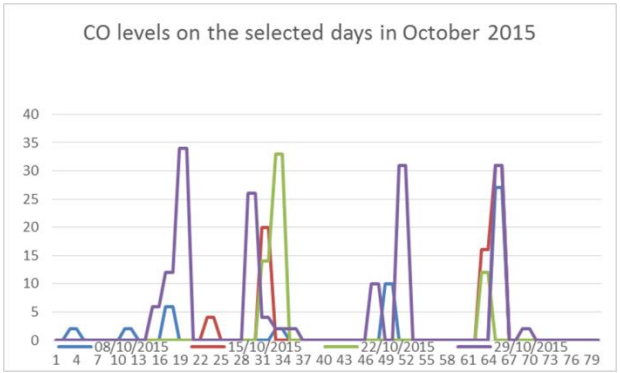

Figure 1: CO levels in station 1 to 80 on the selected days in October 2015.

Bungalows recorded as high as 77.50% of the buildings studied (see Table 2). One storey buildings accounted for 20% while two storey buildings were 2.5% of the lot. Comparatively, there is considerable increase in the level of concentration between study position 13 – 20, 28 – 34, 46 – 52 and 61-67. The highest reading occurred on 29/10/2015, as high as 34ppm. The average CO concentration levels for one hour at the eighty positions were 1.225ppm for week one, 1.775ppm for week two, 1.475ppm for week three and 4ppm for week four. These average levels are lower than the WHO indoor air requirement of 30ppm for 1 hour and the USEPA (NAAQS) 35ppm outdoor air 1 hour average.

CONCLUSION

The study shows that there are certain positions that have the possibility of high CO concentration levels (as high as 34ppm) in the study area – positions 13 -20 and 46 - 52. The study further shows that comparatively, certain positions in the study area for the four weeks have consistently high CO level emissions – positions 28 – 34 and 61 - 67. On the average, it was discovered that the one hour average is lower than WHO (indoor) and NAAQS (outdoor requirements). This shows that although previous studies have indicated that vehicular traffic and generator fumes increase CO levels in the environment, the levels are still within permissible limits in the study area.

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Sustainable Site Planning; A Soil Conservation Strategy for Residential Developments in Lagos, Nigeria

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ABSTRACT

The concept of sustainable has taken center stage as a key to addressing several tropical development problems. The residential built environment is a complex environment consisting of both artificial and natural elements. Soil conservation and management problems usually arise in residential areas in situations where the artificial elements largely dominate the residential plot. The research through the collection of primary and secondary data from questionnaires administered, observations, literature and case studies revealed that most developed residential plots in the study area have larger areas covered with artificial site organization elements. This research aimed at employing the principles of sustainable site planning in increasing the amount of natural elements or sustainable artificial elements of residential tropical plots in Lagos, Nigeria. It reveals that planning and monitoring were the major problems that brought about covering of large areas of residential plots by the built structure. This research recommended that the element of percentage covered by sustainable landscape elements should be provided as part of the components of site analysis for building approval. The building code should be strictly adhered to during the development of residential plots, especially with the aspect of setbacks and local development and planning authorities should be more vigilant, transparent and transparent in monitoring and ensuring standards. This research concluded that sustainable site planning for tropical residential developments in Lagos, Nigeria is the basis for ensuring available and conserved soil space around residential structures.

Keywords: Built environment, Residential area, artificial elements, Natural elements, setback, and Sustainable site

INTRODUCTION

It is imperative that building owners and developers maximize the restorative impact of site design and building infrastructure while meeting the projects other demand (World Building Design Guide Sustainable Committee, 2013).

The major natural component of outdoor residential building development is soil and this component serves as the base for the development of all other components, both natural and artificial. Hence there is a need to stabilize this component, so as to enhance the functionality of all other components that it supports including the residential building structure which it surrounds. Sustainable site planning involves majorly sustainable landscaping of outdoor building spaces and this encompasses a variety of practices that have been developed in response to different environmental problems. One of such environmental problems is the issue of erosion. Due to the severity of its ecological effects and the scale on which it is occurring, erosion constitutes one of the most significant global environmental problem we face today (Toy et al, 2002).

Aim and Objectives

This research aims at tackling erosional soil management issues with setbacks of buildings in residential areas through the application of sustainable site planning principles. In other to achieve this aim, the research employed the following objectives:

i. to establish, through literature, the concept, origin, objectives and functions of sustainable site planning;
ii. to examine the various erosion types and soil conservation strategies for erosion control in residential developments;

Akagwu M. (2016). Sustainable Site Planning; A Soil Conservation Strategy for Residential Developments in Lagos, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 97-104

iii. to identify and study the different sustainable landscape and building roof design solutions employed in sustainable site analysis that enhances erosion control;
iv. to articulate the concept of sustainable site planning, with special emphasis on measures that will lead to the achievement of soil conservation around residential buildings;
v. to propose through Site analysis and Sustainable landscape design, percentage areas for different landscape elements to enhance soil conservation and erosion control in residential areas.

CONCEPTUAL AND THEORETICAL ISSUES

Sustainable Site Planning through Sustainable Landscaping of Outdoor Residential Developments

According to Bob (2011) a site plan has least environmental impact while still meeting the client's project goals. It's sustainable if it meets project needs and budget and at the same time reducing environmental impact. Site planning refers to the organizational stage of the landscape design process. It involves the organization of land use, zoning, access, circulation, privacy, security, shelter, land drainage and other factors, by arranging the compositional elements of landform, planting, water, buildings and paving in site plans.

Kerry (2007) emphasizes that during site planning and design process, it is important to study ways to integrate sustainable elements such as recycling materials, innovative storm water management practices sensitive to site layout, native (or naturalized) landscape materials and site lighting into a complete site package. Kerry (2007) further emphasized that it's not all about writing about the benefits of exterior natural spaces on human wellbeing, but how planners and designers should integrate the basic infrastructure required for today's projects into a sustainable site plan that also incorporates natural areas or green space.

Sustainable Site Planning Through Employment of Sustainable Landscaping Solutions

i. Soil management techniques, including composting kitchen and yard wastes to maintain and enhance healthy soil that supports diversity of soil life.
ii. Recycling of products such as glass, rubber from tires and other materials top create landscape products such as paving stone, mulch and other materials (United States Environmental Protection Agency, 1998).
iii. Permeable paving materials to reduce storm water runoff and allow rain water to infiltrate into the ground and replenish ground water rather than run into surface water (Interlocking Pavement Institute, 2008).
iv. Creating and enhancing wildlife habitat in urban environment (Harker et al, 1999).
v. Reduction of storm run-off through the use of bio swales, rain gardens green roofs and walls (Robinette and Sloan,1984).
vi. Bio filtering of wastes through constructed wetlands (Campbell and Ogden, 1999)

Soil Conservation in Residential Developments through Erosion Control in Open Spaces around Buildings

Soil conservation is a set of management strategies for prevention of soil being eroded from the earth's surface or becoming chemically altered by overuse, acidification, salinization or other chemical contamination (Dave and Favis, 2014). Erosion refers to the actions of exogenic processes (water flow or wind) which remove soil and rock from one location on the earth's crust and transport it to another location where it is deposited (Blanco, 2010). Due to the severity of its effects and the scale on which it is occurring, erosion constitutes on of the most significant global environmental problem faced today (Toy, 2002a). Land degradation is a process in which the value of the biophysical environment is affected by a

combination of human induced processes acting upon land (Conacher et al, 1995). According to Toy (2002a), water and wind are now the two primary causes of land degradation; combined, they are responsible for about 84% of the global extent of degraded land. Physical processes which may result from rainfall produce four main types of soil erosion (Toy, 2002b). Splash erosion which is generally the first and least severe stage in the soil erosion process, which is followed by sheet erosion, then rill erosion and finally gully erosion (Zachar, 1982).

In splash erosion, the impact of a falling rain drop creates a small crater in the soil, ejecting soil particles. If the soil is saturated or if the rainfall rate is greater than the rate at which water can infiltrate into the soil, surface runoff occurs. If the run off have sufficient flow energy, it would transport loosened soil particles down slope (Food and Agricultural Organisation, 1965). Sheet erosion is the transport of loosened soil particles by overland flow. Rill erosion refers to the development of concentrated flow paths which function as both sediment source and sediment delivery system for erosion (Nearing, 1997). Gully erosion occurs when the runoff water accumulates and rapidly flows in narrow channels during or immediately after heavy rains or melting snow, removing soil to a considerable depth (Poesen 2007). Most common in urban developed areas are the splash, sheet and rill erosion types and gully in rear cases due to obstructions and flow paths created by different structures in the urban environment, except for cases of neglect.

Some residential development erosion control parameters employed include:

a. **Perimeter Run off Control**; trees, shrubs and ground covers are effective perimeter treatment for soil erosion prevention by insuring any surface flows are impeded. A special form of this perimeter treatment is the use of a grass way that both channels and dissipates runoff through friction, impeding surface runoff and encouraging infiltration of the slowed surface water (Lumina Technologies, 2002)
b. **Windbreaks**; these are created by planting sufficiently dense rows of trees at the windward exposures. Evergreen species are preferred to achieve year round protection; however, as long as foliage is present the seasons of bare soil surfaces, the effect of deciduous trees may also be adequate (Mingyuan et al, 1998).

MATERIALS AND METHODS

The research was undertaken at Genesis Conceptual Perceptions Limited, an architectural research and construction firm, in Newsite Estate, Satelite town, Lagos, Nigeria between 2014 and 2015; it covers residential areas in Amuwo-Odofin Local Government Area in Lagos Nigeria.

Population Sampling Size and Technique

Descriptive research Approach was used for the study in which field survey was conducted using well-structured questionnaires as the main research instrument. In addition to that critical field observations were also done. The survey was carried out by random sampling of stakeholders of the residential development. The study population includes; the designers, developers and owners of structures in the estate.

The population size for the study is 167 and out of this 40 was structurally sampled out. This is because out of the 167 residential plots in the study area , nothing less 5 – 10 is owned or developed by the same Developer/Building owner .40 questionnaires were structurally distributed so as to avoid certain degree of repetition, 37 were returned and used for the analysis. The questionnaires solicited substantial information on sustainability and sustainable site analysis in relation to the achievement of erosion control and enhanced soil conservation and management in residential development in Lagos Nigeria from the

aforementioned respondents based on their knowledge and experience. The opinions sampled included the respondents understanding of sustainable site planning, erosion control around buildings, benefits, problems and measures of achieving soil conservation around the built residential environment. The questionnaire had 3 sections namely; section, A, B and C respectively. Section A (this is to assess how different group of individuals involved in construction in the study area perceive the concepts in study) contained respondents profile, section B solicited information on sustainable site planning and section C on erosion control.

Methods of analysis and presentation

The method used for analysis was a descriptive analysis, involving the use of percentages, mean scores and ranking of some factors.

Table 1: Professions of Respondents

Profession	Number Distributed	Number of Responses	Percentage Responses
Architect (Building Designer)	14	14	100
Builder (Building Developer)	16	15	93.75
Civil Servant (Building Owner)	5	5	100
Business (Building Owner)	5	3	60
Total	40	37	92.5

Field Survey 2014

Table 2: Awareness of respondents

	Concept of Sustainability		Sustainable Site Planning		Erosion Control	
Response	No. of Response	Per. of of Response	No. of Response	Per. of Response	No of Response	Per. of Response
Yes	28	100	28	75.7	37	100
No	-	-	9	24.3	-	-
Total	37	100%	37	100%	37	100%

Field Survey 2014

Table 3: *Measures of Achieving Sustainability of sites*

		Frequency of response						
S/n	Measures	1	2	3	4	∑f	∑fx	Mean(x')
1	Minimize development of open spaces	0	1	21	14	37	121	3.27
2	Link Natural Areas	0	5	28	4	37	110	2.97
3	Control rain water runoff through improved landscaping	0	0	5	32	37	143	3.86
4	Use of interlock and permeable surfaces	0	0	16	21	37	132	3.57
5	Use of roof gutter systems on buildings	0	7	28	2	37	106	2.87
6	Increase awareness of sustainability and sustainable site planning	0	0	12	25	37	136	3.68
7	Encouraging tree planting and grass covers	1	0	9	27	37	136	3.68
8	Encouraging sustainable design and Construction	0	2	12	23	37	132	3.57

1: Not Important; 2: Less Important; 3: Important; 4: Very Important

Field Survey 2014

Table 4: *Benefits Derived from Achieving Sustainability of sites*

		Frequency of response						
S/n	Benefits	1	2	3	4	∑f	∑fx	Mean(x')
1	Achieving a relaxed and organized residential environment	0	0	18	19	37	130	3.51
2	Savings on site construction cost	12	18	7	0	37	69	1.86
3	Reduce impact on the environment	0	2	23	12	37	121	3.27
4	Natural resource conservation	0	0	20	17	37	128	3.46
5	Improved micro tropical climate	0	1	15	22	37	135	3.64

1: Not Important; 2: Less Important; 3: Important; 4: Very Important

Field Survey 2014

Table 5: *Problems of Achieving Sustainability of sites*

S/n	Problems	Frequency of response 1	2	3	4	∑f	∑fx	Mean(x')
1	Poverty and low Urban Investment	5	10	18	1	37	80	2.16
2	Lack of urban construction policy	0	1	24	12	37	122	3.29
3	Lack of knowledge of sustainable site planning	4	10	16	7	37	100	2.7
4	Lack of technical and professional knowledge	0	4	21	12	37	119	3.21
5	Lack of awareness	1	3	16	17	37	123	3.32
6	Lack of interest of professional stakeholders	13	23	1	0	37	62	1.68
7	Lack of enabling environment such as building legislation	8	11	9	3	37	69	1.86
8	Lack of compliance with available relevant statutory building document	1	3	14	19	37	125	3.38
9	Monitoring issues from building monitoring and planning agencies.	0	5	20	12	37	118	3.19

1: Strongly Disagree; 2: Disagree; 3: Agree; 4: Strongly Agree
Field Survey 2014

DATA PRESENTATION, ANALYSIS AND DISCUSSION

Data Presentation and Analysis

Results obtained from the research are presented under the following appropriate headings and sub headings.

Breakdown of Respondents: 92.5% of the questionnaires distributed were returned. This level of return was achieved because a conscious effort was made to retrieve questionnaire from respondent personally. Reminders in form of text messages and phone calls were made also to respondents before collection .Table 1 shows that the breakdown of the questionnaires from 37 respondents. Architects (Designers) returned 100%, Builders returned 93.7%, Civil Servants returned 100% and Business Owners returned 60%. From Table 2, it can be observed that all the respondents claimed to have heard of erosion control. Table 5 shows the responses from questionnaires on the measures of achieving sustainable residential sites in Lagos Nigeria. The result shows that minimizing the development of open spaces averaged 3.27, meaning it is important, while linking natural areas averaged 2.9 (important), control of rain/storm water runoffs through improved grading and landscaping averaged 3.86 (important), minimizing impervious surfaces using permeable flooring averaged 3.57 (important), reducing and controlling runoff impact from roofs using roof gutter system averaged 2.86 (important), increasing awareness of the concept of sustainability and sustainable site planning averaged 3.68 (important), encouraging sustainable design and construction practices averaged 3.68 (important) and encouraging tree planting to create covering over exposed soil averaged 3.57(important). Table 4 shows responses from questionnaires on the benefits derived from sustainable site planning .Table 5 is about the problems achieving sustainable site planning in residential developments in Lagos, Nigeria.

From the above presentation, the study reveals that the respondents believe that the measures outlined in the questionnaire are important for the achievement of a sustainable built residential environment through sustainable site planning. This invariable means that there is a need to design and develop residential plots in the area in ways that are less impact on the residents, building structure and the environment

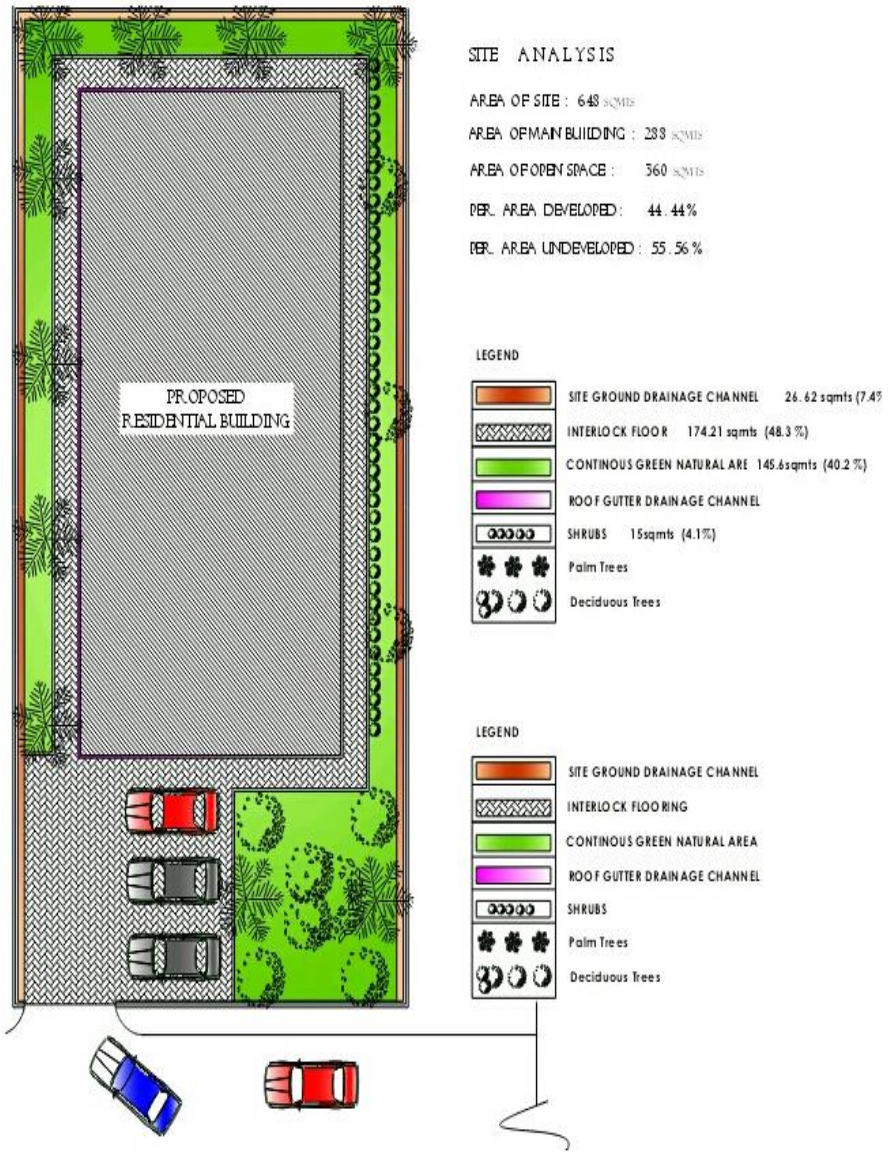
The entire benefits derived from soil conservation and sustainable site planning for residential development were seen important. This implies that the soil is an essential element for site planning and needs to be managed in a manner that it enhances the entire outlook and

functionality of the residential plot. Out of the problems/Challenges stated, the most agreed was lack of compliance with relevant existing statutory documents, urban construction policies and monitoring issues from monitoring authorities which has led to erection of most buildings occupying major set-back areas designated for sustainable landscaping and a soil conservation.

Observations of Soil Erosional Effects on Structures

Fig. 1 *showing common soil erosional effect of the building structure at the study area*

RECOMMENDATIONS



The study recommends that;

i. There is a need to effect sustainable site planning percentages on site plans through percentage areas occupied by landscape soil conservation elements during design, as part of the Government approval criteria for residential building approval.
ii. There is also a need for Amuwo-Odofin Local Government should revive its monitoring agencies to ensure strict adherence to set back rules and regulations.
iii. There should be a proper enlightenment of stakeholders and the general public on the need to sustainable plan their environment so as to enhance building structure and environment through erosion control.

CONCLUSION

The study reveals that a greater percentage of the respondents who are stakeholders involved in the development of Newsite area of satellite town, Lagos are aware of the concepts of sustainability and sustainable site planning as ways of achieving erosion control and management in the area. It further reveals that the issues of cost, design, monitoring and implementation were major problems hindering the development of sustainable sites in the area.

Therefore the study concludes that through the implementation of the proposed sustainable site development parameters presented in the study and a cooperative process involving building owners, designers, developers, government and its agencies sustainable sites would emerge and increase in New site area of Lagos. Achieving this will invariably improve the environmental outlook and quality of the neighborhood, creating a standard for other neighborhoods within and outside Lagos.

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Fire Safety Education and Training in Architecture: An Exploratory Study

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ABSTRACT

Studies have shown that building designs contribute greatly to the magnitude of fire in building with severe consequences on safety of life and property. Hence, fire safety is an important consideration in building design which architects seek to fulfil at the early stage. Knowledge of fire safety amongst architects can aid the design of safer buildings in terms of fire protection. Fire safety designs are expected to meet the provisions in Approved document B of the UK Building Regulations which specifies basic fire safety requirements. The main objective of this paper is to explore the educational underpinning of architects with respect to designing fire safe buildings. This paper is based on literature review and interviews conducted among architects both in academia and in practice to ascertain the need for fire safety education in architecture, and as a working knowledge for practicing architects. Findings showed that architects undergo fire safety education under different modules, but not as a distinct course. Fire safety education provides architects with basic understanding of fire safety principles, and to determine when to consult fire experts. Recommendations include creating a separate course on fire safety and if taught as part of other modules, more time/ depth should be allocated to its contents.

Keywords: Architects, Building design, Education, Fire safety

INTRODUCTION

Fire according to Cote and Bugbee (1988) is a serious threat to people, and the principal cause of death in building, beside falls, which is also responsible for a large number of deaths in building related incidents. Among the momentous dynamic forces such as earthquake and windstorm, devastations from fire are about 20 times those from earthquake and wind disasters (Walls, 2007). Fire accounts for almost half of the insurance policies claims against fire and multiple perils (Cote and Bugbee, 1988; Association of British Insurers (ABI), 2014; Hogendoorn, 2016) and a leading source of property loss and its contents (ABI, 2009; Haynes, 2015). The ability of a building to either confine or fast-track the growth of fire depends on how it was designed. For instance interior finishes might facilitate or restrict the spread of fire. Likewise walls, duct systems, barriers and routes can either allow or compartmentalise fire. Occupants' routes might or might not be protected, lighted, signage, of sufficient size, as well as the provisions of fire detection and suppression facilities or otherwise (Cote and Bugbee, 1988).

Fire safety is one among several other considerations such as functionality, aesthetics, human comfort, structural stability, cost-effectiveness, constructability, maintainability, and sustainability, etc (Kodur, et al, 2012; Park, 2014), that building designers must fulfil at the early stages of building design process (Stollard, 1989; Fire Sector Federation, 2015). This is to ensure safety of the building users in the event of a fire incident, as well as the protection of the built property using active and passive measures. For a building design to be effective in terms of satisfying both architectural and technical objectives, fire safety must be integrated early on in the building design process (Lawson, 1990, Stollard, 1989, Lataille, 2002). Arguably, the duty of guaranteeing the fulfilment of fire safety objectives rests with the architect (Stollard, 1986; Abraham and Stollard, 1999; Stollard, 2014). Kodur (2012) highlighted that:

"Most of the passive fire protection design for structural framing remains within the project architect's responsibility, with little if any input from a fire protection or structural engineer" (Kodur, et al 2012. Pp 826).

Although architects are not trained to be fire scientists, it is important for them to be aware of the fundamental principles of fire safety (Abraham and Stollard, 1999; Stollard, 2014) because of their roles as principal designers. Architects should also ensure they are

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acquainted with specific safety issues of a structure being planned, as well as obtaining necessary advice and information from fire specialist early in the design stage (Megri, 2009). The necessity for safety awareness especially for fire safety is due to the fact that the design and construction of a building contributes substantially to the severity of fire in building (Stollard, 1986; Stollard, 1989; Sagun et al, 2014). For example, in the inquiry into the Summerland disaster, it was reported that 20 out of 34 recommendations had to do with the building and the design process. The knowledge of designers with respect to the combustibility of the materials was faulted in the following areas (Rasbash et al., 2004):

i. Oroglas acrylic sheeting or poly methyl methacrylate, is a form of plastic materials whose quality is of low fire resistance and can easily be degraded was used for constructing the wall and roof of the building (Rasbash et al., 2004; University of Birmingham, 2016);
ii. The rear part of the amusement arcade to the top of the building was adjoined on the oroglas with a wall of Galbestos cladding. The cladding was covered with resins which makes specimen prone to a radiation of 12kW/m^2; and
iii. A 300 mm wide cavity with a length of 12 m, which contains fibreboard called Decalin was used between sheet steel outer wall and the amusement arcade. The decalin was of low rating in terms of spread of flame test in the BS 497 part 7.

In addition to the materials used in the building, delayed evacuation, locked exit, lack of escape stairs contributed to the fire deaths during the incident.

Another notable example is the fire that occurred at the Faculty of Architecture building, Delft University of Technology, Netherland, in 2008. The incident showed some effects that building design has on fire development. The fire as reported by Meacham et al. (2010) and Park (2014) started around 9:00am on the 6th floor of the South tower, but quickly spread to the 11th floor which leads to the failure of the North tower after approximately 8 hours. Even though the building was said to have satisfied Local Fire Regulations for existing buildings, other features contributed to the speedy development and vertical spread of the fire. These features include (Park et al, 2014):

i. The large open space in the design studio area sustained oxygen which allowed the fire to grow fast at the beginning of the fire development;
ii. Combustible acoustic material at the bottom of the mezzanine floor which aided the fast heat release rate (HRR);
iii. The 30 minutes fire barrier could not confine the fire within the fire origin room. The fire developed more rapidly that it could not be controlled by the fire service;
iv. Horizontally continuous exterior windows served as means of horizontal fire propagation making the fire to spread around the fire barriers; and
v. The 4.95 m tall exterior window height was high enough to facilitate large flame extension which could annul 2.05 m vertical separation in the international Building Code requirement. The extended flame height out of the opening reached was reported to be more than 7 m.

Figure 1 shows an extended flame over two-story high (left), and the right picture displays the rapidity of fire spread within 12 minutes from when the left image was captured (Park, 2014).

Figure 1: Faculty of Architecture Building, Delft University of Technology Netherland, 2008 Source: (Park, 2014)

The two examples cited above provide insight into how some building design features and the material choices impact on the seriousness of fire in buildings.

This work seeks to find out among other things the level of importance accorded to fire safety in the design process as well as the extent of fire safety awareness that is currently available among architecture students, and practicing architects. This work further explores the training that building designers currently undergo to identify deficiencies and efficiencies that affect fire safety considerations in building design. The motivation for this research comes from the fact that the design and construction of building contributes substantially to the severity of fire in building (Stollard, 1986; Stollard, 1989). Stollard (1986) reviewed a number of major fire incidents including the Summerland of 1973, Fairfield of 1974, Coldharbour of 1972, Woolworths of 1979, and Bradford City Football ground of 1985 and established that the design of those facilities play a major role on the magnitude of fire after ignition and consequences for occupants.

LITERATURE REVIEW

Current Approaches to Building Design

Building design process is an uninterrupted series of actions by design team members such as architects, structural, mechanical, electrical and fire safety engineers, to achieve a comprehensive building design (Park et al, 2014). Laseau (1980) describe the process as a chain of transformation from ambiguity to information. The design process according to Balcomb and Curtner (2000) involves four stages which include: pre-design (PD), schematic design (SD), design development (DD) and construction documents (CD).

Design stages are realised using two patterns which can be either: conventional linear design or integrated design. In the linear design approach, architects primarily manage the design progress and request engineers and other consultants to take part when the design has advanced (Gane and Haymaker, 2009). This method is effective for a small and uncomplicated building projects, that are carried out by few stakeholders usually with little budget, and where it is not necessary to undertake major building performance analysis and evaluation (Park et al, 2014). Integrated design on the other hand is used for large size building project where, interested parties in the projects such as the client, the project manager, architects and other consultants come together early on in the design process to share project information. This process allows for identification of required building performance and reduces any possible clashes that may arise later in the design stages.

In the past few decades, enormous transformations had been observed in the design and construction of fire engineered buildings such as transport termini, airports and high-rise buildings. This is due to rising demand for efficient space, greater comfort level and safety (Megri, 2009; Wilkinson et al, 2013). Megri (2009) maintained that fire safety plays a major role in building operations and should be properly coordinated with other subsystems early in the design stage to provide efficiency, reliability and performance. He further stated that consideration for fire protection is carried out by the architects in conjunction with the structural engineers. While architects design the building layout-including the exterior and interior walls, structural engineers produced structural calculations that meet fire safety regulation. In addition, inclusion of an experienced fire engineer in project design team according to the National Institute of Building Sciences, (2015) is crucial at all stages of the design to occupation. This is to ensure the construction of a reliable and safe building for occupants' habitation.

Need for fire safety education and training

The need for education and training on fire safety arose from different reports in literature (National Commission on Fire Prevention and Control (NCFPC), 1973; Barham and Roberts, 1995; and Watt, 1998). This includes creating a common understanding among designers and consultants involved in building design to be adequately equipped with the currently available fire safety information and their applications. This common understanding could prevent any form of delay that could come up during the design process (The fire safety studies group, 1992). In addition, fire safety was reported to be lagging behind other consideration such as aesthetic and cost in building design (NCFPC, 1973; Watt, 1998; Lo

and Yuen, 1999). Watt argues that the gap between building and fire safety design was due to fire safety analysis not meeting up with rapid innovation in building design, as well as inadequate attention being given to fire safety by architects and engineers. He opined that as a result of insufficiency of formal education in fire safety for architects and engineers, a lot of information necessary for effective fire safety application appeared to be unheeded. For instance in architectural curricula for most schools, students are not taught any course specifically on fire and life safety design (Watt, 1998).

Fire safety education

Fire safety education involved providing people with good knowledge of fire prevention and protection. The Mid and West Wales Fire and Rescue Services (2015) use the term fire safety education with respect to the following:

i. creating awareness among young people on the need to be mindful of fire hazard in home;
ii. Give necessary information that can help people prevent, detect and escape from fire;
iii. Cautioning children to overcome the peer pressure of getting involved in crime such as arson and hoax calls.

Fire safety education can be an effective and empowering tool for intervention with fire setting behaviours among children if properly utilised (Kolko, 2002). For operators of business premises fire safety education deals with issues such as false alarm due to malfunctioning of fire detection system poor maintenance and insufficiently trained staff (Rielage, 2009). In some cases fire safety awareness is created through different means. For instance, the distributions of free fire alarms to communities that have high prevalent rate of fire incidents (Parmer et al, 2006).

Fire safety education is important in many ways. For example, the National Fire Protection Association (NFPA) runs education programmes that are focussed in educating individual representing different age groups about the practices of making responsible choices concerning health and safety (Gamache et al., 2011). Similarly, the Fire Service College runs training programmes to develop the capability and expertise within UK Fire and Rescue Service, emergency services and other categories of respondents (Fire Service College Limited, 2015). However, the example included here highlights the breadth of fire safety education encompassing a range of stakeholders representing specialist emergency services on the one hand to the general public on the other. Thus, the architectural practitioners may or may not be covered as a stakeholder group. This forms the focus of this research, to shed light on how exactly fire safety design training is imparted or conducted.

If people have good knowledge of fire, the number of fire related fatalities in buildings may be greatly reduced. For the aforementioned reason, it is a valuable project to train people on the various ways of preventing fire. Cote and Bugbee (1988) asserted that fire safety education have impacted positively in subsiding fire hazards. They also highlighted that the advantage of public fire education outweigh the cost that may be incurred in creating such awareness. The main purpose of public fire education is to enhance people's awareness, support and participation in fire prevention activities. Local fire department contribute to this process in the form of periodic inspection of building of various occupancy types, fire safety materials distribution, presentation of fire safety material to the public as well as presenting fire safety educational programmes in schools (Cote and Bugbee, 1988).

Fire safety training

Lawrence Webster Forrest (2015) defines Fire safety training as "the process of instruction and learning between trainer and trainee for the efficient application and management of evacuation procedures for a building". Training on fire safety is often provided to prevent injuries and deaths that could result from fire incidents. The general knowledge of fire safety among people helps in determining the level of training that could be provided. The effectiveness of fire safety training programmes such as 'fire Ed' (carried out by the Oklahoma City Fire Department) and 'kid safe' (conducted by the Melbourne Fire Brigade, Melbourne, Australia) led to the provision of fire safety information and skills for young people. It also contributes to reducing fire deaths and more use of fire alarms in homes and workplaces (Huseyin and Satyen, 2006). In order to achieve a fire safe design, Buxton (2011)

suggested that a good working knowledge of the building regulations dealing with fire safety is required of architects, even when there may be opportunity for consulting fire experts. In her opinion, architects should not leave all activities regarding fire performance technology to fire engineers, as such seeking knowledge of building materials and how they affect designs becomes necessary.

METHODOLOGY

To carry out this task, a number of stakeholders who have roles to play in the education of architects (principal designers) as well as those governing the practice of architecture in the UK were identified. Under these categories falls the professional body – the Royal Institute of British Architects (RIBA), and the Schools of Architecture. A significant numbers of trained and qualified architects go into professional practice of architecture, designing buildings which are expected to comply with building and fire regulations such as ADB and BS 9999 etc. The architects in practice formed the third group of stakeholders who are considered in this work. Then the next two are those that enforce the provisions of the building regulation from the conception design stage through construction and operation of the building. They are the Building Control Officers, and the Fire Prevention Officers (Communities and Local Government, 2007). The Fire Prevention Officers are the Statutory Consultee for Regulation B5 (access for firefighting personnel to building) during the design and construction stages, their statutory functions of enforcing the regulatory reform fire safety order (2005) commence after a building have been completed and occupied. Further information on the interviews is given in the next section, the interview design. Table 1 shows the profile of research participants including their years of experience, post and their places of work.

Table 1: Profile of the Research Participants

S/No	Participants	Years of experience	Post	Organisation
1	AA1	8	Academic leader	Educational Institution 1
2	AA2	16	Lecturer	Educational Institution 2
3	AA3	20	Head of School	Educational Institution 3
4	AA4	12	Head of School	Educational Institution 4
5	PA1	20	Director	Architecture Practice 1
6	PA2	20	Partner	Architecture Practice 2
7	PA3	7	Project Architect	Architecture Practice 3
8	PA4	34	Director	Architecture Practice 4
9	PA5	28	Director	Architecture Practice 5
10	PA6	48	Director	Architecture Practice 6

Note: AA - Academic Architects; PA- Practicing Architects

Interview design

For this research, interviews were conducted to find out amongst other aspects the relevance of fire safety education, its coverage in the curriculum, specific topics where fire safety is considered, mode of delivery and intended learning outcomes. Information generated from the interviews is expected to provide insight on how the current approaches to fire safety in architectural education contribute to shaping the understanding of fire safety issues amongst the future practitioners, and assessing the adequacy of the approach to fire safety problem during the building design process.

Stakeholder samples were obtained using stratified random sampling. The suitability of this sampling method was due to the spread of population into distinctive groups, or strata (Fellow and Liu, 2008). The selection of each of the stakeholders was based on their various roles within the study area. Four members of academic staff from various schools of architecture identified as Educational Institution 1, 2, 3…n, comprising of two heads of school, and two academics were interviewed. Two of the interviews (AA1 and AA4) were conducted face to face, while the other two (AA2 and AA3) were carried out over telephone. Three of the interviewees consented to audio recording of the interview, but fourth respondent declined recording. Consequently, little information was obtained from the participant AA4 even from the note taken during the meeting, as not all questions were responded to, therefore analysis with regard to participant AA4 was be restricted to the area

where information were provided. For the practicing architects (PA), 6 participants were interviewed, 1 was carried out by telephone while 5 were conducted face-to-face in the location preferred by the participants, mostly in the offices of the participants except one that volunteered to be interviewed outside the office. 3 Building Control Officers participated, 1 of which was conducted by telephone and the rest face to face. The last stakeholders interviewed are the fire prevention officers, all the interviews were conducted face to face in the various offices of the participants.

Similar questions were asked during the interviews for the various stakeholders, but sometimes additional questions do arise from answers given by respondents for clarification of responses and detailed understanding. This approach is categorised differently by in literature. While Valenzuela and Shrivastava (2008); McNamara (2009); and Tuner (2010) consider it as standardised open-ended interview, Davies and Beaumont (2010) and Open University (2015) on the other hand referred to it as semi-structured interview. This method enables a quicker interview that can be analysed and compared straightforwardly. It is in contrast to the closed, fixed response type of interview where interviewees select answers to questions from same set of options (Valenzuela and Shrivastava, 2008). The standardised open-ended interview according to Baker (2012) allows the interviewer to further probe unexpected responses to obtain more information.

FINDINGS AND DISCUSSIONS

Under this section, findings from the analysis of data collected are discussed under the following sub-headings:

Relevance of fire safety education in architectural programme

This section highlights the importance of fire safety in architectural education in the UK. Views and opinions of architects both in academia and in practice were sought to gain insight on fire safety related courses are taught amongst the various Schools of Architecture. There are different views among architect concerning what they studied of fire safety while in the school of architecture. Some of the practice and academic architects confirm dealing with some aspects of fire safety to the level of awareness, and compliance with the building regulations (PA4), others were of the view that nothing of fire safety were done (PA5, AA4).

The relevance of fire safety education was expressed by the various participants in terms of creating awareness among students, and how other design criteria can be integrated in building design to ensure a fire safe building. Fire safety knowledge is mostly needed in practice where actual designs that will comply with building regulations are carried out. Designing out fire in buildings is key to reducing fire risk where possible. With fire safety awareness, architects highlight necessary steps and measures to be employed to mitigate fire risk, where it is not possible to design out fire (PA4). Some of the critical fire safety issues that are considered during the building design process include the provisions of adequate means of escape for safe evacuation of building occupants, as well as protecting the building to allow for people escape and intervention of fire and rescue services.

Understanding fire safety will enable students to know where to seek information on fire safety design, developing a proposal that is fire safe (AA2), as well as getting a good grasp of building regulations and its application in design (AA3). These include understanding the guidance document, the approved document B both for domestic and non-domestic buildings, and the Department of Communities and Local Government Guidance on fire risk assessment for various types of buildings. Some of these buildings comprise of Offices and shops; sleeping accommodation; educational premises; places of assembles – both large, medium and small; health premises; places of entertainment such as cinemas and theatres; and fire safety risk assessment covering means of escape for disable persons (University of Reading, 2008).

The significance of fire safety was emphasised as an aspect that examiners check for the understanding of architectural students. For instance in studio courses students are expected to prove how their designs comply with regulatory requirements including fire safety as explained in the Part B of the Building regulations for England and Wales. It is one of the

determining factors for students' success in examination even as it may not be a stand-alone module.

"... fire safety is one of the key things that external examiners look at, as a sort of evidence that they understand the building regulations" (AA 1).

In addition, Fire safety awareness is necessary as part of architectural professional ethics to comply with the building regulations and standards (RIBA, 2005; RIBA, 2007; Architect Registration Board (ARB), 2009; and Sadri, 2010). The aspects of building design feature which need to conform to the regulation include accessibility and fire core. Equivalent solutions are negotiated for, if it is not possible to produce an efficient design using the guidance in the approved document B of the Building regulations 2010. As part of personal and professional responsibility, it was also stated that architects ensure the safety of users of the buildings designed by them (AA1).

Fire safety content in architectural programme

Essentially, architectural curriculum is grounded on the design studio that is concerned with learning by doing, a process that is achieved through lectures and critique sessions, through which students express their understanding based on discussions with teachers, friends and colleagues (Utaberta, et al., 2011).

The general opinions of the interviewees from educational institutions and from architectural practitioners are that there is very little content of fire safety related topic in architecture. The topics are not treated as an individual subject rather as part of other technical courses such as Building construction and studio works. In studio students learn by doing, and are expected to present their work before peers and teachers, in a form that can be built to conform to all existing standards and regulations that apply to the project type.

Participant PA2's view supported the opinions of academic architects' stakeholders concerning the content of fire safety in architecture and went further to state that fire does not really feature in the architectural education in the university. The participant's view also agrees with others such as AA2 and AA3 that advocated for on the job fire safety related trainings. When asked if a participant's interest in fire safety was inspired by education in the school of architecture, the response of PA2 was as quoted below:

"No I can honestly say that has nothing to do with it, absolutely nothing to do with it... I can still say there is still very little in terms of fire engineering in schools of architecture...fire doesn't from my understanding of what people are going through now, it doesn't really feature at all...I don't think it (fire safety) sits well in the architectural training, in terms of the formal training at the university. I basically believe it is far more successful on the job training, because you can see the relationship far better" (PA2).

The aforementioned statement does not rule out the necessity of having the basic knowledge of fire safety in the widest engineering terms. The fire safety taught elements of curriculum was stated to be within the range of 1.25% to 3% of the total course contents (AA1, AA2, AA3). It is covered within an estimated duration of 3 to 6 hours in a year. This issue might have prompted Gillie and Morvan (2006) and others in proposing course content that could improve the fire safety engineering knowledge among architects and engineers. Although it was stated that the duration could be more when one considers time spent by student for independent learning (AA3).

All the interviewees agreed that fire safety is not run as a distinct course. For example, participants AA2 was of the opinion that it should not be a stand-alone module stating that the purpose of architectural education is to improve critical abilities of an architect, rather than filling them with knowledge. Although the respondent is entitle to his opinion, the research argues that a separate fire safety module may enhance a better understanding of the basic principles of fire safety. The next section indicates the module where fire safety topics are taught in architecture schools.

Modules with fire safety topics in the architectural programme

This section seeks to find out where to locate fire safety related topic within the curricula of various Schools of Architecture. The collected data shows that the modules under which fire safety topics are taught include: technical lectures (AA2), tectonics modules, professional

studies, and all studio modules for undergraduate degree (AA3). In the Masters of Architecture (MArch), it is usually taught as a lecture in the design studio (AA1). Some of the architects in practice interviewed could not recall precisely the module under which they studied fire safety (PA4, PA5, PA6). However, PA4 stated to have learned in the School of Architecture in the past three decades, how to provide adequate means of escape, the principles of travel distances, compartmentation, fire resistance of structures as well as fire doors and partitions, although not to the level of fully complying with the building regulations (PA4).

The participants AA1, AA2, and AA3 were all of the view that the modules with fire safety topic prepare majority of students with the understanding of basic principles. The available information in the module may not be enough to be used on real building in practice. According to PA2:

"*Fire does not from my understanding of what people are going through now; it doesn't really feature at all".*

The above quotation was supported by one of the academic architects (AA4) who opined that there is no fire safety education in architecture. According to the participant AA4, things like calculation of exit width, numbers of escape routes are not carried out by architects. He further stated that design education do not cover evacuation and collapse of building during fire. The participant however admitted that architect do consult fire engineer during preliminary design stage, and where necessary modify the design based the outcome of such consultation.

For some schools of architecture that fire safety related topics were admitted to be taught, the impact of such course(s) on architecture students include: knowing how fire safety problem in design is solved; and whose assistance that may be required to provide effective design solutions. Practical experience about understanding how these modules get applied to real buildings was suggested for students, whereas continuous professional development (CPD) was highlighted as a veritable means of acquiring fire safety education in practice (AA2, and AA3). This is in agreement with Cerda (1981) who supported that Continuing professional development serves as a mean of providing up-to-date information for architects on specific types of building, new materials and methods as well as new legislation. CPD helps to further develop the basic knowledge on fire safety acquired from the school of architecture (Stollard, 1986).

The teaching of Fire safety in the school of architecture is carried out as part of studio, technology courses by structural engineer, and/or as part of building services by either a building services engineer or environmental engineer (AA3). Part time lecturers working in design firms sometimes bring in their practical experience in the real world to support students' understanding of design for fire safety.

"*…bringing their expertise to the holistic design process… and demonstrate to the design of building"* (AA3)

Methods adopted in teaching include technical lectures, practical demonstration, one to one tutorial, informal discussion and studio reviews (AA1). Assessment of fire safety part of a module is through Portfolio submission, in which they will need to make drawing or diagrams that show where the exit route is, the travel distances, and correctly label the fire rating for building element.

Tools used for fire safety education and training

The tools used for promoting fire safety training include; combination of lectures and studio where students learn by getting involved in activities (AA3), group discussions and physical demonstrations through which students contribute to the learning process, rather than being told what to do (AA1). Fire safety teaching is also enhanced through the guidance of technically competent tutors (AA2). Technical competence of tutors entails trainers having sufficient skills on the use of wide range of training techniques to present training materials to students eithers on one-to-one or to group of learners (Buckley and Caple, 2009). Architect in practice enhance their skills by attending fire safety seminars (PA3), seeking relevant information using the internet, research projects, British Standards, AD B, as well as

consultation with the Building Control Officers / Approved Inspectors (PA5). The use of Microsoft excel was mentioned as a tool that some architects used for calculating sizes and width of escape stairs and fire doors for building with large population, in compliance with the provisions of Building Regulations and the British Standard, BS 9999.

Suggestions for improving the existing modules

Interviewee AA3 encourages improvement to the modules, but made no specific suggestion as to improving fire safety related modules. AA2 was of the view that critical understanding of fire safety should be left to the time of architectural practice. Therefore, made no suggestion for any improvement besides knowing who to consult when a need arise. AA1 advocated for creating a summary of the main principles required to understand fire safety and using pictures to present alternative solutions. AA4 made no suggestion since the respondent is of the view that fire safety is not part of architectural education.

CONCLUSION

This investigation has revealed that there may be no need for a separate module to be created on fire safety education and training for architecture students. However, majority of the participants supported on the job training through continuing professional development (CPD) to enhance architecture graduates fire safety design skills. The overall opinions show that the current provision for education and training is adequate to provide the type of fundamental skills that students require, and students are told where to ask for help if necessary. Practicing Architects also believed that they have knowledge of fire safety sufficient to allow for effective fire safety design. They are willing to engage fire engineers, should the need arise, especially for complex design projects. Although some architects have conflicting opinions on the need for creating a module on fire safety within the architecture programme, future work in this study area shall seek to verify the reliability of the various assertions.

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Integrating Green Infrastructure to Enhance the Environmental Quality of High Density Residential Areas in Zaria

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ABSTRACT

Urbanisation in Nigeria has been characterised by the concentration, rapid growth of population in certain towns and cities which has put enormous pressure on land and its management. Its consequent effect is the inability of the towns and cities to provide adequate facilities infrastructure that will accommodate and cope with the population growth which has negative impact on the urban environment. This paper examines ways through which Green Infrastructure (GI) can be integrated into High Density Residential Areas (HDRA) as a means of improving and enhancing the quality of the environment. This study employed the case study approach to make a descriptive assessment of some High Density Residential Areas in Zaria, Kaduna state and to suggest ways of integrating GI for enhancing the environment. It is established that the quality of the urban environment can be improved and assist in eliminating urban slums. This study observed that the use of gray infrastructure in the study area is not sustainable, because it is costly to maintain. The quality of the environment can be enhanced by the use of GI elements such as trees, impervious walkways, rainwater harvesting. It recommends that governments and urban managers can encourage and motivate house owners in the HDRAs to embrace aspects of GI to improve their environment by giving them some incentives.

Keywords: Environmental Quality, Green Infrastructure, High Density, Residential Areas, Urban Environments

INTRODUCTION

The urbanisation process in Nigeria, since the 1970's has been characterised by the concentration and rapid growth of population in certain towns and cities which are majorly administrative, commercial or educational centres. The growth in the population of these centres (most of which were created by administrative fiats to serve as headquarters of local governments or capitals of newly created states as a result of the various political restructuring of the country) is caused by the migration of people from other places in search of better opportunities that are presumed to abound.

According to Onibokun and Faniran (1995), the population increases account in part for the rapid expansion of cities. Most often these cities and towns do not have the capacity to provide the necessary infrastructure and other urban services such as adequate housing environment to cope and accommodate the physical expansion taking place with same speed. Among the effects of urbanisation according to Nubi and Ajoku (2011) is that enormous pressure is often placed on the land and its management. The authors observed that in cities like Lagos, rapid urban population growth has resulted in unprecedented urban sprawl as a result of the failure of the government agencies that are empowered to monitor and control development to cope with the expansion.

The rapid population growth and expansion of the cities without proper monitoring and control of development always brings about negative impacts on the general urban environment and most especially it affects the well - being of users in the residential environment if not properly managed. The draft National Urban Development Policy (NUDP, 2004), notes that Nigerian towns are growing without adequate planning. Lanrewaju (2012) affirms that environmental conditions in cities deteriorated due to the rapid growth of the cities and the attendance inability of social services and infrastructure to keep pace with the rate of growth. The rapid growth of cities are therefore characterised by being overcrowded with poor quality housing in certain quarters, poor or nor drainages, un - cleared waste dumps

Sagada, M. L. (2016). Integrating Green Infrastructure to Enhance the Environmental Quality of High Density Residential Areas in Zaria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 115-123

and proneness to flooding. Lanrewaju (2012) reports that, millions of Nigerians live in sub-standard and sub – human environment plagued by slum, squalor and grossly inadequate social amenities.

The urban settlements in Nigeria are segregated into three major categories namely the Low Density Residential Areas, the Medium Density Residential Areas, and the High Density Residential Areas. There are also the Special Residential Plots and the Comprehensive Development, (Abuja Development Control, 2007). This study examines the possibilities of integrating Green Infrastructure into the High Density Residential Areas which is often the most vulnerable and neglected areas in terms of infrastructural development and provision urban amenities as a means of enhancing the quality of the environment. The objectives of the study is to evaluate the elements of green infrastructure that can be used in enhancing the quality of the residential neighbourhood, and to suggest and to recommend those components of GI that can be used in the neighbourhood.

Characteristics of the High Density Urban Residential Areas in Nigeria.

The high density residential areas in most towns and cities in Nigeria is characterised (either by design or by default) by the provision of cheap housing for certain section of the urban population. According the Ogunleye (2014), the types of building in the area are mostly multifamily (tenement) buildings which comprise mainly of single rooms and room and palour. Majority of the residents are either artisan, petit – traders, skilled and unskilled labourers. The area is generally plagued by overcrowding, little or no infrastructure, most of the roads are not tarred and drainages are either not existent or have blocked. Past researches in housing studies (Filani, 1987, Agboola, 1998) have shown that most urban centres in the country are characterized by high density buildings, acute sanitary problems, and pollution of air, surface water, noise and solid wastes.

The quality of housing in the area is generally low, most of which are in need of major maintenance. Coker, Awokola, Olomolaiye & Booth (2007) points out that, housing in the high density residential neighbourhood have the worst property and environmental characteristics.

Fig. 1 satellite imagery of a sector of Sabon Gari a high density residential neighbourhood
Source: Google Earth

The houses are built on rectangular plots measuring 15mx30m or 450sqm. The buildings are often compacted on a plot thereby giving no room to ancillary uses. The division of the land into various plots did not make provision for other uses other than residential purposes, that is why no provisions for other land uses (like open spaces) are hardly made. Plate 1 shows the satellite imagery of a high density residential layout.

Green Infrastructure

Green Infrastructure according to Benedict and McMahon (2002) is an interconnection of network of green space that conserves natural ecosystem values and functions that provides

associated benefits to human population. Foster, Lowe & Winkelman (2011) see green infrastructure as more often related to environmental or sustainable goals that cities are trying to achieve through a mix of natural approaches. Green infrastructure can be a centre piece of smart regional and metropolitan planning; ensuring communities have a liveable environment, with clean air and water, for generations to come American Society of Landscape Architects (ASLA, 2012). The United States Environmental Protection Agency opines that, "Green infrastructure is an approach that communities can choose to maintain healthy waters, provide multiple environmental benefits and support sustainable communities". The approach uses vegetation and soil to manage rainwater where it falls and also mitigate flood, air quality management and enhances the aesthetic quality of the environment among others. According to New York Environmental Protection, (2015), Green Infrastructure describes an array of practices that use or mimic natural systems to manage urban storm water runoff.

The Study Area

Zaria the second largest town in Kaduna State has become an important educational centre in Nigeria. It houses many Federal and State institutions of higher education including the Ahmadu Bello University, and many others. Zaria is one of the traditional towns in the north that which came under the influence of the "Lugard" colonial planning policy whereby urban units were created outside the traditional wall city. These urban units are, the European Reservation Area (now referred to as Government Reservation Area), Sabon Gari, and Tudun Wada were based on segregation (Urquhart, 1977). Other settlement like Samaru grew as a result of the establishment of the Ahmadu Bello University, Zaria.

The paper looks at Sabon Gari and Samaru which are two high density residential areas within the Zaria Urban Area. Sabon Gari (plate II) was laid out in 1911 in a grid plan with few plots measuring 50 by 100 foot arranged in blocks and separated by 100 foot or 50 foot roads. According Urquhart (1977) the then Governor directed the area should be planned for the occupation of Railway labour and petty traders using the construction camps. Presently, Sabon Gari provides accommodation for all categories of people, ranging from traders, factory workers, civil servants, artisans, skilled and unskilled workers. The housing in the area which provides cheap accommodation is mostly multifamily (tenement) buildings consisting of single rooms in row and room and palour, built on 15mx30m plots of land.

Sagada (2013) observed that the area is highly built up with scarce or no tree cover, the absence of which often makes residents and pedestrians to have experience of discomfort, especially during heat period. Further study of the area, reveals that within the residential areas, there are no parks, play areas for children, nor designated green areas.

Fig. 2 A section of Sabon Gari through Dogon Bauchi and Club streets
Source: Google Earth

The main streets like Aminu Road, Dogon Bauchi Road and Club Street, part of Lagos Street and Old Hospital road are asphalt covered with artificially constructed open side drains some

of which have been blocked either by silting or dumping of refuse, other streets in the area are untarred and without side drains. There is a clear absence of sidewalks and other urban furniture along the streets (plate III). Table 1 gives an assessment of the urban infrastructure in Sabon Garia and Samaru.

Fig. 3 A street view of Club Street in Sabon Gari
Source: Field work, 2015

The present location of Samaru (plate IV) was mapped out in 1947 and served as settlement for settler labourers. Oyedele, (1989) points out that, the growth of the population resulted in the building of houses for renting, a practice that became a dominant aspect in the area. Like most high density residential area in Nigeria, it is highly built up with scarce or no tree cover, there are no parks and play areas for children, nor designated green areas.

Fig. 4 A satellite image of a part of Samaru neighbourhood
Source: Google Earth

The main streets like Basawa, Iya and Danraka roads in the area are covered with asphalt and artificially constructed open storm water drains on each side. However, majority of the roads in the area are untarred. Generally, there is a clear absence of sidewalks, trees and other urban furniture along the streets. Plate V, is a view of an asphalt covered street in Samaru showing the side drainages and pedestrians.

Fig. 5 A street view of Samaru
Source: Field work, 2015

Table 1 Assessment of urban infrastructure in Sabon Gari and Samaru

Item	Description	Remarks
Roads	Most of the roads in the study areas are wide with a Width of 12m and no sidewalks and some few have Side shoulders of 1m wide. Less than 30% of the roads Have asphalt cover	width of road can reduced to create permeable side walk and pedestrian walkways
Sidewalks	Sidewalks are non-existent, in some cases there are side Shoulders of 1m wide on both sides of the road where it is Covered with asphalt	the area can benefit from the introduction of Permeable side walk
Drainages	over 60% of the storm water drains and gutter have been Covered by sand and are not functional	green streets can use where the drains Have collapsed to Absorb storm -water runoff
Trees and Hedges	trees and hedges are sparsely planted in the area	this is the most common green infrastructure element that every house can adopt
Rainwater Harvesting	rainwater harvesting is practically non existent	residents can be encouraged

Method of study

The study adopted a case study approach to provide a descriptive assessment of the quality of the physical environment of the two residential areas. Case studies can be employed as a source of providing practical information that leads to potential solutions to problems. According to Francis (2010), the case study is a well-documented and systematic examination process, decision making and outcomes of a project, which is undertaken for the purpose of informing future practice, policy, theory, and /or education. Yin (1994) had shown that case studies can be done alone or together.

Information was obtained by carrying out a survey and physical assessment in order to understand the areas being studied. The survey also provided a description of the physical characteristics of the environment of the areas, through the use of photographs and sketches.

Integrating Green Infrastructure

The growth of towns and cities if not properly controlled and managed can present the risk of creating unliveable and unhealthy living environments. According to Ely and Pitman (2014 p3), "the contention that human habitats need to be healthy and friendly places that use and recycle resources wisely, are clean, safe and accessible, are protected as far as possible from extreme weather conditions and where natural systems are not only recognised and valued for the critical functions and services they provide, but assisted in delivering these services." However, for the towns and cities to properly function there have to be good and functioning infrastructures, roads and to move vehicles, transmission lines to distribute electricity, sanitary sewer systems to remove wastewater to safeguard public health, and storm water systems to prevent roads and homes from flooding. Much of the infrastructure whenever they are available are built in the traditional approach by using grey infrastructure, there is little or no consideration of the relationships between the built and natural environments. The repair and installation of grey infrastructure is becoming increasingly expensive for the authorities to sustain.

Similarly, Benedict and McMahon (2006), point out that more 40% of total urban land is covered by impervious surfaces as roads, parking and buildings. The use of green infrastructure at city scale is therefore important in improving environmental conditions. Perini and Rosasco (2013) points out that vegetation plays and important role in the human

psychological well-being inside dense cities. Green areas provide recreational facilities and improve resident's quality of life.

The elements of green infrastructure that can be employed and used to enhance the quality of the high density residential area include the following: permeable walkways, swales, bio retention pool, rain gardens, green roofs, planters and hedge, and trees.

Most of the streets and roads in the Sabon Gari and Samaru residential neighbourhoods are in bad conditions, with a minimum width of 12m. Provisions are made only for vehicular transit; there is no provision for pedestrian walkways and tree covers, neither are waste bins installed. Most often the pedestrians have to struggle with motorist for space (Plates III, V). However, several intervention processes can be carried out by integrating elements of green infrastructure to enhance the environmental quality.

i. **reduction of the street width by introducing permeable pavement and walkways:** The roads in the residential neighbourhoods are wide enough measuring about 12m, this can however be reduced to 7m by the provision of permeable pavements and sidewalks on both side of the road (see Plate VI). The Permeable pavement installations allow rain water to percolate into the ground. The maintenance of many green infrastructure practices can be done by hand and does not require expensive machinery to keep them operational, Rowe and Bakacs (2012).

Fig. 6 Example of the use of permeable sidewalks and green lane in residential neighbourhood.
Source: Field work, 2015

ii. **Planting of trees and hedges**:
The addition of trees to a landscape is one of the simplest green infrastructures techniques (see plate VII - IX). Tree canopy can reduce storm water runoff by intercepting rainfall, as well as by improving storm water infiltration in soils. Trees and hedges are the simplest elements of green infrastructure and can be easily incorporated into the neighbourhood to enhance its quality and environmental appeal. According to United State Environmental Protection Agency (2011) Street trees and trees planted along building exteriors can lower surface and air temperatures through shading and evapotranspiration. Shaded surfaces are likely to be 20 – 40°F cooler than those that are non-shaded, which reduces electricity demand for cooling in summer.Street and landscaping trees also reduce wind speeds, slowing heat loss in winter.

Every compound in the study area can be requested to plant a minimum of two (2) shade providing trees in front of their houses. This will provide shaded surfaces for pedestrians, reduce outdoor temperatures, enhance the visual quality of the environment, reduce wind speed and dust during the harmattan season and improve storm water infiltration during the rainy season.

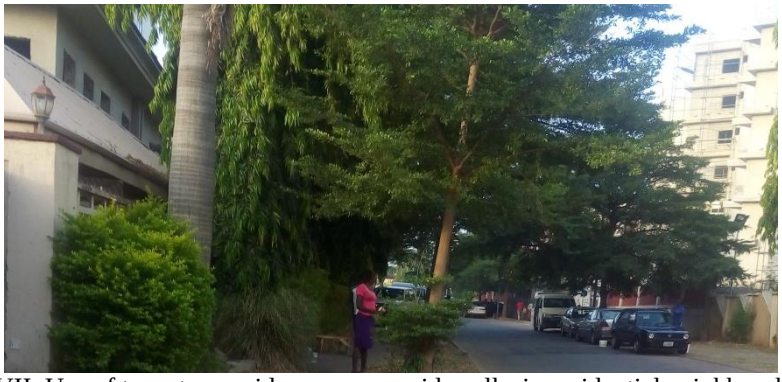

Plate VII. Use of trees to provide canopy on sidewalks in residential neighbourhoods.
Source: Field work, 2015

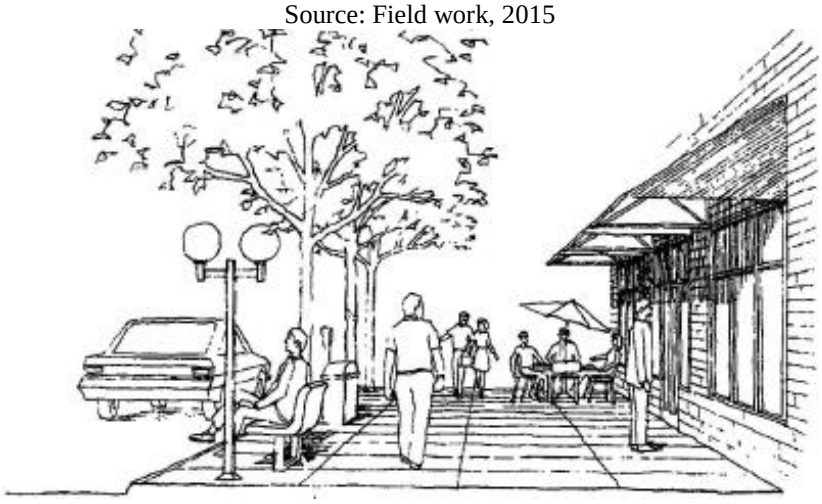

Fig. 8 Use of trees to provide canopy on sidewalks in residential neighbourhoods.
Source: Streetscape Urban Design Elements

Fig. 9 Use of trees and shrubs to provide canopy on sidewalks in residential neighbourhoods.
Source: Streetscape Urban Design Elements

iv. **Bioretention cells**, or **rain gardens**

These are shallow landscaped depressions that utilize soil and both woody and herbaceous plants to remove pollutants and infiltrate storm water runoff (USEPA, 1999). Bioretention cells consist of different zones that perform specific functions for treating and infiltrating storm water. Bio retention cells can be installed either in residential properties or parking lot islands, and even in areas with high clay content by amending the soil with sand and compost and installing an under drain.

iv. **Rain water harvesting:**

Rain water can be harvested and stored in underground tanks during the raining season and the same water can then be utilized in the dry season to water flowers and hedges. USEPA (2011) States that rain water harvesting will help to reduce the amount of run-off water going into the surface drainage. Water harvesting and reuse includes practices such as rain barrels and cisterns that can reduce energy use by saving on the need to use highly treated drinking water for outdoor water and other non-potable uses.

Most of the houses in the study area have either gabbled roofs or hipped roofs of corrugated roofing sheets. For the hipped roofs, rain barrels, and re - use drums and cisterns can be placed along the roof valley, while a metal or plastic collector channel should be placed along the roof eaves to receive and channel rain water to rain barrels. Similarly, for the gabble roofs, metal or plastic collector channel can be used toreceive the rain water along the eaves and channel it to a down pipe into the rain barrels.

Fig. 10 Rain water harvesting tools for residential buildings
Source: Rowe & Bakacs (2012)

v. Green Roofing

According to Architectural Record, (2003) there is an easy and largely forgotten place to restore green infrastructure in urban regions at a fraction of the cost of open space - rooftops. Traditional urban rooftops are black tar, and thus they absorb huge amounts of heat in the summer, contributing to the urban "heat islands" that have been demonstrated to measurably alter weather patterns around urban centres. USEPA (2011) points out that, the green roof offers a myriad of environmental benefits including providing improved air quality and preventing storm water runoff from entering the area's already taxed combined sewer system. The ASLA green roof retains about 80 percent of annual rainfall and significantly reduces the amount of nitrogen entering the watershed. The report further points out that, the green roof provides an extra layer of insulation for the building, reducing building energy use by as much as 10 percent during the winter months and temperatures on the roof itself measure 59 degrees cooler than a conventional black roof.

Rooftops in the study area are silver - coloured corrugated galvanized iron roofing sheet which reflects a large part of the incident solar radiation thus raising the ambient temperature. Green roofs will therefore offer a lot of benefits including the reduction of storm water runoff, reducing the incidence of urban heat island and improved air quality.

CONCLUSION

Embracing and adopting the use of aspects of green infrastructure in the high density residential neighbourhoods in our urban areas is an economic way of enhancing

environmental quality in the study area by increasing the size of green areas. In addition it makes it visually acceptable by reducing the size of paved area and reduced cost of road construction because the width has been reduced. Similarly, tree planting by the roadside will create a walkable conducive microclimate for pedestrians and reduce the possibility of an urban heat island arising.

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Manipulation of Daylight as a Post-construction: A Partial Comparative Analysis

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ABSTRACT

Prior to the late 19th-century, sunlight was considered as the primary day-time lighting system for buildings. Classical and other early architectural designers manipulated daylight and incorporated various strategies to make it more efficient. Although lost to the discovery of electricity and the Industrial Era, the energy crisis of the last few decades has spurred renewed focus on daylighting. Literature shows multiple daylighting options for architects which have been extensively reviewed. But a model daylight retrofitting principle is lacking. This paper seeks to bring to the fore the need a strategy for incorporating efficient daylighting as a post-construction strategy towards achieving sustainable designs. This study involves a partial comparative analysis of ten (10) daylight strategies on a residential building with daylighting challenges. A retrofit rating was developed from the analysis and used as a guide to select the best daylight strategy for the retrofitting process. This paper recommends that retrofit projects be embarked upon to incorporate ample daylight using a step-wise method to rank the various strategies available. This way the benefits of daylighting can be fully maximized.

Keywords: Comparative Analysis, Daylighting, Design, Retrofitting

INTRODUCTION

The 21st century has been the age of globalised innovative advancements in technology. This extensive development has however resulted in a rise in global energy demands. Although there have been attempts all over the world to reduce energy demand and emissions, buildings presently account for approximately 40% of global energy consumption and play an important role in the energy market. (Nejat, Jomehzadeh, Taheri, Gohari, and Majid, 2015; World Energy Council, 2013). This suggests that significant reduction in global energy consumption can be achieved if we alter the way we design and maintain our buildings.

However, Xing, Hewitt, and Griffiths (2011) and Ibn-Mohammed, Greenough, Taylor, Ozawa-Meida, & Acquaye, (2013), surmise that for now, buildings' energy demand is still predicted to continue growing worldwide in the coming decades. IEA (2013) put forward that for the past forty (40) years, the energy demand from buildings (including residential and commercial buildings) has grown by 1.8% per year. The scenario implies that the global trend is worsening. Despite the scarcity of petroleum products, energy demand in Nigeria has been on the steady rise due to increase in economic development and the population growth (Emodi, & Boo, 2015).

The residential sector constitutes the third-largest major energy consumer in the world, representing 27% of total consumption (Laustsen, 2008). Steaming the tide of the global energy crises thus requires significant attention in this sector. Renovation and retrofitting are concepts that provide the architect an opportunity to enhance the sustainability attributes of buildings, particularly with regards to energy efficiency. These post-construction processes allow for major or minor modifications or repairs to homes. In most cases these involve masonry, electrical, plumbing or fitting and installation changes. Clients seldom engage architects for daylight retrofitting.

The Daylighting Challenge

Sunlight was considered as the primary day-time lighting system for buildings before the discovery of electricity. Classical and some other early architectural designers manipulated daylight and incorporated various strategies to make it more efficient. Although lost to the

Attoye, D. E. (2016). Manipulation of Daylight as a Post-construction: A Partial Comparative Analysis. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 124-130

discovery of electricity and the Industrial Era, the energy crisis of the last few decades has spurred renewed focus on daylighting. But a model daylight retrofitting principle is lacking. The significance of which will assist both architects and building owners to harness more of the daylight and reduce energy consumption.

BACKGROUND

In making a case for the increase in daylight considerations, the debate has been significantly advanced by researchers advocating significant benefits of daylighting. According to Edwards & Torcellini, (2002), the integration of daylighting into the building as an architectural statement and energy savings strategy, gravitates into benefits which extend beyond structural functionality and energy conservation. Their proposition is that utility costs and building occupants well-being are heightened by improving daylight admission. The assertion that daylight integration has gains beyond the confines of architecture and energy was earlier put forward by Hathaway, Hargreaves, Thompson, and Novitsky, (1992). They stated that human biological functions are dependent on the highest levels of natural light while Robbins (1986) had also earlier surmised that on a psychological dimension, daylighting facilitates the desire for building occupants to have contact with the outside living environment.

Furthermore, workers in daylight and full-spectrum office buildings have reported an increase in general well-being, with specific gain including health, reduced absenteeism, increased productivity, financial savings, and preference of workers (Pellegrino, Cammarano, & Savio, 2015; Franta and Anstead, 1994). Similarly, daylighting has been to improve the academic performance of students (Nicklas and Bailey, 1997), and there is consensus among researchers that spatial quality can be enhanced through natural light to afford psychotherapeutic care to building users (Edwards & Torcellini, 2002; Vischer, 1986; Verderber, 1983). Thus, the conclusion is that the therapeutic qualities of indoor environments can be enhanced by daylighting.

Daylighting Strategies:

Literature shows multiple daylighting options for architects which have been extensively reviewed. These options in some cases utilise mechanical systems to help transport daylight from openings into the building. This significant difference in these systems determines issues like the cost, complexity, amount of embodied energy, and effectiveness.

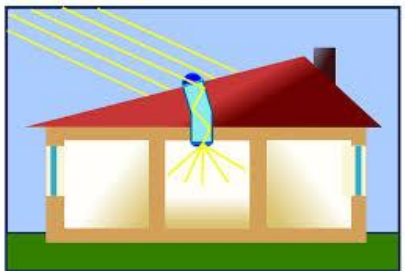
In achieving a classification for daylighting systems, there are several approaches taken by researchers. Some researchers focus on the strategies that involve the entire building design while others focus on the manipulation of daylight through various openings. According to Belakehal, Aoul, and Bennadji (2004), daylight admittance into functional spaces can be achieved by the use courtyards with various configurations (totally and/or partially covered) – giving special considerations for the building type; semi-open spaces; skylights; different shapes of windows (recessed, screened, and small sizes) and some constructional and aesthetic details. These passive strategies represent the preferable way to harness sunlight as they do not directly add any extra cost to the energy requirements of the building, seeing that they do not consume energy in operation.

(1) Courtyard

(2) Skylight

(3) Sidelighting

(4) Toplighting



(5) Light Pipe

(6) Light Tube

Fig. 1 – 6: Types of Daylighting Strategies
Source: Google images

Boukekri (2008) detailed strategies for daylighting from a purely design point of view, integral with the building envelope. He classified these as sidelighting and toplighting. He highlighted the use of side windows, the clerestory system, combined side systems, light shelves, louvre systems, prismatic systems, and anidolic zenithal collector system as sidelighting options. He then listed the skylight and light pipe systems as toplighting options. Although these are basically window design options, the variety shown in design, materials, integration and technology has guided their classification as individual daylighting strategies. Core daylighting and atriums can also be used to light interiors as investigated by several researchers and highlighted by Ander (2003).

It is important to note that in practical application, some of these strategies discussed above can take on both passive and active controls. In the passive configuration, they will not require energy in operation, while in the active configuration they require energy for mechanical parts. For example, there are passive and active windows and lourve systems as well as.

DESIGN EXAMPLE

i. Introduction

The methodology for this investigation required the selection of a residential unit with sufficient daylight challenges. The various daylight strategies identified by researchers were ranked based on a rating index to guide selection. The index outlined the terms as passive

design, performance, and DIY (Do-It-Yourself) technique as positive indicators and embodied energy, demolition requirements and cost has negative indicators.

The residential unit selected for this study is a 4bedroom semi-detached bungalow located in Akure Ondo State, Nigeria. This region of south-western Nigeria was selected owing to the fact that it is characterized with abundant sunlight all year round. The building type was selected so as to present a typology with inherent daylighting challenges sufficient to raise the concern of the building dwellers.

ii. Orientation

The building orientation is such that it is slightly off the North-South axis. This exposes the longer axis of the building to daylight to the East in the morning and to the West in the later hours of the day. Although this orientation may increase solar heat gain –which can be solved by passive shading, it maximises the daylighting potential the site offers.

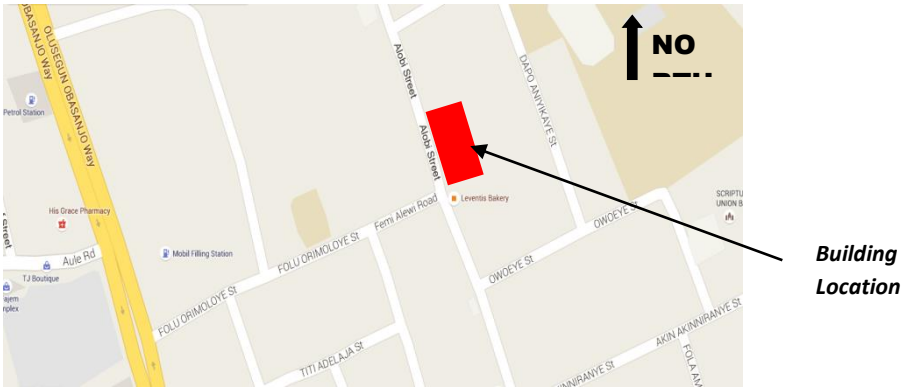
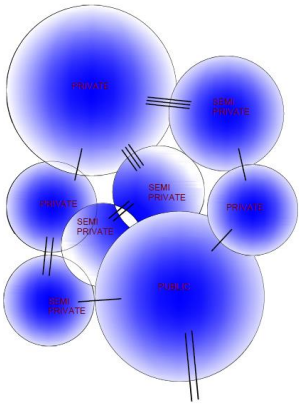


Figure 2: Building Site Plan:
Source: Google Maps

iii. Zoning

The diagrams below show the building zoning and spatial arrangement. They give an idea of the client's general requirements and design.



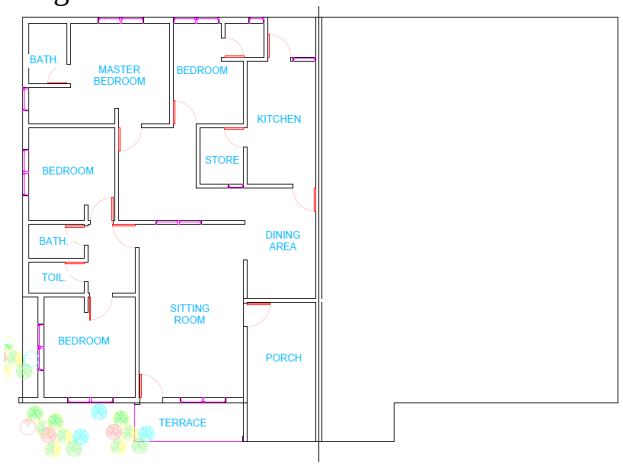


Figure 3: Building Zoning; Figure 4: Building Floor Plan
Source: Researchers Practical work

BUILDING DAYLIGHTING CHALLENGE

Step 1: Identify poorly lit areas on the plan

This was done on the floor plan and shows the exact situation of the plan. The function and area of the space, as well as the surrounding spaces are critical to guiding the manipulation scheme.

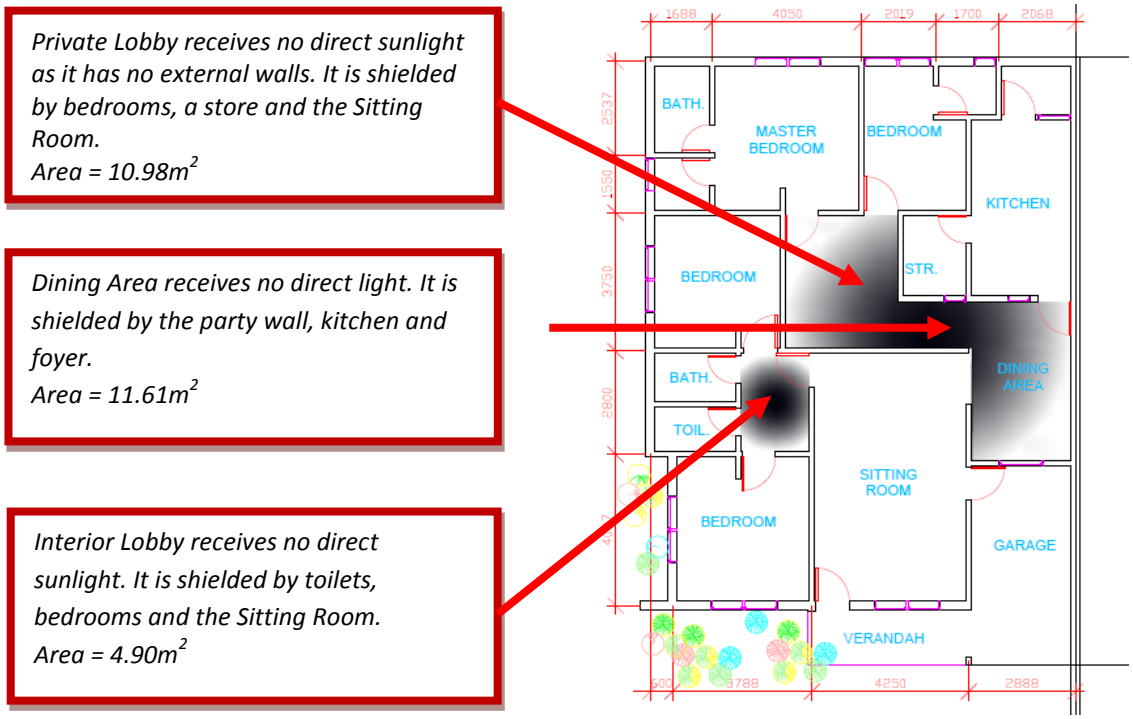


Figure 5: Outline of Poorly lit areas
Source: Researcher's Work

Step 2: Retrofit Rating

A table was developed based on literature survey and practical construction experiences to develop a simplified rating system for home-owners. The chart defines a comparative analysis of the daylight strategies in available to designers and evaluates the possibly of implementation. Using the chart will assist in the choice of which strategy to adopt in the Daylighting retrofit as well has save time and finances. The goal will be to find which strategy is most practical-unique to the design, and has the highest benefit to the building owner.

Table 1: Retrofit Rating (A)

DAYLIGHT STRATEGY		RETROFIT RATING								AVE
		POSITIVE				NEGATIVE				
		Passive	Performance	DIY	Sum	Embodied Energy	Demolition required	Cost	Sum	
1.	Courtyard	✓	✓ ✓ ✓	x	4	✓ ✓	✓ ✓	✓ ✓	6	5
2.	Semi-open spaces	✓	✓ ✓	x	3	✓ ✓	✓ ✓	✓ ✓	6	4.5
3.	Sidelighting	✓	x	x	1	✓	✓	✓	3	2
4.	Toplighting	✓	✓ ✓	x	3	✓ ✓	✓	✓ ✓	5	4
5.	Corelighting	✓	✓ ✓	x	3	✓ ✓	✓	✓ ✓	5	4
6.	Atrium	✓	✓ ✓	x	3	✓ ✓ ✓	✓ ✓	✓ ✓ ✓	8	5.5
7.	Light Shelves	✓	✓	✓ ✓	4	x	x	✓	1	2.5
8.	Light Tubes	✓	✓ ✓	✓	4	✓ ✓	x	✓ ✓	4	4
9.	Light pipe	✓	✓ ✓	✓	4	✓ ✓	x	✓ ✓	4	4
10.	Skylight	✓	✓ ✓	x	3	✓ ✓ ✓	✓	✓ ✓	6	4.5

Source: Researcher's work

Guide to colour-coded Retrofit Rating Table

Each tick on the table represents a "one" mark of a maximum of 3, while an "x" represents "zero". The table is divided into the green (positive) columns and the red (negative) columns; the sum for each is indicated next to it. A high green score indicates that the strategy is rated high while a low green score indicates that the strategy is rated low. In contrast, a high red score indicates that the strategy is rated low while a low red score indicates that the strategy is rated high.

Positive Ratings

i. **Passive:** strategy will rely on no active means (i.e no electric power)
ii. **Performance:** effectiveness in daylight admission (i.e. a comparative index based on other strategies on the table)
iii. **DIY:** degree of independence from hired skilled labour (i.e. DO-IT-YOURSELF)

Negative Ratings

i. **Embodied Energy:** average amount of energy required to effect this strategy (i.e. a comparative index based on other strategies on the table)
ii. **Demolition required:** degree of demolition required to install this strategy.
iii. **Cost:** relative cost –whether high, low or average required installing thus strategy.

Step 3: Selection of Daylight Strategy

Table 2: Retrofit Rating (B)

DAYLIGHT STRATEGY		Sum (G)	Sum (R)	AVERAGE
1.	Sidelighting	**1**	**3**	**2**
2.	Light Shelves	**4**	**1**	**2.5**
3.	Toplighting	**3**	**5**	**4**
4.	Corelighting	**3**	**5**	**4**
5.	Light Tubes	**4**	**4**	**4**
6.	Light pipe	**4**	**4**	**4**
7.	Semi-open spaces	**3**	**6**	**4.5**
8.	Skylight	**3**	**6**	**4.5**
9.	Courtyard	**4**	**6**	**5**
10.	Atrium	**3**	**8**	**5.5**

Source: Researchers work

Based on the comparative analysis, the table shows that "sidelighting" has the lowest average rating of 2 and "atrium" has the highest of 5.5. The summary table however shows that "sidelighting" has the lowest (worst) green performance on the index and the lowest (best) red performance. While "Atrium", has a high (good) green performance on the index and the highest (worst) red performance.

This scenario guides the architect in selecting a strategy somewhere in the middle of the table. While the perfect option will be a strategy with a high green score and a low red score, (e.g. Toplighting) the alternative option will be a strategy with an average green and average red performance. This will help to maximize on the gains and minimize the losses. Thus, the use of Light pipes or Light tubes may also be selected and recommended to the client for the daylight retrofitting.

RECOMMENDATIONS AND CONCLUSIONS

Daylight retrofitting requires a methodological procedure which can be done with sufficient professional expertise. It is however simple to educate building clients so that they can make an informed decision on the type of strategy to adopt. To advance this, architects are required to be vastly knowledgeable about current daylighting strategies. Further research will however be required to appraise client preference of various daylighting strategies and environmental impact. Summarily, daylighting provides an increase in natural lighting, reduction in artificial lighting needs, increase in health benefits, and passive aesthetics. Incorporating it yields present and future gains for building occupants

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Control of Daylight and Natural Ventilation in Traditional Architecture of Ghadames, Libya

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ABSTRACT

Housing energy consumption accounts for almost 36% of total primary energy use in Libya of which cooling and lighting are the main source of demand. This study reviews passive control methods employed in traditional dwellings of Ghadames that highly contribute to enhance indoor thermal and visual comfort. Designing for natural ventilation and daylighting in harsh environment poses a greater challenge to building designers. Twenty one traditional dwellings were surveyed to assess building designs and performance in terms of daylight and natural ventilation interoperability. This study conducted field surveys comprising measurements of indoor/outdoor temperatures while concurrently investigating inhabitants' thermal feeling through both direct semi-structured interviews and questionnaire. In addition, drawings were made to demonstrate the design elements and techniques used to minimize extreme outdoor temperatures and best make use of daylight. Findings indicated that skylight openings play an important role in promoting day and night ventilation. The opening's position and size have to be carefully studied to prevent excessive direct solar heat gains and induce air movement across internal spaces. The field surveys showed that occupants were thermally satisfied in naturally ventilated dwellings having considered that fixed ceiling fan is used at late afternoon when indoor temperature starts to rise gradually. Also the use of light color roofs and walls is recommended which is approved to enhance interior lighting and increase the outdoor albedo ratio. Embedding passive design measures in traditional dwellings can be very effective and cheap in reducing the cooling and lighting demand; the impact on future housing development is also discussed.

Keywords: traditional architecture, natural ventilation/lighting, passive design features

INTRODUCTION

The demand in energy has seen an increase of over 26% in the last five years in Libya within the domestic sector, expected to be even higher by 2017 (GECOL, 2012). Cooling loads and lighting are the main energy consumers in buildings in hot regions particularly in summer seasons. Roaf et al. (2009) mentioned that for thousands of years traditional societies have managed to live in comfort dwellings using natural and simple means to cool or heat spaces. The window design plays a major part in controlling the ventilation and lighting of dwellings on which other interrelated aspects (solar heat gain, heat loss, privacy and security) may depend on (Wilson, 1999). Although there is sufficient detailed design guidance on daylight and natural ventilation issues in CIBSE publications and other related sources, there yet especial cases in extreme climatic conditions may require additional revision. Therefore, understanding the general climate and the micro-climate conditions in particular could help building designers offer better control of indoor built environment. The most important element connecting the indoor and outdoor world is openings in terms of thermal and visual interaction. This element plays many roles including the supply of daylight, the view to outside world, control of air exchange, noise and acts as a glare protector and climate moderator, as well as contributing to energy efficiency in buildings (Wilson, 1999). McCluney (2008) believes there are many benefits of good daylighting design in buildings, starting from enhancing the users' visual and thermal comfort to worldwide issues like global warming and dwindling of fossil fuel energy supply. In the US lighting alone accounts for 30% to 50% of all energy consumed in buildings and 20% to 40% saving in lighting and cooling can be achieved by utilizing daylight and natural ventilation system (Boubekri, 2008). A number of studies highlighted the performance of some

Alabid, J.; Taki, A. & Painter, B. (2016). Control of Daylight and Natural Ventilation in Traditional Architecture of Ghadames, Libya. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 131-140

architectural elements employed in vernacular architecture such as the Arabic *Mashrabiya* and its environmental implication on visual connection, users' privacy and natural ventilation systems (Hansen, 2008). Hansen also stated that only few studies considered integrating such passive strategies into contemporary architecture and these have the potential to synergize buildings, microclimatic conditions and interrelated human activities. Henriques, et al. (2012) focus on developing a responsive skylight system with a mechanism response to indoor and outdoor environmental conditions, synthetically imitating the natural biological system of daylight control.

METHODOLOGY

The study conducted field surveys evaluating the traditional dwellings' performance and control of daylight and ventilation investigating how satisfied occupants are within this naturally ventilated (NV) indoor environment. The nature of the study necessitates carrying out qualitative surveys involved semi-structured interviews of 4 professionals and 7 house owners, personal observations and meanwhile a questionnaire was distributed in 16 neighbourhoods to include 85 respondents to quantitatively evaluate the residents' opinion and preference of their thermal and visual indoor environment. In addition, 21 traditional dwellings were visited during summer 2013 and 2014 and simultaneously temperature measurements were taken inside and outside dwellings. The study also used CBE thermal comfort tool to predict the neutral comfort temperature and zones of these investigated dwellings comparing the two models with actual votes of subjects participated in the surveys. *EnergyPlus* is used for daylight analysis and architectural drawings were made to demonstrate design techniques and methods employed in traditional dwellings

CLIMATE

It is well known that indoor environmental conditions in buildings depend highly on outdoor climatic conditions. Thus, housing designs should consider climate analysis in a very early stage in order to make buildings responsive, healthy and friendly to the environment. Literature is rich in discussing the implications of climate on the design of homes particularly of those who study vernacular architecture such as Singh, et al. (2009). Climate has an immediate impact in forming old cities and related effects on local community traditions and way of life and the choice of adaptation methods to deal with surrounding environment (Ben-Hamouche, 2008). Libyan climate classified into three main regions; the coastal region "hot and humid", Mountain region "cold zone" and desert region "hot and dry" but also there are subsidiary regions may found within those mainstreams as stated in Bukamur (1983).

Ghadames Oasis lies in the Libyan Sahara desert "hot and arid climatic zone" characterized by high average temperatures and temperature variations, very directional solar radiation, clear sky most of the year, almost no rainfall, very low humidity and hot dusty winds occurs occasionally in summer. It is very extreme climate conditions especially the diurnal swings of temperatures in summer times where temperature may rise over 47˚C during the day and drops down to 20s˚C at night and can drops below 0^0C in winter. It is always important to know the wind shadow and sun patterns of the region throughout the year for effective passive optimization of building designs. However, in Ghadames direct exposure to sun and wind is not desirable especially in summer when scorching sun and high solar radiation rates as well as sandy and hot windstorms are the case.

Site & Urban Structure

Old settlements in a wide range of climates have been produced in different architectural styles based upon the local climatic conditions and inhabitants' way of life (Singh et al., 2009). The urban fabric of the old town of Ghadames is highly compact and dense with a clustered type of building design. It has been existed for over 400 years ago and re-erected

several times as local builders gained experience over time by trial and error. The discovery of the artesian spring called Eyn El-lfaras (horse's lake) was the impetus of the town existence that built on an Oasis of an area of 310.3 hectares surrounded by massive sand-dunes and mountains according to (Ealiwa, 2000). One can notice that there are underground water-streams passing underneath the urban fabric of the town ending at green fields surrounding the town. On a city scale, the urban plan of the old town indicates a hierarchal structure from public wide scale to private family space concerning every single issue in community life. Elwefati (2007) described the urban structure of the old town as a covered connected city as majority of roofs are interconnected whilst streets and alleyways also covered in order for shade, privacy and security to be ensured.

Yet, natural ventilation and daylight are among the issues concern local builders and users which carefully were employed in accordance with interior space requirements and moreover upon inhabitants' need for protection from undesirable outdoor conditions. Littlefair et al. (2000) underlined the role of urban morphology, building geometry, street patterns and other local features like vegetation play in natural ventilation field. However, local builders have recognized such effect and adopted certain building techniques to maintain sufficient access of fresh air and daylight in dwellings throughout the year. And the only way to ensure this mechanism is to rely on skylight openings. Open courtyard was not ideal due to the sandstorms that hit the area from time to time. Therefore, there is a modified microclimate in the town differs from the regional synoptic climate brought by its urban structure as well as the massive green fields that contribute to mitigate the extreme regional climate by preventing the buildings from direct sandy winds and vegetation helps promoting thermal stability and increasing humidity rates. The urban stratification of the town and its individual dwellings shows a great coherence to the natural world surrounded formed upon social and environmental considerations making the entire city works as a one unit. Figure 1 demonstrates a curved and centralised urban structural design of the old town surrounded by over 36 thousands of palm trees and part of the new town with an open rectangular kind of western style of city urban design.

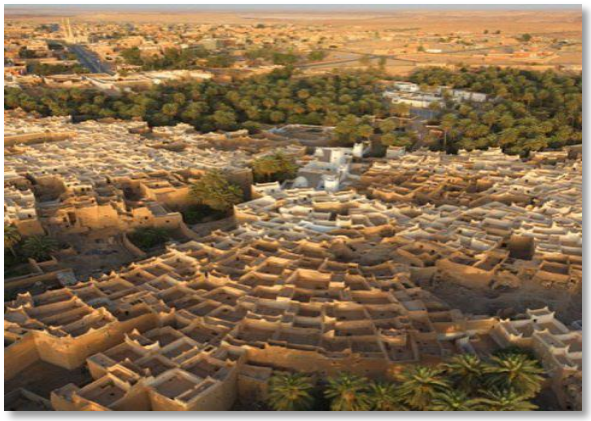

Figure 1: view of the urban settlements of old and new towns of Ghadames

DATA ANALYSIS

House Design

The visit to the old settlements involved drawings to capture the most common architectural design and features of different dwellings besides the investigation of indoor thermal conditions. Surveys found that traditional dwellings somehow have similarity in form, layout and interior space organization irrespective of the dwelling size. According to Ealiwa (2000) the traditional house plot area ranges from 25m² to 50m² whereas the total floor area of the house may also varies from 70m² to 80m². Figure 2 demonstrates the location of the modelled house within the compound and its space organization. As this drawings of typical traditional

house show, the majority of houses consists of three storeys stratified according to social and environmental requirements.

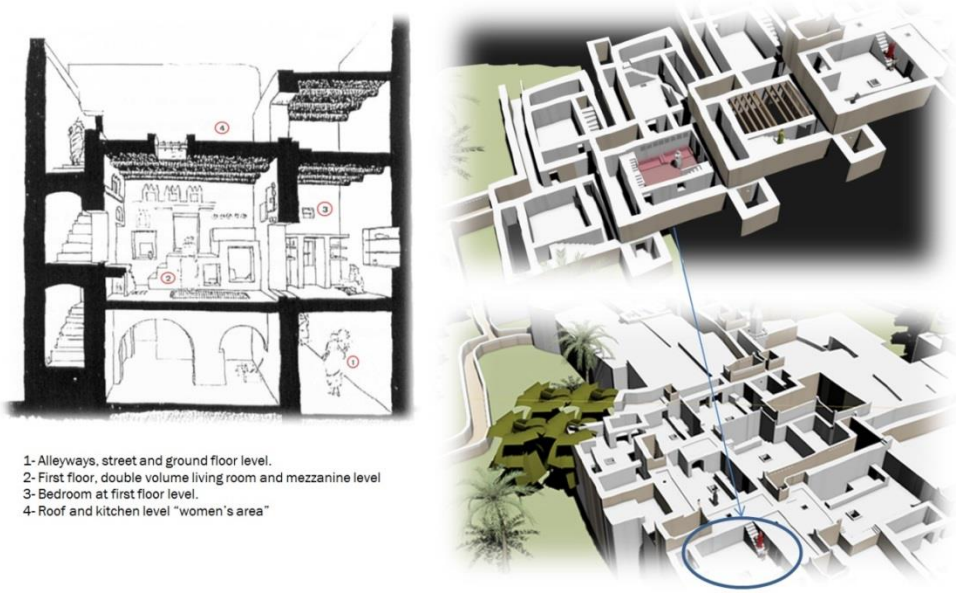

Figure 2: architectural details of typical traditional house

Socially, privacy is very important issue for local community and therefore ground floor allocated for visitors and storage purpose. The first floor is the semi-private space where family may invite someone and also part of it still considered as private area for sleeping and practicing certain cultural affairs. The third floor is only for women use where the kitchen is located and a shed used in summer time at cool nights. Thermally, ground floor found to be cooler and the higher the level the warmer it gets. The living room is built in a double volume with a height of 4.5m to 5.5m. The relatively high ceiling space enhances the air circulation and helps remove the heat gained through the roof structure during the day.

Comfort & Users' Thermal Sensation

According to a number of studies, thermal comfort requirements may vary from region to region and even between individuals. Therefore, it is important to understand the building users' thermal perception in order to determine the proper indoor conditions that natural or mechanical systems may deliver. Brager & De Dear, (2001) compared The upper limit of comfort zone in ASHRAE Std. 55 which is 26˚C that base on 0.5 cloth rate (clo) and 50% relative humidity (RH) to the new adaptive comfort standards (ACS) which is based on climatic data and 80% acceptability limit of subjects. To some extent Brager and De Dear's study agrees with a number of studies conducted in North African context including current work suggesting that adaptive approach in hot regions so often allows warmer indoor temperatures in naturally ventilated dwellings during summer, which may refer to psychological and physiological adaptation of the human body to surrounding environment. The air movement is a significant parameter in human thermal comfort and how effective may depends on other physical environmental parameters. For example, in warm humid conditions, higher indoor air speed is preferred (Tablada, et al. 2009). On the other hand, in hot dry climates lower air speed and mean radiant temperatures could enhance indoor thermal comfort as Ealiwa, (2000) and Al-Jared, (1991) concluded.

As figure 3 demonstrating the comfort temperature records for naturally ventilated buildings show that neutral comfort temperature for subjects falls within the acceptable band in adaptive model and stepped aside in Predicted Mean Vote (PMV) model. This findings may underpin the study carried out by Honnekeri, et al. (2014) that explains the case users' expectation towards particular thermal environment which sometimes overrides other

psychological or physiological factors. The study found that in naturally ventilated dwellings occupants are thermally satisfied preferring to be slightly cooler despite air temperatures of 32˚C and relatively low air speed that ranges between 0.04 m/s to 0.08 m/s. In air conditioned dwellings, the majority wanted no change to the indoor thermal conditions with temperatures recorded at 21˚C to 25.5˚C and air velocity of 0.12m/s to 0.25m/s. According to the equivalent temperature reduction method (ETR) suggested by Lechner (2014) there is only necessity to increase air velocity when relative humidity is higher to maintain the same thermal sensation. This may explain the tolerance for higher air temperatures and relatively low air speed of those who live in naturally ventilated dwellings of Ghadames.

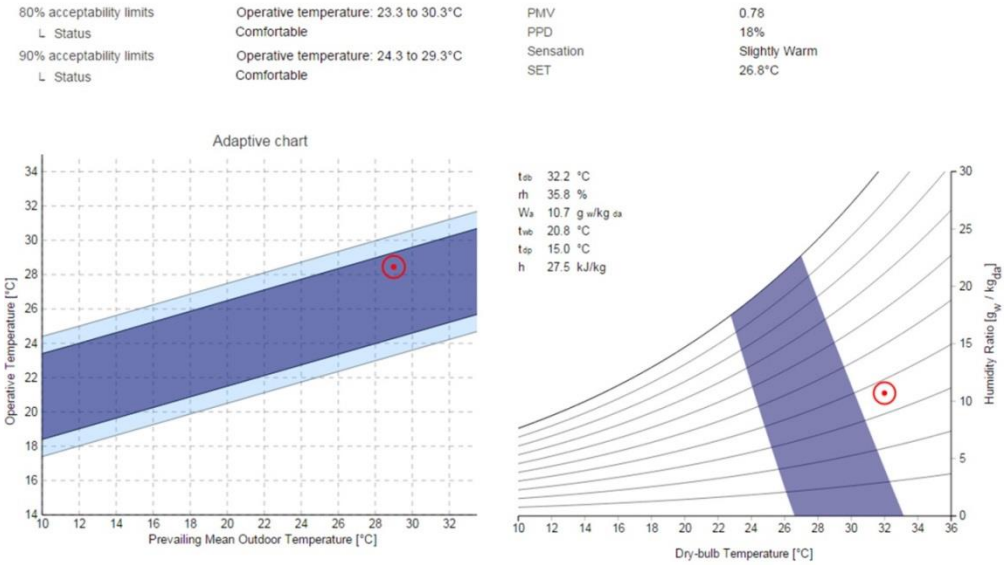

Figure 3: Thermal comfort zone in CBE tool for MPV and adaptive models

Natural Ventilation

Clancy, (2013) has stated in CIBSE knowledge series – KS17 that ventilation is very important component in human thermal comfort and highlighted certain reasons for which ventilation is mainly needed:

i. providing fresh air for metabolism, dilution and removal of pollutants from space
ii. extracting contaminants at source (e.g. extract systems for kitchens, bathrooms, industrial processes and fume cupboards)
iii. satisfying combustion needs for appliances such as gas cookers, boilers and unvented heaters
iv. distributing conditioned air (for heating or cooling)
v. space pressurization to inhibit the infiltration of pollutants from outside or from one space to another (e.g. preventing integrated circuits within cleanrooms from being contaminated by dust particles)
vi. pre-cooling building fabric (e.g. night venting of naturally ventilated spaces)

For naturally ventilated dwellings it may seem quite challenge for designers to ensure all is achieved particularly in extreme conditions. However, Ghadames traditional dwellings show an incredible application of natural ventilation systems in homes considering all mentioned above by Clancy. The house is so often surrounded by adjacent houses from three or four sides with light-wells interposed in between. These light-wells play an important role in ventilation especially during summer. The position of those voids designed mainly according to both the room location and privacy issue. Air speed was measured in different locations within the house and found to be higher the closer to those openings at an average of 0.12 m/s whilst lower in the middle of the living room at an average of 0.06 m/s which may explain why occupants use ceiling fan in this room at that position. Minimum exposure of external

facades helps reducing the direct solar heat gain whereas the greater thermal mass structure the more the amount of heat transferred through building fabric is delayed, which means less heat extraction from the space to cool the air down as shown in figure 4.

The skylight aperture is the soul of the building structure acting as an artery for daylight and air movement daily cycle linking inhabitants with the outside natural world. During the day air enters the house through relatively small room voids approximately 15x25cm crossing all other spaces to leave the house via the 1m² roof aperture. Vice-versa at night time as outdoor temperature is getting lower, cool air begins to penetrate through the skylight opening and warm air leaves through the same opening via stack ventilation effect and more recent a fan ceiling is used to enhance the air circulation. Al-Zubaidi, (2002) and others have mentioned how roof is an important component in traditional house of Ghadames for women do home cooking and some other family traditional customs. The main reason that kitchen was placed on the roof is to extract heat and smoke away from the house and therefore there is no heat generated from home appliances and such activities inside the dwelling.

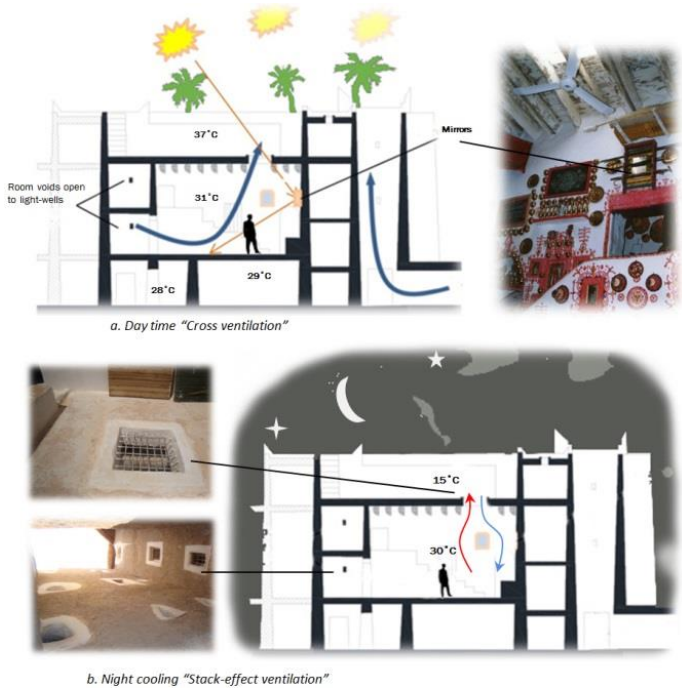

Figure 4: Natural ventilation, design and methods "traditional house"

Daylight

Boubekri, (2008) defined the daylight or sunlight as a vital component to life that plays fundamental, biological and psychological functions to humans and other creations on earth. Daylight is also known as natural light which is the amount of solar radiation stemmed from either the sun "direct sunlight" or the sky "diffused light". Scientifically, as figure 5 demonstrates natural light is the visible wavelengths on the earth surface which ranges from 400 to 760 nm (Thomas, 2006). Obviously, considerable factors can affect the availability of natural light such as the geographical location, weather conditions and the time of the day and year, and notwithstanding the spatial design and the particular use of the space has a significant impact on the required amount of daylight.

Recent studies concerning with daylight design in residential buildings have developed possible passive solutions to provide an adequate amount of daylight to buildings in order to optimize its energy efficiency and consequently for human well-being and productivity. Carter, (2014) and some other researchers have studied the use of tubular daylight guidance system (TDGS), that was introduced in the last decade of the last century and became widely

used in a wide range of buildings. The polycarbonate collectors are located at roof level to capture direct and indirect sunlight which may enhanced by additional reflective devices such as mirrors where sun conditions may not be predominant. Despite TDGS being 50% more expensive method than electric systems and compared to conventional roof lights and windows, it is still considered as passive tubular daylight system and have capacity to deliver deeper daylight into areas that cannot be covered by conventional means.

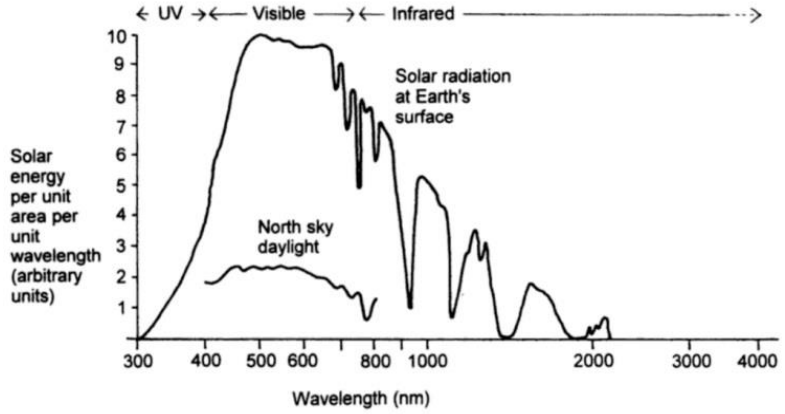

Figure 5: The visible solar radiation on earth surface ... source (Thomas, 2006)

Similarly, but over 200 years ago traditional dwellings of Ghadames employed such passive design technique installing skylight aperture at roof level to lit the interior with the use of reflective mirrors and brass motifs to deliver the daylight into deep areas. Figure 6 shows the use of these reflective devices on internal walls not only for decorative propose but rather to optimize indoor visual environment. The figure also shows dynamic simulation of daylight analysis using EnergyPlus tool to compare the average of daylight inside the living room with and without reflective surface. As may figure 4 illustrated the position and size of external openings and one can notice that roofs and internal walls are painted with white colour to intensify reflected solar radiation, as the lighter the colour and more reflective the surface the less heat will pass through the roof. Due to clear sky in desert regions and high solar radiation which creates extreme brightness that more likely to cause glare, therefore the size of external openings is minimized whilst sky diffused light is optimized to avoid overheating and discomfort occurrence. Sealed and porous plank shutters have been used to cover roof aperture according to weather conditions and another shutter type to prevent from insects invading buildings during some seasons.

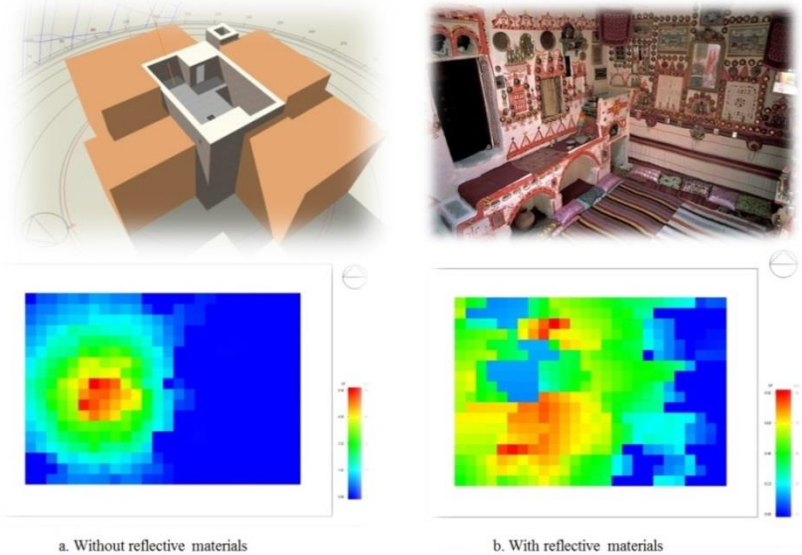

Figure 6: Daylight analysis in living room of traditional house

The sunlight's motion incorporated through the design of the old town's streets and alleyways. The repetition of shaded and sun-lit zones resembles a natural phenomenon of day followed by night, which is experienced in sequence as one walks through these alleyways during the day as shown in figure 7. These streets and walk paths were designed for minimum exposure and daylight requirements, inhibit the amount of direct sunlight and diffused reflections. Thus, during the hottest summer days while outdoor air temperature was around 44˚C it was recorded in these shaded paths at 28˚C to 31˚C.

Figure 7: Design methods and distribution of daylight in alleyways

Ground Water Cooling Strategy

In fact, not only minimum exposure to outdoor environment contributes to alleviate the extreme outdoor conditions but also water systems passing underneath the town alongside those alleyways have a great impact on indoor microclimate. These canals designed to work in gravity fed system starting from the water source "Eyn El-lfaras" passing the town urban structure to end up at fields surrounding the town. The water contributes to humidify the indoor air and brings cool breeze into pedestrian paths and light-wells attached. Figure 8 demonstrates the process of using the water from the domestic use point to the green fields.

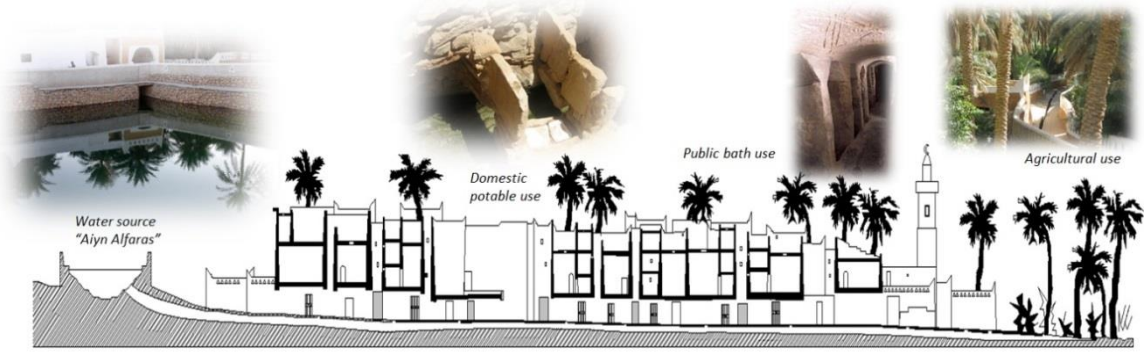

Figure 8: Gravity fed water system and distribution in old town

However, the water flow promotes air circulations and introduces air currents into the indoor atmosphere that can clearly be noticed at the junctions of alleyways and those opened voids to the water streams. The air enters the alleyways through the wider main streets may have been passed over the canals and subsequently cooling it via latent heat exchange and humidity in the air may increase though.

CONCLUSION & RECOMMENDATION

Good design of daylight and natural ventilation could result in considerable avoidance of energy consumption in buildings. The benefits of that are not only saving energy operating costs rather than achieving the desirable natural environment in buildings. And to do that

building designers should have an understanding of the design methods and techniques found in vernacular architecture that harness the climatic conditions to work to its advantages. The purpose of this work is to shed light on various techniques used in indigenous settlements of Ghadames to naturally control the indoor thermal and visual environment. Obviously, uncountable benefits can be achieved by incorporating various passive design techniques and bioclimatic features into future developments which some may underline here:

i. Considering a compact type of settlements in such climate conditions that provide less exposed external surfaces which mean more shadings and less solar heat gain rate.
ii. Ensuring high thermal mass structure in order to stretch the time lag reducing the heat transfer rate per unit of the surface into internal spaces.
iii. Paying more attention to external openings and promote the concept of roof and skylights rather than vertical windows to;
    - Promote stack ventilation
    - Minimize direct solar and heat gain through openings
    - Achieve appropriate daylight distribution
    - Prevent from undesirable hot sandy winds during summer
    - Respect cultural norms and preserve local identity
iv. Applying mutual shadings from adjacent buildings helps reducing solar heat gains.
v. As the visible solar radiation is high in the region so that size of openings on external facades can minimized to avoid issues such glare and discomfort.
vi. Narrow shaded streets and pedestrian paths will act as cooling ducts that vents away hot dusty air which may contribute to enhance the heat loss via winds to the outside environment.
vii. Light-wells behave as environmental modifier for heat exchange and provision of natural light and adapting such concept in future housing development can solve number issues like heat islands and reduce energy costs for lighting and ventilation.
viii. Covered public routes and squares ease residents' movement during the day at which car parking locations may be connected to in future developments.
ix. Having live plants within the dwelling and an enclosure of green belt around settlements helps stabilizing the outdoor microclimate for instance absorbing CO_2, provide more shades and filters out hot dusty air which in turn have an impact on indoor environment.
x. Creating wet surface within the building or surroundings cools the air via latent heat extraction that may passes over intermittently-wetted surface and also increasing its humidity rate.
xi. Introducing double volume space e.g. living room or covered indoor courtyard with roof openings promotes the night ventilation system by trapping cooler air at night and stratifies air presence during the day.
xii. Reflective external surface by painting it white could help increase albedo rate and reduce the heat gain and transfer through the building structure into interior spaces.

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Analysing the Importance of Climate Forecast Information for Transhumance Pastoralists in Katsina State, Nigeria

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ABSTRACT

Undoubtedly, climatic variability wields remarkable influence on the livelihoods and well-being of Pastoralists in the semi-arid regions of Nigeria. Hence, scientific weather forecasts can help increase the resilience of communities to unpredictable weather events and seasonal patterns. The study examined the value of climate change prediction for transhumance pastoralists in Katsina State, Nigeria. Specifically, the study investigated pastoralists' access to weather forecasting and early warning information, main sources of climate forecast information and barriers to pastoralists' utilization of climate information. Multistage sampling technique was used to select 367 respondents for the study. Data were analyzed using percentages, frequencies and tables. The results showed that pastoralists generally lacked access to timely climate forecast information. More than half of the pastoralists affirmed that the main sources of climate information were the radio, extension services, television and pastoralists 'personal observation. In conclusion, the study contended that climate forecast information is crucial to pastoral economy; however, timely access to reliable forecasting and early warning information would enhance capacity of pastoralists to adapt to climate variability. Hence, adequate training of extension workers and farmers on the interpretation and use of forecasts is necessary to enhance effective dissemination and utilization of climate information.

Keywords: Climate, Forecast, Information, Pastoralist, Transhumance

INTRODUCTION

Climate change has turned out to be most critical issue at the global level, regional and local level to such a point that it is considered as the severest challenge for the mankind in the present century (Kumar, 2014). Consequently, there is an emergent concern that climate variability and change, coupled with other environmental, social and political pressures, may overpower resilience of pastoral systems (Francis, et al., 2015).

Hence, the expected global temperature increase, more intense rainfall and more frequent droughts will have overwhelming effects on pastoral livelihoods. The economy of the vulnerable areas also declines in the event of these misfortunes considering that droughts and diseases resulting from floods affect the health of livestock which is the major source of livelihood for the pastoralists (Geoffrey, 2010). To navigate these risks, pastoralists need better and more complete information on both climate (long-term patterns over months or years) and weather (short-term changes in conditions).This would enable farmers and pastoralists take crucial crop, livestock, land and water management decisions before and during growing seasons.

Although, their decisions should be based on indigenous climate knowledge, but as precipitation patterns alter there is an increasing need for science-based climate information. But then farmers and pastoralists lack access to reliable forecasts on probable rainfall patterns in coming rainy seasons, and knowledge about the full range of technologies that they could use to ease production under increasingly challenging conditions. Consequently, it is problematic for them to make operational decisions, which results in increasing food insecurity and vulnerability, and persistent or even increased poverty.

In Nigeria, principal sources of climate services include; the Nigerian Meteorological Society [NMETS], academic institutions such as universities, non-governmental organizations and research institutions.

Kim, I.; Ikpe, E. & Sawa, B. A. (2016). Analysing the Importance of Climate Forecast Information for Transhumance Pastoralists in Katsina State, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 141-148

Although several studies have been carried out on adaptation to climate change in developing countries [Nhemachena, (2007); Ojiako, Manyong and Ikpi, (2007); Selvaraju, Subbiah, Baas, and Juergens (2006); Idrisa, Ogunbameru, Ibrahim and Bawa,(2012); Onu, (2006)], these studies do not look at the significance of Climate Forecast Information (CFI) and its linkage to adaptation to climate change by farmers and pastoralists.

In view of that, this study seeks to fill this lacuna and contribute knowledge to the general adaptation literature by analyzing the importance of climate forecast information for transhumance pastoralists in Katsina state, Nigeria.

The specific objectives of this study were to:

i. identify the socio-economic characteristics of respondents in the study area
ii. analyze how pastoralists in Katsina State accessed weather forecasting and early warning information.
iii. examine the pastoralists main sources of climate forecast information
iv. assess how access to climate forecast information influenced pastoralists adaptation decisions
v. assess barriers to utilization of climate forecast information in the area of study

LITERATURE REVIEW

Pastoralism and Climate Variability

According to Okoti, Kung'u, and Obando (2014), pastoralism is a complex livelihood system seeking to maintain an optimal balance between pastures, livestock and people in uncertain and variable environments. Pastoralism, therefore, is a subsistence system based primarily on domesticated animal production for meat, milk, hides and blood (Encyclopedia Britannica, 2009). The way of life of pastoral herders depends largely on mobile grazing of livestock. They practice differing levels of mobility, from sedentary herds that move within a locality, to transhumant herders who move between particular locations on a regular basis, to nomadic herders who have high mobility without regular patterns. (Blench, 2001; Joshi, Jasra, Ismail, Shrestha, & Wu, 2013)

Therefore, Nori, Taylor, and Sensi (2008) noted that pastoralism plays a crucial role in supporting local livelihoods, in contributing to national and regional economies as well as in in providing diverse ecological services in some of the world's poorest countries. However, its capacity to adapt to change is facing many challenges, including those posed by climate change.

Although long-term impacts are difficult to predict and are bound to vary from one location to another, most climate change models predict rising temperatures and decreasing rainfall in many dry land areas (Hesse and Cotula, 2006). Consequently, Bai and Bent, (2006) remarked that the quality, quantity and spatial distribution of natural pastures are mainly shaped by rainfall. Predicted changes in rainfall patterns are bound to result in increasingly scarce, scattered and unpredictable pastures. Furthermore, the number, distribution and productivity of permanent pastures and water points, which are so critical for livestock survival during the dry season, are bound to decline (Hesse and Cotula, 2006) Berhanu and Beyene (2015) also maintained that scarcer resources, coupled with current levels of demographic growth, are likely to lead to stronger competition between pastoral communities and between these and other groups - possibly resulting in conflict and even violent clashes. As a result, access to pastures becomes more difficult, leading to loss of livestock and of livelihoods.

Supporting the aforementioned, Oxfarm (2008), Seo and Mendelsohn, (2008) opined that there are also significant negative consequences including loss of livestock through heat stress or colder seasons; increase in animal pests and diseases; loss of land to agricultural

encroachment as the rise in rainfall raises the productive potential of the dry land areas; an increase in frequency of flooding, and the spread of human and livestock diseases that thrive during the wet season; declined animal performance such as growth, milk production, and reproduction. The resultant effects have been food insecurity in the most parts of Arid and Semi-Arid Lands (ASALs).

In the sub humid zone of Nigeria, infectious diseases continue to be the most common cattle health hazard. The principal ones are rinderpest, foot-and-mouth disease, and contagious bovine pleuropneumonia. These have led to the deaths of many livestock.

Weather Forecasting and Early Warning Information in Pastoral Communities

According to Dinku, et al., (2014) advance knowledge of climate information is important in helping farmers and pastoralists make decisions on resource allocation and type of agricultural enterprises in a season. Climate information coupled with agro-advisory services offers greater potential to enhance capacity of pastoralists to adapt to climate variability and climate change. The effects of climate change and increased climate variability mean that farmers and pastoralists have to make crucial management decisions based on available climate information (Mase and Prokopy, 2014)

However, they are hampered by their lack of access to science-based forecasts of the coming season, and also their lack of knowledge about the full range of crop and livestock management options that could help minimize rainfall-related risks (Mugabe, Admassu, Sall, Omolo, and HanKponou, 2011). Hence, Radeny, et al., (2015) opined that making available timely Seasonal Climate Forecasts (SCFs), which offer crucial information ahead of the next growing season helps livestock keepers to make informed decisions on when to migrate with livestock, destock and restock as well as adoption of livestock breeds that are more productive.

Similarly, Hansen, Challinor, Ines, Wheeler, and Moron (2006) admitted that forecasts can provide advance information so that farmers can adjust critical agricultural decisions, thereby improving efficiency, and enabling them to adopt the most suitable coping strategies An Early Warning System (EWS) involves the provision of timely and effective information, through identified institutions, which enables individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response (Shakespear and Godwell, 2014)

Consequently, for pastroral communities to be prepared, there should be early warning systems in place to disseminate information so that pastoralists take necessary action in advance. However, (Vermeulen, Aggarwal, Ainslie and Angelone, (2010) posited that many of the promising opportunities provided by early warning and climate information have not been fully exploited. Conversely, Dinku, et al., (2014) noted that the availability and access to such information and the ability to use it, is a serious challenge in most rural areas across the continent.

METHODOLOGY

Description of the study area

The precise location is between latitude 11˚7' 49"N, 13˚05' 22"N, and Longitude 6˚52'30"E and 9˚20'40"E and a total area of 24,192 km² (Patrick, 2012). It borders Zazzau Emirate in the south, Kano in the East, Daura in the Northeast, the kingdom of Maradi in Niger Republic in the North and Sokoto Emirate in the west. Katsina state has thirty-four (34) Local government Areas. See (Fig.1). Katsina State has a total land area of 23,938 square kilometres.The projected population of the state was put at 7,452,629 in 2014 from the 2006 figure at a growth rate of 3.2 percent. Majority of the population are Hausa/Fulani Muslims. The climate is semi-arid with average annual rainfall of about 689mm falling between May

and September. The major economic activities of the people are farming, livestock rearing and marketing of agricultural products (Umar and Musa, 2015 ; Ikani, 2015).

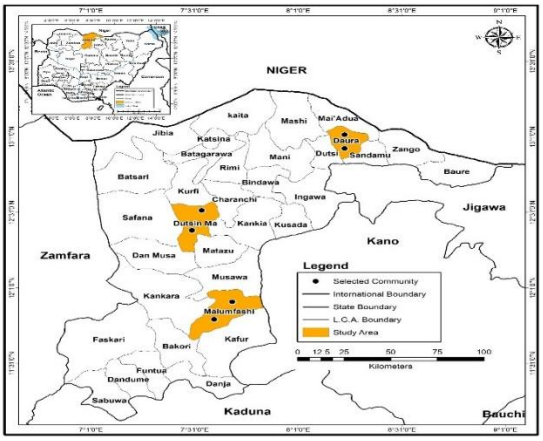

Figure 1: Map of Katsina State showing Study Area
Source: Adapted from the Administrative Map of Katsina State

Sampling Method

A multi-stage sampling method was used to select respondents for the study. Hence, one LGA from each senatorial zone was purposively chosen, two wards from each LGA were systematically chosen and two settlements from each ward were purposively selected (Table 1).

Based on Krejcie and Morgan's (1970) table of sample size determination, 367 pastoralists were interviewed .This is because the population of sampled communities is 7, 266(see table1) and according to Krejcie and Morgan's table could have a sample size of 367. Consequently, a total of 367 copies of the questionnaire were administered, while 300 (96 in Daura, 107 in Dutsin-ma and 97 in Malumfashi LGAs) copies of the questionnaire were retrieved representing 81.74%. Focus Group Discussion was also employed for data collection. The data obtained were analyzed using descriptive statistics and chi-square analyses.

Table1: Sample Size for Questionnaire Administration

Katsina State Senatorial Zones	Selected LGAs	Selected Wards	Selected Settlements	Population 1991	Projected Population 2013	Proportion of questionnaire
Katsina North	Daura	Madobi Sabongari	Tudu RumaSanda	478 717	925 1387	47 70
Katsina Cent.	Dutsin-ma	Dabawa Tsauri	Gamzoka Garazawa	491 850	950 1645	48 83
Katsina South	Malumfashi	Malumfashi Ungwa Arzuka	Kwarsu Makurdi C	542 677	1049 1310	53 66
Total	**3**	**6**	**6**	**3755**	**7266**	**367**

Source: Field work, 2015

FINDINGS AND DISCUSSIONS

Socio-Economic Characteristics of Respondents

Table 2 expresses the socio-economic characteristics of respondents in the study area. Regarding gender, nearly all the pastoralists (90%) were males. This implies that pastoral activities in the study area is male dominated. Various studies (Idrisa, Sulumbe and Mohammed, 2007; Onu, 2006) found that gender plays significant role in having access to production resources and hence utilization of information. Hassan, (2008) asserted that male-

headed households are often considered to be more likely to get information about new technologies and take on risks than female-headed households.

The age distribution of respondents has indicated that 20% of respondents (i.e. majority) were between the ages of 20 -24 and greater than 50 years. This by implication suggests that pastoralists in the study area were made up of young and fairly old people with over 70% having cognitive herding experience of 20 -30 years. This has further shown that the study area has large number of able-bodied farmers who have a greater tendency to utilize agricultural information/innovations (Obinne and Oche, 2001).

With reference to marital status, the results revealed that 80% of the pastoralists were married with a mean house hold size of 17 persons, whereas only 4% were widowed. Marital status has implication for utilization of agricultural information and technologies since married people are willing to seek information about improved technologies so as to enhance the welfare of their families (Idrisa, 2009).

On the basis of education, table 1.4 has expressed that pastoralists were literate to varying degrees. It has shown that majority (over 36%) had Islamic education. Education influences farmer's information utilization. Educated people are expected to perform certain jobs and functions with higher efficiency and are also more likely to utilize information and new technologies in shorter period of time than uneducated people (Ofuoku, Uzokwe and Ideh, 2006).Considering the income level of respondents, table 2 has illustrated that majority (33.33%) earned between 201,000 to 300,000 annually.This investigation further disclosed that in general pastoralist communities in Katsina state had medium economic status and hence may possess the financial muscle required to purchase and utilize ICT facilities.

Table 2: Socio-Economic Characteristics of Respondents (N=300)

SOCIO-ECONOMIC CHARACTERISTICS	NUMBER	PERCENTAGE
GENDER: MALE	270	90.00
FEMALE	30	10.00
TOTAL	**300**	**100.00**
AGE <15	18	6.00
15-19	12	4.00
20-24	60	20.00
25-29	30	10.00
30-34	18	6.00
35-39	36	12.00
40-44	42	14.00
45-49	24	8.00
>50	60	20.00
TOTAL	**300**	**100.00**
MARITAL STATUS		
MARRIED	240	80.00
SINGLE	24	8.00
DIVORCED	24	8.00
WIDOW/WIDOWER	12	4.00
TOTAL	**300**	**100.00**
LEVEL OF INCOME		
<100,000	40	13.34
100,000 – 200,000	60	20.00
201,000 – 300,000	100	33.33
301,000 – 400,000	58	19.33
TOTAL	**300**	**100.00**
LEVEL OF EDUCATION		
TERTIARY	78	26.00
SECONDARY	67	22.33
PRIMARY	40	13.33
ISLAMIC	109	36.33
INFORMAL	6	2.00
TOTAL	**300**	**100.00**

Source: Field work, 2015

Access to and Use of Forecasting and Early Warning Information

About 78% of the pastoralists affirmed that it was important for them to know about expected amount and distribution of rainfall as well as temperature trend in the subsequent season. Regarding questions on the awareness of the pattern of rainfall and temperature in the succeeding season, about 40% of the pastoralists claim to have knowledge. Concerning drought and violent storms, approximately 30% avowed that they got timely warning.

Main Sources of Climate Forecast Information

Sources of weather forecasting and early warning information include modern methods, traditional knowledge and farmers' observation. However, this research focused mainly on access to forecasting information from modern methods. More than half of the pastoralists stated that they receive weather forecasting information through personal assessment of weather parameters.

Furthermore, the pastoralists ranked radio as the most important channel for accessing information. This is followed by extension services and television. On the reliability of the modern forecasting information, majority (78%) admitted that the information was only 'reliable once in a while'.

Role of Forecasting Information in Farm Decision- making

Undoubtedly, a farmer has various decisions to make in the course of farming. Consequently, the pastoralists were asked about factors that mostly influence farming decisions. Three factors were cited and ranked in this order: Input costs, weather and climate information and output price expectations. These investigations indicate that weather and climate information is an important determining factor in farming decision in the study area.

Again, the pastoralists were asked to rank farming decisions that were mostly influenced by climate forecast information. The most important decision were knowing when to migrate, harvest water, collect fodder and choosing animal species as well as having more knowledge. Additionally, pastoralists ought to have information and knowledge on how to apply the forecast information received. Disappointingly, 56% of the pastoralists asserted that they did not have knowledge on how to effectively utilize the climate information received.

Barriers to Utilization of Climate Forecast Information

In the study area, the major challenges to weather information utilization included among others lack of timely advance information (42%), inappropriate and non-context specific information (35), undependability of information (13%) and wide spread illiteracy (10%). The preceding assertion is corroborated by Speranza, Kiteme, Ambenje, Wiesman, and Makali,[2010] that communication of climate information to support adaptation actions in Africa is hindered by several contextual factors: social-cultural, content-related and technological barriers. In addition, a study conducted by Gwimbi (2009) in Gokwe District of Zimbabwe, revealed that more than 70 percent of the surveyed farmers lacked access to timely Weather forecasts.

CONCLUSION

The present research found that there was a general lack of access to timely rainfall forecast, temperature trend and early warning information on droughts and violent storms. Some of the key channels that transmitted the information were the radio, extension, the television, and the farmers enquiring directly.Pastoralists acknowledged radio as the most important channel. Besides, the forecast and early warning information were perceived as not being very reliable. Although it played an important role in the decision-making process of pastoralists, particularly, when deciding the time to migrate in search of pasture, collect and store fodders and choosing livestock varieties. A severe constraint for pastoralists was lack of

complementary information, inputs, and technology that could be used to adjust their livestock management practices consistent with forecasts. The forecast and early warning information is imperative as it acquaints individuals and communities on the need to take action

RECOMMENDATIONS

Government and Non-governmental Organizations should:

i. Enhance farmers' timely access to reliable forecasting and early warning information
ii. Help in improving reliability of forecasts and early warning information through upgrading and maintaining meteorological stations and equipment, and enhancing the skills of the personnel.
iii. Adequately train extension workers and farmers on the interpretation and use of forecasts
iv. Enhance the knowledge and capacity of farmers in terms of general preparedness and adaptation to climate variability and change through provision of complementary information, inputs and technology

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Impact of Cities Physical Development on the Aged Lifestyle in Akure, Nigeria

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ABSTRACT

In Nigeria, the practice of aged support is solely anchored on the traditional practice of adult children to care. However, recent trends show that the aged now live alone in indecent houses that lacks housing related services and environmental benefits. Cities development patterns and infrastructure are presumed to be responsible for the non-cohabitation between the aged and their families in the cities as the aged find it difficult to adapt to the city lifestyle due to its non-compliance to their culture and communal life. This study therefore investigates the city defect on aged communal lifestyle and suggests how the situation can be mitigated. Qualitative data was collected through structured interview aided by voice activated tape recorder. Two categories of the aged were interviewed, those who reside permanently in the city and those that have come to live with their adult children. The aged who were at least 70 years of age, oriented to person, place, and time, were asked to participate alongside their adult children where necessary. Observations of the environment, and the participant expressions were utilized in combination with the aid of relevant literature on the subject matter. This study upheld the presumptions that city development pattern is a disadvantage and therefore concludes that it is to the uttermost benefit of the aged if urban development conform to the communal lifestyle of its inhabitants as this will improve family unity and give the aged the sense of belonging.

Keywords: Aged lifestyle, Akure, city development, communal life, Nigeria

INTRODUCTION

Old age is a status quo that is pervasive to every living creature. This age has a peculiarity of low strength and agility to cater and sought for themselves their daily needs. The need for some form of care, assistance and special consideration to residence provision increases as people move into older age, particularly for those aged 75 years and over (National Research Council, 2001). The customary practice of family support, which has been solely affixed on the capacity and willingness of adult children to care for their elderly parent in Nigeria is increasingly coming under threat of contemporary transformation in life styles and expansion of expectation (Omokaro and Ibrahim, 2011). It is of general view in Africa that children and relations must do their best to care for their elderly as it is part of African tradition.

Living is becoming more challenging lately owing to the general downturn of economy, a blame casts upon poor governance and actualization of the dividends of democracy in Nigeria, thereby makes the adult children in the family to have migrated to developed countries and cities in search of economic advantages, educational opportunities, and diversity of experiences that large cities provide. The need to keep the aged close to their adult children also have necessitated the relocation of the aged to the cities where their adult children live for proper care and close monitoring of their health as they grow older. Nevertheless, it has been observed that it does not take long before these aged return to their various old locality where care is far from them and their livelihood is been threatened.

The physical characteristic of the built environment is presumed to be responsible for the inability of the aged to fit into city environment as it is sensed that the pattern of the aged activities and lifestyle contradicts the planning of the urban cities from a holistic point of view. Rural communities where most elders grew are sparsely populated areas outside of large urban centers that have defined social, economic and cultural traditions associated with their region or community (Woods, 2005). The city development of the present generation does not conform to this well-established lifestyle and interest that the aged pattern of life have long been fashioned towards.

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To assist ageing in a place, consideration needs to be given not only to housing options but also to transportation, recreational opportunities, and amenities that facilitate physical activity, social interaction, cultural engagement (Wahl & Weisman, 2003) through the span of the aged remaining existence. Therefore, it can only be said that the aged is considered by understanding their communal lifestyle and investigation on how the physical development of a city can contribute to the sustainable ageing in the relocated areas.

The continuity theory of Neugarten, Havighurst, and Tobin (1961), as also supported by Atchley (1989), posits that successful adjustment to old age requires continuing life patterns across a lifetime. This continuity and a connection to the past are maintained through a continuation of well-established habits, values and interests that are integral to the person's present lifestyle. The aim of the study is therefore to investigate the physical development in the selected neighbourhood in Akure and its implication on sustainable ageing in the neighbourhood to ensure healthy living conditions for the aged. The objectives set to achieve this are to investigate the communal lifestyle of the aged in their old locality; access the level of physical development and infrastructure in the selected neighbourhood; evaluate ageing in selected neighbourhood in Akure; and access how the physical development contributes to sustainable ageing in the selected neighbourhood in Akure.

It is expected that the objectives itemized will enlighten on the challenges the physical development in the built environment poses on aged well-being in the society, and the need for government and key decision-makers to put in consideration the measures for ageing in place and out of place to make the environment sustainable to aged, giving them the sense of belonging, and thereby strengthening the family bond in the society.

LITERATURE REVIEW

In research, the focus is mainly on attempts to systematically probe a subject matter in order to uncover the cause and effect, the magnitude of a problem and its impact (Omokaro, 2010). The objective is to explain the multi variant nature and workings of the matter under discussion (Ibrahim and Omokaro, 2011) which in this case would be addressing the importance of bringing families together through proper city planning that considers all stages of life, with more consideration on the aged health as optimal aging involves staying active and managing to resist the shrinkage of the social world by maintaining the activities of middle age for as long as possible.

The Theories of Aged Right

As the most populous country in Africa, Nigeria currently has the highest number of aged or elderly people in Africa (Kinsella & Velkoff, 2001; Ajomale, 2007; UN, 2005). With the largest population in Africa and the seventh in the world, it is estimated that by the year 2050 the population of Nigerians aged 60 and above will constitute nine percent (9) of the entire population (UN DESA, 2015). This growth in the number of older people was explained as the increasing expectation of life, which results from improving living standards, better nutrition. These aged were able to attain this level of age because before they aged, they were able to seek out for themselves their necessary needs.

The four major theories that expresses the obligation of the children to the required care of old age people are (1) the developmental theory of sociology (2) the structural function theory (3) the role theoretical perspective and (4) the exchange theory (Omokaro and Ottong, 2004). The developmental theory of sociology has postulated that the care given to the aged should be based on cultural, systematic and learned behaviours, while the Structural Functional theory posits something related as it argues that care giving behaviour by adult children is systematically learned and developed through socialization and internalization of

cultural norms. The Role Theoretical perspective also postulates that care giving is a normative requirement and social role prescription, while the Exchange Theory perspective posits that care of the elderly by adult children is based on the norms of reciprocity and filial obligation. These four major theories that concentrated on aged care points toward a paradigms that the adult children owe society and their parents, provision of services and social values, and the customs of society confer legitimacy on the moral rights of elderly parents to such services (Omokaro et al, 2004). No wonder the adult children in Nigeria when interviewed felt strongly that care should be given to the aged by their children and expressed that it is even a taboo for a child not to attend to his aged parent's needs. One of the adult children interviewed in Lagos, Nigeria stated that dumping the elderly in seclusion from their relations is not fashionable as the elderly want to maintain their natural environment till their dying day which they believe gives a sense of belonging, freedom and responsibility to the elderly (Obasoro, 2011).

Decreased physical agility which is associated with old age necessitates their dependence on others for tasks such as shopping, bathing, housework, cooking among others. This poor physical health could also be made worse with mental health problems such as depression (Heidrich, 1998) caused by loneliness. Dean, Kolody, Wood and Matt (1992) affirmed the fact that elderly people who live alone has higher level of depressive symptomatology. Bower (2000) notes that it is tough to grow old when one lives all alone and without satisfying contact with either friends or relatives as such isolation carries an added burden in that it sharply boosts a person's chance of developing Alzheimer's disease or related brain ailments associated with advancing age.

In view of this, the need for the aged to move alongside their adult children to the cities arose as their stage in life requires close monitoring. Although this decision is necessary as it will help in moving the aged close to their adult children for proper care, but the urban city form of development have been frustrating the idea due to its non-compliance to culture and the communal lifestyle of the aged.

Aged Communal Lifestyle

Globally, the two major sets of people that dwell in today's cities either migrate from one locality or the city could have been their one time rural community. A larger percentage of the aged in Nigeria hail from one rural settlement or the other. These rural settlements are known for their disperse settlement style which does not actually conform to any pattern. It gives room to good spacing of residential houses, creating more of open spaces for gathering, recreation and sporting activities, green areas of good creature display that brings about innovation, pure and clean air good for body system among others.

Prior to the colonial era in Nigeria, open spaces played vital roles in the lives of the people in the traditional setting in the villages and towns, mostly in Yoruba land (Iloeje and Emenike, 2014). These open spaces serve as common places for connection of spaces, they also serve as area for social interaction, communication and share of ideas. The people of same community will group themselves together in peers to interact, play games and share memories. Sometimes the aged of the community will gather the children together for moral teaching, passing down the cultural and the historical information that is associated with the community to the children. The aged were never alone even when the adult children have left to farm as they will group themselves together to chat and relate.

It is easier to reason and discuss together as the whole community do feel concerned about their neighbour wellbeing, and their built environment encourage neighbourhood interaction. The houses are without fences, thereby encouraging even a distance chat between neighbours.

Theft and other criminal activities are found wanting in those settlement as everyone felt responsible for the neighbours wellbeing.

People in the rural settlement tend to live longer breathing unpolluted air and eating fresh food crops. There are numerous natural elements and green plant that relax the mind and boost creative thinking. Also the rural environment encourages walking ability over a long distance as the streets are connected through path ways. Most time in the evening, after the children might have returned back from farm, the aged will walk down many streets with their children singing and discussing.

The rural environment is not densely populated, therefore the number of vehicles are minimal and noise level is drastically low. This encourages the aged to rest well at any time of the day they deem fit, thereby positioned their health in good shape. This to mention a few are the characteristics of the life that most of the aged were brought up with, a lifestyle seen very different from what we have in many cities in the country. The lifestyle of the cities is characterised by fenced off buildings, doors steps road connection, pollutions due to the industrial discharges, noise from every angle.

METHODOLOGY

Structured interview questions were the data collection instrument adopted for this study. This methodology appears to be one of the most productive means of collecting qualitative data (Henderson, 1991) as it gives the respondent the opportunity to express themselves to the fullest. The aged interviewed were of two categories. The first set was the aged that have lived in the study area before it became a city and the second set were those that have migrated to the study area from a different locality. Due to the non-conformity of the aged to city lifestyle, the second set were fewer in numbers in the study area and therefore making the first set the dominant of this study. Nevertheless both group tended to reason along the same line as their salient points were quite related. This is not unexpected as it is known that today's city was once a rural settlement of the first group of the aged.

Information was also sought from relevant literature in order to exhume the in-depth knowledge of factors underpinning the aged views. This is needed to proof the credibility and the authenticity of the results. The aged who were at least 70 years of age, oriented to person, place, and time, as judged by the researchers, were asked to participate alongside their adult children. Application of the age screening criteria and the fenced off method of building development in the study area led to the limited population of 40 participants in all. Observations of the participant, the activities, the setting for interviews and their expressions were utilized. A voice activated tape recorder was used to record each resident's answers so as to capture all the responses.

The Research Study Area

Akure is a city in the Southwestern region of Nigeria and the capital of Ondo State. It is the economic nerve centre of Ondo State and a leading producer of mineral resources and food crops in Nigeria. It is located on the intersections of Latitude 7^{o} $17^{'}$ and Longitude 5^{o} $14^{'}$. It comprises of Akure South and Akure North Local Government Area. The study was carried out at the Aule housing estate in Akure south local government, Akure. Akure south LGA has an area of 331 km² and a population of 353,211 at the 2006 census (Fig 1). The maximum mean global radiation which occurs around (14:00hrs LT) varies in the course of the year from 512 W/m2 in the wet season to 543 W/m2 in the dry season (Falodun & Ogolo, 2007). In a seven year average (between 2001 and 2007), Akure received statistical mean daily sunshine hours of 5.21 hours (Afolami and Fadairo, 2014) and the recorded measured values for relative humidity of Akure in 2007 was close to 100% for the rainy season months

(Adediji and Ajewole, 2008). Average rainfall measurement for year 2010 review in the South West States (including Ondo State) was 2,000mm to 3,000mm (NIMET, 2010; as cited by Afolami and Fadairo, 2014).

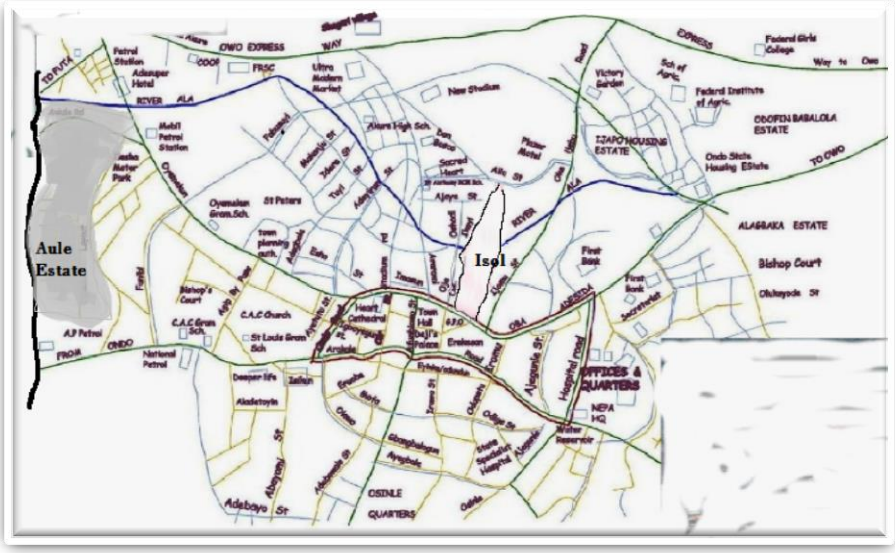

Figure 1: Map of Akure showing the study area
Source: Ondo State Ministry of Lands and Housing, Akure; 2010

FINDINGS AND DISCUSSIONS

Responses of the participants indicated that the most popular activities were sitting at home, and sometimes at daybreak, interacting with children. This finding was understandable in light of the fact that most of these activities were un-socially inclined and the study areas lacks neighbourhood relationship due to the house built pattern.

The investigation focused on the planning pattern of the study area as to discover its conformity to the culture and communal lifestyle of the aged living in that environment. Based upon the analysis of the data collected, three (3) themes were deduced from the communal lifestyle of the aged which were consequently tried on the environmental design of the study area. The themes are as follows:

i. The neighbourhood environment
ii. The house type
iii. Space planning and recreation

The Neighbourhood Environment

It was observed that nature does not exist in the study area any longer as the environment is connected with hard asphalted road network with no sidewalks. The participants explained that this was not the case in pre-modern times, when human settlements either integrated or co-existed peacefully with the nature. This statement is related to Kaveh (2012) study when he notes that during modern era of human development, growth of towns and cities displayed a separation between nature and human activities. The building surrounding was of hard landscapes of either over-site concrete or stone paved. Most of the natural infrastructure has been destroyed due to the city development that is said to focus on making life more convenient, with drive through services. One of the guiding design principles outlined with reference to the best qualities of the traditional neighborhood design from Congress for New Urbanism stated that "Neighborhoods should be compact, pedestrian-friendly and mixed use"(Urbanism, 2007). In a related study, Jacobs (2007) described the four necessary physical conditions for dynamic urban life as multifunctional neighborhoods, short blocks and

connected street systems, varied age residential areas and a high concentration of people. All this have been and made evidence in the traditional architecture that encompasses the culture of a community in accordance with the lifestyle of its people.

The cost of disregarding nature has extended also to quality of life. As stated by one of the aged, he emphasized that the disregard of nature in urban design of the study area in terms of housing type and choice of material, neighborhood planning, and infrastructure planning among others have make the area inhabitable. Among what was stressed by the respondents in neighbourhood planning is the difficulty in walking down the road. Inefficient transit service and precarious walkable environments was observed to have been another barrier to the adaptability of aged to the city planning as the urban areas remain largely auto-oriented and difficult to traverse on foot. Over the last three decades, both research and practice have provided substantial evidence confirming that walkability is essential for improving social integration, enhancing urban quality of life and maintaining physical health (Doyle, Kelly-Schwartz, Schlossberg, 2006). Evidence to date suggests that adults living in more walkable neighbourhood (ie, higher residential density with mixed land use and connected street networks) have higher levels of transport-related walking, overall physical activity and a lower body mass index (BMI) than those in less walkable neighbourhood (Doyle et al., 2006; Saelens, Sallis, and Frank, 2003).

This came to be due to the lack of pedestrian walkway as regards road planning in one hand and recklessness of the vehicular drivers on the other hand. Walking is so essential to the aged for it is the only possible exercise that their ability can tolerate as it offers relatively little risk of injury. Research has affirmed that each exercise session appears to be additive in reducing the risk of infection over time (Nieman, 2001; Hu et al, 2004; Davey, 2000; Laverty et al, 2015) and those positive changes in the immune system occurs during moderate exercise. Sidewise this, during the time that the adult children that the aged are residing with would have gone to their places of work and the grandchildren to school, the aged could like to take a walk to relief loneliness and boredom. This culture is common in the traditional setting as it improves neighborhood relationship. It is therefore not advisable for the aged to walk by the road side due to the absence of pedestrian walkway and inconsistency in driving of the motorists to avoid the unexpected.

Aside this, the new social crime that concentrated on the aged is also not helping matter. Senior citizens or the aged are now been kidnaped to extort money from their adult children, a situation that is lately rampant and seems uncontrollable. To avoid distress, most aged are always being restricted of movement in the neighbourhood. The study area is also known for its high sun intensity, the reason behind its slogan as the sunshine state. Therefore, the choice of hard landscape pattern adopted in the study area have resulted in an unbearable heat in both the interior and the exterior of the environment as it was stated by the respondents, causing discomfort to the elderly.

House Type

Housing, a subset of traditional architecture, evolves from the culture of a community in accordance with the lifestyle of its people, the materials for construction available, and technical possibilities open to them (Gardi, 1973; Olotuah and Ajenifujah, 2009). Advocates of housing pattern that evolves from a people lifestyle described it as pleasant, private, and safe. They claim that it creates a sense of togetherness and tight-knit community among their residence. Moreover, the residential development in the study area has long deviated from this trend as stated by the older participants, they now provide a lifestyle and higher quality standards of living as it may seems with a homogenous social groups. This new pattern of residential development in a community is what researchers termed “Gated

Community/Society" (Teipelke, 2011). Exclusive amenities like swimming pools, children playgrounds, and other recreational facilities were added advantage of the present way of development but the gating phenomenon is not without costs (Al Shawish, 2015). Being self-sufficient and large enough, it detaches those living inside from the outside world; on the other hand, it denies access to the outside world (Ayna, 2011).

As it was deduced from the interview, the aged tends to have the same feeling in this regard, a phenomenon that they stated posed isolation and gives the feeling of been cut off from the world. As stated by Mrs Ajayi (aged 81),

> *"I have stayed more than five years here in Akure but hardly know well even this area I am. My daughter forbid me of walking around, said it's risky. So I took pleasure in walking round the house while I listen to what goes on in the environment. Due to this high fence I could not deduce what is going on around, and when it feels weird, I will return to my room awaiting the return of my daughter."*

Mr Adewale, a retired civil servant staying in his personal residence also expresses the discomfort that the high level fence poses. He explained that the high fence became necessary due to the insecurity state of the country. According to him, he stated that the present life pattern in the estate have created an isolation of neighbourhood and eradicated neighbourhood relationship. He commented that he and his neighbor next to his door steps only do meet accidentally or during the monthly landlord association meetings.

Previous research has identified a wide range of indicators of social isolation that pose health risks which includes living alone, having a small social network, infrequent participation in social activities, and feelings of loneliness (Waite and Cornwell, 2009). The isolation of individual neighborhoods from each other and from the public spaces that the new pattern of residential development is associated with is completely unacceptable and hard to adapt to by the aged. As other cities in the world have their reasons for the adoption of this pattern of development (Levent and Gülümser, 2007; Touman, 2002), the respondents allied their reason to security improvement. Meanwhile, this development type has restricted the aged in their everyday life and most time confined them into a room creating a lifeless, blank, and windowless walled streets between them and the society. This in return has led to the loss of public life, limits their experience of the city, and consequently resulted in life frustration.

Space Planning and Recreation

The benefits of quality recreation spaces in a neighborhood include encouraging people to be more physically active, enhancing opportunities for social interaction with others, and relieving stress and mental fatigue, thereby improving the health of its users. (Richardson, 2013). The African concept of recreation as well as physical exercises includes acts such as dance, acrobatic and gymnastic displays during cultural festivals and other related occasions. These activities are usually done for enjoyment and refreshment as well as finance in some situations. Many of these activities are carried out in special places earmarked for recreation; however in the absence of these special spaces, children, youths and adults in the society have had to improvise (Ajenifujah-Abubakar and Ojo, 2015). It is the major determinant of their life consciousness as a basis for the adoption of value and attitude that influence their behaviour in other aspects of life. Among the measures which have received considerable attention in recent years in understanding measures that contribute to an enhanced quality of life for institutionalized elders are recreation/leisure activities (Teague & MacNeil, 1992). Although these aged have past their prime in terms of physical activity and strength, but their first-hand knowledge of historical events, wealth of experience and hindsight, makes them veteran advisors to the young.

CONCLUSION

The study has revealed a major shortcoming in development, highlighting the particular plight of the elderly population, who by choice of not their own making, cannot move about freely and can only engage in restricted leisure activities within the confines of their immediate physical environment. The healthy functioning of a natural system, including their life-sustaining processes, depends on all species participating in a coordinative way. If cities are built in such a way that children could play in creeks, the families could watch the sunset and the night sky, and sometimes there is quietness, the feelings of change of environment from ones locality would be eliminated and the city dwellers would begin to know nature again. Respect for cultural and ethnic diversity and the recognition of multi-cultural leadership are important inputs to a healthy city. For the benefit of actualizing the focus on proper care for the aged, the unionism of the aged with their adult children has to be attained. The family union could be achieved if adequate consideration is given to the aged communal lifestyle during city planning to make the environment sustainable to them and thereby improve their sense of belonging in the community. To accomplish this, the lifestyle pattern of the aged and their birth community needs to be understood and a way to balance the city development to conform to the communal lifestyle of the people has to be addressed.

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The Influence of User Perception and Social Sustainability on Architectural Design

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ABSTRACT

Social sustainability is understood as creating a successful place that is founded on what people need from the places they live and work. Research in social sustainability suggests that this combines the design of the physical realm with the design of the social world. Architecture on one hand has contributed a great deal in the design of the physical realm. On the other hand a variety of social concepts like place making, perception, sense of place, livability, and community resilience to mention a few have significantly contributed to the design of the social world. However, very little attention has been given to the effect both realms have on the other. It is with this in mind that this paper set out to highlight the influence of user perception and social sustainability on Architectural design. To achieve this, this paper assessed students' perception in the design of architectural studios with Ahmadu Bello University as a case study. Through a review of relevant literature, a theoretical background was established between social sustainability, perception and architectural design. Furthermore, themes in form of design requirements were identified and validated by focus grouped discussions. Questionnaires (65) were used to collect primary data from the student respondents to assess their perception in the design of architectural studios. Results showed the priority of the user needs in the design of Architectural Studios. In addition, the students' perception helped to clearly show a strong link with the concept of user perception and social sustainability in Architecture. This paper recommends that, due to the subjective nature of social sustainability with respect to its location and the constant demand to satisfy user needs, the concept of user-perception should be incorporated in architectural design as a major tool in the architectural design process.

Keywords: Architecture, Design, Social sustainability, Sustainability, Perception

INTRODUCTION

In recent times, there has been a lot of demand on the concept of sustainability. In every discipline and profession the concept of sustainability has taken a major focus and is incorporated in fundamental aspects. In 1987, the world commission on environment and development sought to address the problem of the conflicts between the environment and development goals and thus coined a definition of sustainable development.

> *"Sustainable development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs". (WCED, 1987)*

This definition highlighted the displeasure on a global scale of large projects, which were at the expense of local peoples and the natural resources. Due to the destructions of the ecosystems many were subject to displacements and vulnerable to job loss (Carley and kirk, 1998). Thus the mandate in 1987 recognized the strong bond between the people, the planet and wealth and advocated and still advocates that policies fully consider these three components to ensure that none negatively impact the others. Furthermore, this mandate has given birth to extensive discussions and interpretation of the concept of sustainable development based on these three components otherwise known as economic, environmental and social components of sustainability (Harris et al., 2001, Reed, 1997).

According to Mebratu (1998), these three components of sustainability have provided a complicated platform for understanding the Brundtland definition of sustainability. Over the past twenty years, the three components were intended to encompass sustainable development. However, sustainable development has been compartmentalized as an environmental issue (Paper, 2012). In addition, there has been a general orientation of

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sustainable as economic growth by both the developed and developing countries. This has not only highlighted the neglect of the social component but has also pointed the priority given to economic and environmental components of sustainability whilst neglecting the social aspects of sustainable development.

Put differently Variance, Perkins and Dixon (2011), pointed out that for the past two decades the social mandate of the sustainable development, which strongly represents the human dimension has been neglected due to a focus on bio-physical environmental issues and the increasing emphasis on economic growth.

Research has shown that despite the extensive body of literature on the social aspects of sustainability, there are still a gap and a need for a better understanding of the meanings and interpretations of this concept, especially when considering it from an interdisciplinary approach (Weingaertner and Moberg, 2011). However this paper would focus on an interpretation of social sustainability in Architecture. With this in mind, this paper set out to highlight the influence of user perception and social sustainability on architectural design. To achieve this aim the following objectives were outlined:

i. To establish a theoretical background between social sustainability, perception and architectural design
ii. To identify variables for assessing user perception in the architectural design
iii. To highlight the influence of user perception on architectural design

Meaning of Social Sustainability

Many definitions in Literature suggests that there is no single definition to social sustainability. However definitions that exist have been derived according to specific disciplines. For example, Konning (2002), maintains that social values such as culture and social justice should be focused on in providing social sustainability. Also, Littig and Griessler (2005) stressed the relationship between nature and the society in providing social sustainability. They added that this relationship can be further understood as "work in the society" and "needs".

Though there is a list of definitions a recurrent concept highlighted in the literature of social sustainability is …meeting human needs. Kefayati and Moztarzadeh (2015) in their study of developing effective social sustainability indicators in Architecture highlighted that social development are designed to improve the quality of human life and consider measures to meet human needs. Consequently, Nastaran, Qasemi and Hadizadehzargar (2013), opined that these strategies pay attention to the welfare needs, cultural and psychological needs, the need for adaptability and the need for growth and development, which are regarded as important human needs in the new society.

Contrary to the views of Sachs (1999), Godschalk (2004), and Chiu (2002, 2003), in identifying different aspects of social sustainability and connecting and connecting them to sustainable development, Vallance, Perkin and Dixon (2011) suggests that social sustainability, drawing from the Brundtlandreport provides an opportunity of reconciling peoples' need with the bio-physical environmental management goals through economic development. They further explained that these needs were either tangible or less tangible necessities of life and if not met would hinder bio-physical environmental concerns.

Thus we can conclude that social sustainability is one of the key component in the drive for sustainable development. In addition, human needs are seen as very pivotal in achieving social sustainability. These needs may be regarded as tangible as in welfare or less tangible as in psychological and cultural needs among others. Therefore human needs are a dimension in social sustainability.

Social Sustainability and Architecture

As stated previously, social sustainability can be seen as the focus of the present and future generation that is meeting human needs and improving the quality of life among others. An equivalent response in Architecture to this definition is to create a responsive Architecture that is consistent with the basic needs and behavior patterns of humans to improve the corresponding spatial qualities for all segments in the society (Kefayati and Mozatarzadeh, 2015). What is known as social sustainability today in Architecture is derived for the socio-cultural approaches in Architecture. Consequently, Architecture with an approach to social sustainability focuses on the design of spaces that are compatible with the culture, behavior and methods of human life for the maximum time possible and is suitable for human life for prolonged times. This clearly shows the strong relationship between social sustainability and architecture in achieving human needs. Thus a socially sustainable architecture is one that designs based on the study of human needs and behaviors in a way that there is a relationship between man and the built environment. Put differently, human needs and behavior must be reflected in the design for it to be socially sustainable.

Over the years, research has proved that human behavior has been carefully studied to propose varieties in the practice and execution of architectural design. Most books on Architectural design have guidelines and principled that caters for range human behaviors in Architectural building products. However this is not the case with human needs which are dynamic and cannot be streamlined to specific guidelines.

User Perception and Human Needs

Environmental psychology is the study of transaction between individuals and their physical settings (Clifford, 2007a). He further stated that environmental psychology has fundamental psychology as a process which included concepts like perception of the environment, spatial cognition and personality (Clifford, 2008).

Perception as a concept is not absolute, reason being, individuals perceive and view things in different ways. Perception is the process of using the senses in understanding, acquiring and mentally interpreting information about the surrounding environment and situation (Demuth, 2013). The consideration of the users' perception in the building is a very crucial component in obtaining a good design. This concept of perception to some certain degree has been adopted and developed in post occupancy evaluation (P.O.E.). This has assisted professionals in assessing the performance of buildings.

Demuth (2013), and Eysenck and Kean (2008), listed a few theories relevant to the concept of perception. They include:

i. Gibson theory of Direct perception
ii. Constructivist theories of Perception
iii. Gregory theory
iv. Computational theories of perception

A careful look at this theory, one would observe that experience is key in obtaining meaningful perception.

The concept of user perception is not new in world of architecture and design, it has to do with how the users or occupants of a space perceive or feel about the space they are in. Applying the concept of user perception will help during the design and planning stage in a design process to accurately provide spaces that are functional and that meet the needs of the user of the space. It also helps in assessing the performance of the buildings after construction as seen in post occupancy evaluation. It describes the opinion of a set of people already using

a space in order to accurately provide spaces in a new design or to guide professionals during the renovation or maintenance of that space. It is from this concept of assessing the user perception of users of a space that the concept of post occupancy evaluation emerged.

User needs in buildings are the likes and desires of the building occupants (the people who use and work in buildings everyday but usually have no active part in designing and managing them). It is crucial to recognize and establish the fact that user needs are growing and increasing by the day as man and his environment evolve and discover possibilities that were not known before, from basic activities that are carried out in buildings to more diverse activities. This increase is a product of changes in weather and climate, technological development and advancement, social and economy factors, increase in world population, increase in crime rate and terrorism, increase in the occurrence of natural disasters. As a result of these factors, professionals in the building industry are making efforts to provide more sustainable, efficient and secure methods and systems in designing, constructing and operating buildings to meet the needs of the building users. This is in line with the concept of social sustainability.

Contribution of assessing user needs in the design of buildings

Building designs that focus on the users and catering for their needs will naturally perform better than buildings that are just designed off the shelf without proper study and research and application of this research in the design process. In some projects, these researches are done and carried out by the professionals but it is evident that in a number of buildings been built today that very little of the information gotten from the studies are used. This shows the dearth in the use of social sustainability in architecture. However, user needs, to a certain degree has been met in residential buildings than in the other types of buildings, because the client who in most cases is the user or occupant of the building is more directly involved in the planning and design of the building. This is not the case in other types of buildings like the institutional buildings. It is with this in mind that this paper set out to establish a link between user perception and social sustainability in Architectural design.

METHODOLOGY

After a thorough study of the concept and developing a conceptual framework through relevant framework, this paper decided to prove empirically the link between user perception and social sustainability in the design of architectural studios. Thus, architecture student perception were assessed in the design of architectural studios. First, after a study of relevant literature basic design considerations for Architectural studio design were outlined. Ogunsote and Prunscal-Ogunsote (2012), gave a summary of the design requirement of Architectural studio design based on their study of leading architectural schools in the world. They include; sufficient space for a standard workstation, working surfaces, exhibition spaces, social spaces, computer laboratories, natural lighting and ventilation, study rooms and discussion rooms, standard space requirement per square area for each student, conveniences, adequate storage facilities, dining areas, modeling space, uninterrupted power supply, intranet and internet connectivity model gallery. These considerations were used as themes in assessing the students' perception in the design of architectural studios. They were validated using focused group discussions.

Data assessing the perception of student was obtained through a structured questionnaire administered to students of the department of architecture, A.B.U., Zaria. The Zaria school of architecture has four (4) levels with over five hundred (500) students. Considering time, available resources, accessibility and most especially experience, the 400 level students were chosen as the representative sample. The sample population comprised the 400 level students of the Zaria school of architecture, reason being that they have had the highest level of

experience and training at the undergraduate level. A total number of 65 questionnaires were distributed and 60 collected. Data from the structured questionnaires were translated into numeric codes by the researcher and data capture was done by statistical analysis using SPSS (version 2 1) and Microsoft excel (2010) computer programs. The following presents the findings of the study.

FINDINGS AND DISCUSSIONS

Table 1: Students' Perception in the design of an Architectural Studio

	Design Consideration of Architectural studios	Level of Importance					Average Mean Value	Rank
		5	4	3	2	1		
1	Uninterrupted Power supply	49	8	2	-	1	4.73	1st
2	Digital Architecture laboratory	44	13	2	-	1	4.68	2nd
3	Internet Connectivity	45	11	1	3	-	4.62	3rd
4	Conveniences	36	17	6	-	1	4.44	4th
5	Work station for illustration of ides among students	33	21	5	1	-	4.42	5th
6	Alternative Power Source	36	17	4	2	1	4.41	6th
7	Storage facilities	28	24	5	3	-	4.29	7th
8	Exhibition and Gallery space	28	21	8	2	1	4.19	8th
9	Group discussion and Study Rooms	30	18	7	2	3	4.17	9th
10	Intranet Connectivity	26	20	8	6	-	4.11	10th
11	Combination of Digital and manual workstations	19	24	13	4	-	4.10	11th
12	Customized or personalized work station	25	19	7	4	5	3.92	12th
13	Sinks for washing equipment	13	28	10	9	-	3.89	13th
14	Professional laboratories	16	23	17	2	2	3.83	14th
15	Rest Relaxation area, Snack Bar, Sleeping Niches	17	16	13	12	2	3.57	15th
16	Digital Workstations only	6	14	28	10	2	3.20	16th
17	Manual Workstation only	9	13	21	12	5	3.16	17th
18	General workstation	8	14	25	6	7	3.08	18th

Source: Researcher, 2015.

Table 1 shows the analysis of students' perception in the design of architectural studio. A look at the table above, the priorities of the architecture students' needs in the design of an Architectural studio in Ahmadu Bello University, Zaria can be clearly seen. The students rated 'uninterrupted power supply', 'digital architecture laboratory', 'internet connectivity', and 'work surfaces for illustration of ideas' amongst the topmost priority with average means of 4.73, 4.68, 4.62 and 4.42 respectively. While 'digital workstations only', 'Manual workstations only', and 'General workstations' as the lowest with mean averages of 3.20, 3.16 and 3.08 respectively.

From the results, it can conclude that other than validate the themes used in the design of architectural studios; the students' perception clearly outlined the priorities of their specific needs in the design of Architectural studios. Thus we can infer that there is indeed a strong link between user perception and social sustainability in Architectural design.

CONCLUSIONS

This paper set out to establish a link both conceptually and empirically between user perception and social sustainability in Architecture. Through the study of relevant literature starting from the Brundtland report and other views on sustainable development, it was established that social sustainability has been neglected when compared to the other components of sustainable development (environmental and economic). However, it was proven that the social component of sustainability contributes equally to sustainable development. Furthermore, one important theme that was used to describe social

sustainability was 'meeting human needs'. Through environmental psychology, the concept of user perception was seen an effective way to assess these needs in architecture. From the research carried out it was proven that user perception goes beyond validate user needs in architectural design but clearly prioritizes these needs thereby by creating a strong link between user perception and social sustainability in Architectural design. It is recommended that user perception be used as a key component in teaching and practicing architecture thus incorporating social sustainability. However further research should be carried out to incorporate more concepts in the practice of social sustainability in Architecture.

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Challenges in Conducting Field Studies in Nigeria: The Built Environment Sector

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ABSTRACT

Research activities across all sectors generally have their challenges. However, the Built environment sector presents peculiar challenges, particularly with regards to field research, which need to be highlighted and documented to serve as reference for future researchers in the sector. Field research is a way of unearthing valuable information gathered preliminarily from a focused area guided by known template and using accepted research methodology while adhering to strict ethical guideline. It affords the researcher a huge opportunity to have a first-hand experience of the research terrain and an experimental contact with the population of interest to the researcher. A further significance can be found in the influence that filed work can have on the epistemological positioning of the researcher, as it facilitates observation and interpretation of the real world. Additionally, fieldwork can be a tonic and a morale booster for the researcher, providing clarity and purpose for the research, and helping to shape the research questions and possible solutions. However, the experience encountered during fieldwork can be sector and country specific, depending on research, institutional, educational, and physical infrastructure in place. In the built environment sector generally, and developing countries in particular, the challenges faced by researchers on field studies cannot be taken for granted. These challenges can be significantly ameliorated if researchers form the habit of documenting their experiences in their thesis to guide subsequent researchers embarking on field studies in the sector or country. This paper through a documented personal experience and critical literature review brings to fore the challenges encountered during fieldtrip by researchers in the built environment sector of Nigeria and the need to be abreast with such challenges while taking up any research topic in the field of the built environment in Nigeria. It is expected that future researchers in the built environment sector in Nigeria and developing countries generally will benefit from this study.

Keywords: Built Environment, Field Research, Challenges, Nigeria, Developing Countries

INTRODUCTION

Field work is a good significant part of a good research. As widely known, field studies is a way of extracting that valuable data collected primarily from a defined area guided by known template and using accepted methodology. Access to quality data facilitates important discoveries and allow hypothesis to be verified or refuted, helping to shape the response to a research question. However, access to quality data is a major challenge in the built environment sector, which implies the physical environment in this context, particularly in the developing countries. The challenges are more acute in Sub-Saharan Africa and Nigeria is no exception. On Over and above, the relative under development of the built environmental, sector of the economy in Nigeria such as lack of local manufacturing of components needed for the development of the physical environment especially the construction sub sector results in little synergy with the economy; leading to over dependent on importation of construction materials and resulting in little opportunity for research in the development of indigenous building materials. According to the immediate past Minister of Industry, Trade and Investment Dr. Olusegun Aganga (in 2014), Nigeria spends over N500bn ($3.3b) on importation of building materials yearly, which he said may increase to $15b in the next few years. It is in view of this that as a built environment professional and a researcher in this field; I saw the need to highlight and document experiences with data collection to serve as a guide for future researchers in the sector.

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Challenges of Field Studies

Finding an appropriate balance between the requirements of ethical research and the requirement of academic success can be challenging, particularly for novice researchers. Participants such as the respondents as well as established authority as the case may be may request that researchers withhold publication of result for a period of time so as not to undermine local initiatives. In particularly, with sensitive cases, participants may request that researchers not publish the findings at all, leaving researchers in a compromised position in terms of their professional advancement. This can put doctoral researchers in a position of unexpected professional vulnerability –potentially jeopardizing the timely completion of their programs.

All these should be made visible by the graduate school in such a way that possible challenges in fieldworks be included in the generic courses designed for researchers. The tensions in this regard can further be explicitly addressed by creating easy access to research school for ease of consultation during field works surprisingly too. In many cases, research participants can become actively involved in all stages of the research due to personal or cultivated interest in the research topic. Some research participants become so involved to the extent of resources contribution, thereby leading to exerting control and undue influence in the direction of the research. This brings to fore the position that "power can be democratically shared vis-à-vis participatory involvement". However the extent/ modalities has been repeatedly called into question (Gilles & Alldred, Page 43).

Major challenges that researchers generally confronts are summarized thus

i. Restricted access to key actors in the sector.
ii. Residual negativity based on poor practices and ethical abuses of past researchers.
iii. The cumbersome nature of government bureaucracy and protocols.
iv. Difficulty of working in politically charged contexts.
v. Risk factor in working in war zones.

These are explained below as follows:

Restricted Access to Key Actors

In a number of cases, potentially interesting participants failed may fail to return repeated calls. And in the end, the researcher would have no option other but to accept their tactical refusal to engage in dialogue on the subject matter., although Although some researchers may found find the lack of response to various queries somewhat dis-hearting, one would be more grateful to those who did consent to respond or to engage in an interview. It is equally most fulfilling too. However, whether the lack of interest on the part of policy makers reflects logical constraints, skepticism towards the researcher interest or some other reasons remains unknown.

Cumbersome Nature of Government Bureaucracy and Protocol

Foucault's interpretation of power as multidirectional, "Operating from the top down and also from the bottom up" (Dreyfus and Rainao, 1983 p.185), is useful here. Certainly, a multi-directional understanding of power does not preclude the possibility of domination or oppression (in this case, in the context of potentially unequal researcher – participate relations) but rather, acknowledges the potential for interviewers to resist domination. Perhaps, the most obvious – and relatively low risk-way that interviewers (both marginalized and elite) resist domination is through non-participation; or would behoove novice researchers to keep at the fore that participants access is a privilege and not an entitlement and to adjust expectations – and assumptions – regarding participation accordingly when planning research process. This would greatly enhance the researcher's delivery capacity in a timely and effective mannerly; with minimum stress possible.

Residual Negativity Based On Poor Practices and Ethical Abuses of Past Researchers
Interview access can also be denied for reasons completely unrelated to the project (and researcher) in question. Poor practices and ethical abuses of past researchers can legitimately result in limited access to respondents or interviewers. Misconduct by researchers can harm a participant community and spoil future research opportunities.

Field Work during Politically Charged Period
Generally, conducting fieldwork during electioneering year is particularly difficult within a politically charged context. Skepticism creeps in and respondents / interviewers become much more reluctant to respond and much more restrictive with the level of information given. Respondents in some instances relate the researcher with electioneering campaign as well as become hostile. In some instances they relate the researcher with bad governance – believing you are a government agent or worker.

Risk Factor – Field Working In War Zones
Conducting research field work in war zones can be extraordinary challenging especially if it is deemed a war zone, conflict ridden and unsafe by international media. This is in the context of not being able to perform normal actions performed daily at a time of peace, This otherwise simple daily actions become challenged by chaos of warfare. Activities such as eating, drinking, finding shelter and protecting oneself from harm can often become recurring struggles, necessary for survival. As such, the usual challenges of empirical research are intensified and are accompanied by various new contests, many of which interconnect the broad categories of methodology, practice and ethics. Some of these new challenges such as the difficulty in receiving funding, the importance of the researchers ethnicity or nationality in conjunction with the wider potential danger of transporting research notes are in essence simple functional dilemmas that merit only a passing reference.

There are however, certain new challenges that deserve particular attention as they developed alongside other research contests, amplifying methodology and ethical qualms. These challenges concern both access to information in the war zone, as the rapidly changing nature of the conflict produces new practical and ethical contest and the character of the researcher, the conflict presenting them with new challenges during which they must rely upon their own judgment (Hellbart, Hellman-Rajanayagam and Koff 2010: 374/380). Summarily, therefore, the difficulty of this imperative element of fieldwork process is heightened in war zones for many reasons. Firstly, the scientific side to academic fieldwork is near devastated as solid accountable statistical data is almost impossible to accumulate. Methodological norms proficiently applied to research in stable settings for decades are difficult to employ in conflict areas. Systematic data collection through surveys and other tools fail due to war – time population movement, significant number of potential participants in hiding and the security situation dictating from where and whom result can be obtained (Ibid: 356, Barakat, Chard, Jacoby and Lume 2002: 993).

Challenges of Research in the Built Environment
For the built environment researchers whose objective is to engage in participating community based field research, the availability of filed work references (including densification of relevant, timely and topical issue as well as community willing to participate in research) is a minimum prerequisite for success. Nevertheless, no matter how prepared one is during the build-ups to conducting field works, one would always be surprised by the degree of professional challenges experienced during the field work stage of the research process. Furthermore, one would be equally surprised to find little methodological or theoretical guidance within the existing research literature, relevant to doctorate field work challenges in general. Meanwhile, doctoral field works in the built environment in particular

remains an under researched area -one seldom addressed in literature. It therefore, follows that a worthwhile research in the built environment in Nigeria is hampered by a number of factors.

The Traditional Built - Environment Professions Educational System:-
The existing educational patterns in the built environment schools do little in creating an attractive research environment for students; by emphasizing intuitive design methods and de-emphasizing academic thought and values. ..The professions in the built environment have over the years attached status to practitioners and conferred only limited recognition for academic and research pursuits, (Sterling, 2009). However integrating designs, research and practice can be viewed as a new strategy for achieving a productive dialogue about the visual environment (Sanoff, 1991). More so as there is a growing dynamism and complexity in modern buildings, environment and building codes as well as the society.

Inadequacy In Human Resources:– It is admitted in the 2004 report by the Nigeria University Commission that human resources to conduct research in Built Environment disciplines are still present in Nigeria Universities and Research Institutes, but their capacity in terms of competence, commitment and population is inadequate. This problem is further compounded by the excessive brain drain currently being experienced in the country leading to very few hands left to attend to the daunting environmental challenges.

Paucity of Research Funds:- This is a leading factor hampering research and development in Africa generally and in Nigeria specifically; particularly in all professions under the Built Environment sector. According to NUC report of the impact assessment of Research Grants and related activities in Nigeria Federal Universities, 2009, fiscal resources needed to fund and sustain research are meager and where allocations for such are made and available, they are often misappropriated It is also on NUC record that for the past one and half decades, Nigerian Universities expended over 98 percent of recurrent expenditure paying salaries and allowances and 2 percent on maintaining services, with zero allocation for research. Meanwhile, of the total funds granted for research nationally, between 1990 and 2003, less than 20 percent were actually allocated to NUC by Government as shown in table1herewith, and out of these, less than 50 percent was actually allocated to the Universities, and out of this allocation, less than 3 percent of the money was utilized for research. However, research activities over the years have been self-funded, that is, the money spent comes from parents and the meager salary / income of the researchers (graduate students, staff-in training, academic staff or self-determined individuals and professionals. This is a fiscal cranium where research can never thrive and will be stifled.

Table 1: Research Grant Allocation and Releases from 1990- 2003.

S/N	Year of Release	Allocation	Amount Released
1	1990	24,000,000.00	22,075,371.00
2	1991	51,266,530.00	16,645,034.00
3	1992	14,500,090.00	17,472,972.00
4	1993	122,182,102.00	122,182,102.00
5	1994	132,213,817.00	98,662,255.00
6	1995	155,534,575.00	73,973,806.00
7	1996	153,842,000.00	50,583,686.00
8	1997	194,013,732.00	122,020,447.00
	1998	215,618,453.00	149,993,549.60
9	1999	302,735,543.00	183,501,468.00
10	2000	448,127,780.00	612,666,910.00
11	2001	206,410,910.00	206,410,619.00’
12	2002	Not available	Not available
13	2003	73,435,618.00	73,435,618.72
	Total	2,146,657,150.00	1,799,637,713.32

Source: Okebukola P. (2004)

Weak Research – Industry Collaboration.

The link between theoreticians and practitioners is not well fostered. If its were well fostered, research solutions would have for long emerged to the quibbles in the built environment professions. It is believed that fruitfulness of any research on the human environment would be predicted on continuous feedback with a cooperative collaboration between researchers and professionals who often utilize such research products,(Okebukola P. (2004).

METHODOLOGY

The study made use of data and information from both primary and secondary source. Primary data were collected through my experience during the field work in the Federal Capital Territory (FCT) while carrying-out a research in "Designing for Sustainable Communities in Abuja, the Federal Capital Territory of Nigeria" – during which the six Area Councils in the FCT were the primary research fields. Secondary data includes relevant information from related studies such as published research works and findings as well as documentations by the National Universities Commission of Nigeria.

RESULT

Summarily therefore, the researcher in the built – environment sector of Nigeria should be prepared to face the under listed challenges especially in the Federal Capital Territory,

a. Limited data availability.
b. Lack of academic capacity
c. Socio-political confrontation ie skepticism on motive for questioning
d. Socio-cultural barriers to free gender interacting with strangers.
e. Difficulty in accessing quality or key respondent of interest due to bureaucracy and protocol.
f. Lack of fellable funding for the project in general.

RECOMMENDATIONS

After carefully studies studying and experienced experiencing the challenges of conduction conducting field-work in Nigeria with particular focus on the Built Environment sector, the paper recommend as follows:-

i. Government through the various Agencies and development partners should be more responsible to the funding of researches in the country in general and the built-environment sector in particular. This is because it is through research that effective policies are formulated that enhances sustainable development.
ii. The built-environment schools should not only be practical in the structuring of its courses structure but should also be research oriented in order to prepare and propel students to a future endeavour in the research world.
iii. Both practitioners and academics should create synergy in the area of data collection and achieving of research findings for referencing.
iv. The researcher in the built-environment sector should have adequate exposure in literature review so as to be duly prepared for the numerous challenges that abound in the field when carrying out fieldwork.

CONCLUSION

Revealed in this paper are the challenges often encountered by researchers, especially in the built environment sector while conducting fieldworks. These challenges are easily surmountable if researchers are abreast with the possibilities of encountering them. In addition, the paper reveals that fore knowledge of these challenges reduces stress usually encountered by researchers in the sector.. It is further shown that the built environment sector

has paucity of research reference materials; due partly to the design structure of their training programs as well as the zero budget allocation to research in Nigeria Universities over the years.

However, It is acknowledged by societies that research forms the basis for meaningful development; specifically so in the built environment sector where research brings about innovations in construction materials and techniques. Therefore. Meaningful development in the sector is possible, only if the educational system is repositioned to address adequately the challenges faced by researchers in the built environment sector

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Evaluation of Procurement Methods Used for Residential Building Maintenance in Ondo State, Nigeria

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ABSTRACT

One of the tools proven to help reduce the incidences of cost and time overruns in construction project delivery are building procurement methods. It is however very challenging to select the appropriate method for maintenance of residential buildings because of the difference in client objectives. To address this problem, this study evaluated the procurement methods used for residential building maintenance, factors influencing the choice of procurement methods used in the delivery of maintenance work and; assessed the performance impact of the adopted procurement methods in terms cost, time and quality. Seventy (70) identical questionnaires were distributed to randomly selected clients, professionals in the construction industry and maintenance officers. Data collected were subjected to analyses using frequency, percentage, mean score and Relative Importance Index. The study revealed that the method mostly employed for procurement of residential building maintenance was the direct labour or in house method (MS = 4.02) while the use of traditional method (MS = 2.89) ranked second. The major factors that influenced the choice of procurement methods for residential building maintenance were cost and time certainty (RII = 0.862) and productivity and efficiency (RII = 0.814). The procurement methods with the highest performance impact were direct labour method (MS = 4.18) and public private partnership method (MS = 3.63) in terms of time; direct labour method (MS = 3.95) and public private partnership method (MS = 3.63) in terms of cost; and direct labour method (MS = 3.81) and design and build method (MS = 3.75) in terms of quality. This study recommends the use of direct labour method for residential building maintenance because of its high performance impact in terms of cost, time and quality.

Keywords: Delivery, Dilapidation, Maintenance, Procurement methods, Residential building

INTRODUCTION

The rapid growth in population recorded in many nations of the world has necessitated the construction of various buildings which serve as a vital requirement for the survival of mankind. Hence, the development of residential buildings to meet the growing demands of the populace has become a worldwide initiative (Ghattas, Gregory, Olivetti and Greene, 2013).

Buildings generally, are structures which serve to provide shelters for man, his properties and activities (Oseghale, Ikpo and Ajayi, 2015). Buildings provide humanity with a great variety of accommodation in form of residence, churches, mosques, offices, schools, hospital and others (Oke, 2011). Buildings, either as temporary, permanent structures need to be properly planned, designed, constructed and maintained to obtain the desired satisfaction, comfort and safety (Obiefuna, 2013). Experience has shown that most of these buildings if left unmaintained begin to dilapidate. Therefore, once a building is commissioned, it becomes very important to ensure that its operating efficiency is maintained. This is actualized through maintenance of buildings.

Ogunmakinde, Akinola and Siyanbola (2013) defined maintenance as stated in BS 3811 as the work or combination of actions associated with initiation, organization and implementation carried out to retain or restore an item to an acceptable standard. Similarly, maintenance has been defined as the process by which buildings are kept usable at a predetermined standard for use and benefit of its users (Mydin, Ismail and Ulang, 2012).

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Maintenance of buildings is needed to enhance the durability, improve quality of life, protection of human health and environment. Maintenance which involves numerous skills influenced by occupancy and the performance level of the expected building, aims at effective and economic means of keeping the building and services fully utilizable (Central Public Works Department, 2000). Consequently, maintenance procurement strategy which calls for high skills is ultimately required in order to keep the building in a good condition.

Straub (2004) described procurement strategy as the overall method used to take a building project from its early planning phase to the completion and occupation by the building users. Maintenance procurement method refers to the method through which the necessary maintenance works are executed (Adenuga and Dosumu, 2012). Davis, Love, and Baccarini (2008) further described procurement methods as organization system through which responsibilities and authorities are made available to organizations and individuals with well-defined elements that constitute the construction project. Procurement methods used for construction projects are classified as the traditional, design and construct, management and collaborative (Graham, Craig, Peter, Peter, and Angela, 2008).

Research evidence has shown that there is a considerable flexibility in the adoption of the use of the many available maintenance procurement methods (Royal Institute of Chartered Surveyors, 2009; Adenuga and Dosumu, 2012). Hence, clients tend to employ the use of those procurement methods in which they are most familiar with while neglecting differences between the types of projects (Eriksson and Westerberg, 2011). However, not all these procurement methods are suitable for a particular project type, based on the difference that exists in client objectives and priorities (Davis, Love and Baccarini, 2008). Moreover, selecting the appropriate procurement method from the available types have been ascertained to help reduce the incidence of time and cost overrun in building construction works, the disputes that may arise and the likelihood of project success (Love, Skitmore and Earl, 1998).

Shirly, Azlan and Anuar (2012) asserted that it is now more challenging for decision makers to select the most appropriate procurement method for a specific building as different types of procurement methods suit different types of project. This challenge therefore stands as a major drawback to effective maintenance of buildings in Nigeria. A critical assessment of the performance impact of the available procurement methods for maintenance of residential buildings is expected to serve as a pointer to building users when considering selecting the appropriate procurement method for residential building maintenance. Therefore, the challenge of decision making as regards the most appropriate procurement stands to be abolished.

Hence, this research evaluates the procurement methods used for residential building maintenance in Ondo State, Nigeria; evaluates the factors influencing the choice of procurement methods used in the delivery of maintenance work and; assesses the performance impact of the various adopted procurement methods in terms cost, time and quality.

LITERATURE REVIEW

Maintenance of Building and Its Variants

Maintenance refers to the combination of all technical and associated administrative actions intended to retain an asset in or bring it to a state in which it can perform its required function (Royal Institute of Chartered Surveyors, 2009). The maintenance of a building begins once the building is completed by the contractor and handed over to the client and since human beings depend on buildings for their comfort and economic survival, maintenance of these buildings therefore becomes important (Ogunmakinde, 2013). Shirly *et al*. (2012) claimed

that a building that has proper operation and maintenance will only continue to be a valuable asset.

Maintenance carried out on buildings has been generally classified as corrective and preventive. Preventive maintenance on the one hand, represents the works undertaken in anticipation of failure; on the other hand, those undertaken upon the event of failure are referred to as corrective maintenance (Waziri and Vanduhe, 2013).

Maintenance of buildings has seen many improvements one of which entails the use of diverse procurement methods and in spite of the recent improvements in building technology; all buildings deteriorate from the time they are completed. The rate of deterioration depends on a number of factors (such as the right choice of materials, suitable construction techniques, adequate specifications for construction and installation works and effective supervision) which are not all under the control of occupants (CPWD, 2000).

Procurement Methods for Building Maintenance Works

Procurement as defined by Akinola, Okolie and Akinola (2013) is the acquisition of appropriate goods and services (which may involve a bidding process) at the best possible cost of ownership to meet the needs of the purchaser in terms of quality, time and location. In the same vein, Adenuga and Dosumu (2012) described procurement as the overall method used by clients or representatives to arrive at a tender figure and other operation towards the selection of a contractor to deliver a project at an agreed time and conditions. Maintenance procurement is therefore employed to undertake the maintenance of building works. In Nigeria, the Public Procurement Act 2007 established the Bureau of Public Procurement as the regulatory authority responsible for the monitoring and oversight of public procurement, harmonizing the existing government policies and practices by regulating, setting standards and developing the legal framework and professional capacity for public procurement.

Procurement process is characterized by its simplicity in theory, balancing quality, time and cost priorities but complicated in practice by legislation, the need to achieve value for money, demonstrates accountability and coordinates consultant and contractual roles and obligations to achieve a satisfactory income (Cunningham, 2013). Several methods of maintenance procurement are available (Adenuga and Dosumu, 2012; RICS, 2012; and Shirley *et al*., 2014). Kumaraswamy (1998) noted that classes of procurement methods have evolved from traditional method of division of labour and specialization to modern methods of collaborative and fast track procurement systems and therefore classified procurement methods into traditional, design and build, and construction management.

According to Davis et al. (2008), in the traditional method, the design works is accepted by the employer as distinct from the construction work; the construction works are usually the responsibility of the contractor while design and cost control functions are executed by consultants. In the design and construct procurement method, the responsibilities regarding the design of specific elements of the projects are saddled on the contractor. Hence, the contractor has input in the design of the project. Quite a number of management procurement methods exist and they are the management contracting, construction management and design and manage. In the case of management contracting, the contractor has contractual connections with all the works contractors and all construction work is the contractor's responsibility (Graham et al., 2008). As described by Davis et al. (2008), 'management contracting differs from construction management in the sense that works contracts, although arranged and administered by the management contractor, are direct between the clients and works contractor'. As regards the design and manage contract, the contractor is paid a fee and assumes responsibility, not only for works contractors, but also for the design team responsibility (Graham et al., 2008).

A study conducted by Adenuga and Dosumu (2012) revealed that for building maintenance works in Lagos State, Nigeria, the procurement strategies most commonly adopted are direct labour, lump sum contract and traditional contract, cost reimbursement contract and measured term contract. In Nigeria, execution of maintenance works is mostly left for the maintenance department to handle on direct labour basis contract while jobs of higher amount are given out in form of maintenance contracts to mostly unqualified maintenance contractors (Kunya, Achuenu and Kolawole, 2007). However, research evidence has shown that the strategy adopted for procurement of maintenance of building works is a function of many factors (Davis *et al.*, 2008; Adenuga and Dosumu, 2012; RICS, 2012). Deciding the method to adopt for a given project is very difficult and challenging because of the disparity in the priorities and objectives of clients which needs to match with the procurement strategy adopted (Davis *et al.*, 2008).

Generally, the strategy chosen for maintenance procurement is often dependent upon the extent to which the host organization seeks detailed involvement in the task, which in turn is informed by the maintenance management structure (RICS, 2012). Furthermore, a study conducted by Adenuga and Dosumu (2012) revealed that time duration, cost of project and risk allocation, price competition and flexibility of contract are major factors influencing the choice of maintenance procurement methods. Davis *et al.* (2008) also concluded that client experience and knowledge project characteristics (location, size and complexity), legal factors were factors influencing the choice of strategies for maintenance works.

It is however worthwhile to note that despite the available studies conducted on building procurement strategy and the procurement strategy for maintenance works, researchers have failed to evaluate the procurement methods employed for the maintenance of residential buildings.

METHODOLOGY

Primary data obtained through questionnaire survey were utilized for this study. Information obtained from the questionnaire were procurement methods used for residential building maintenance works, factors influencing the choice of procurement methods and performance impact of the various procurement methods in terms of cost, time and quality.

The population for this study comprised clients, consultants, maintenance officers and professionals in the construction industry in Ondo State, Nigeria. Seventy (70) identical questionnaires were distributed to randomly selected clients, maintenance officers and professionals in the construction industry in Ondo State, out of which fifty seven (57) were duly completed and retrieved for the study, and this constituted eighty one (81) per cent response rate. Data obtained for this study were analyzed with frequency, percentage, mean score and Relative Importance Index using IBM Statistical Package for Social Sciences (SPSS) 20 software.

FINDINGS AND DISCUSSIONS

Summarized in Table 1 are the characteristics of respondents in Ondo State. These are professions, nature of firm/organization and year of experience. Majority of the respondents 27 (47.37%) were Builders. The professional distribution is expected since Builders are majorly involved in maintenance of buildings. Investigation into the nature of firms revealed that 20 constituting 35.09% were contracting firms, 16 constituting 28.07% were consulting firms, 10 constituting 17.54% were clients and 11 constituting 19.30 were Government establishments. This indicates that all types of firms involved in the maintenance of buildings were adequately represented in the study. This study further sought information on the years of experience of the respondents and the result of the analysis revealed that over 89% of the

respondents had working experience of not more than fifteen(15) years. This implies that these respondents have adequate experience and knowledge of current procurement techniques for building maintenance works.

Table 1: Characteristics of Respondents.

Profession	**Frequency**	**Percentage**
Builder	27	47.37
Sub-contractor	5	8.77
Client	2	3.51
End user	4	7.02
Estate Manager	1	1.75
Quantity surveyor	7	12.28
Maintenance officer	6	10.53
Others	5	8.77
Total	57	100
Nature of Firm	**Frequency**	**Percentage**
Contracting	20	35.09
Consultancy	16	28.07
Client	10	17.54
Government	11	19.30
Total	**57**	**100**
Year of Experience	**Frequency**	**Percentage**
0-5 years	18	31.58
6-10 years	22	38.6
11-15 years	11	19.3
16-20 years	4	7.02
21 years and above	2	3.51
Total	**57**	**100**

Presented in Table 2 is the result of the analysis of the procurement methods employed for residential building maintenance in Ondo State. The method mostly employed for procurement of residential building maintenance was the direct labour or in house method (MS = 4.02). Next in frequency of use was the traditional method (MS = 2.89) while public private partnership (MS = 1.89) method ranked third. Ranked least among the procurement method employed for residential building maintenance was the design and build method (MS = 1.49). The direct labour or in house method mostly employed for the procurement of residential building maintenance implies that most clients are likely to prefer this method because of savings in terms of cost which is of benefit to the client wishing to embark on maintenance of residential buildings. The ranking of direct labour or in house method as the most employed procurement method for residential buildings therefore corroborates the work of Adenuga and Dosumu (2012) which revealed that procurement strategies most commonly adopted for general building maintenance works is the direct labour method.

Table 2: Procurement Methods employed for Residential Building Maintenance Work.

Maintenance procurement methods	N	Mean Score (MS)	Rank
Direct labour or in house method	57	4.02	1st
Traditional method	57	2.89	2nd
Public private partnership method	57	1.89	3rd
Outsourcing method	57	1.79	4th
Labour only method	57	1.68	5th
Partnering method	57	1.65	6th
Design and build method	57	1.49	7th

Presented in Table 3 is the result of the Relative Important Indices of the factors that influence the choice of procurement methods employed for maintenance of residential buildings. Ranked highest among the factors influencing the choice of procurement methods for the maintenance of residential buildings was cost and time certainty (RII = 0.862); next in

rank was productivity and efficiency (RII = 0.814) while technical competency (RII = 0.754) was ranked third. Ranked least among the factors that influence the choice of procurement methods employed for maintenance of residential buildings was arbitration/dispute resolution (RII = 0.278). The average RII was 0.627.

The factors that influence the choice of procurement methods employed for maintenance of residential buildings with RII higher than the mean RII (0.627) were cost and time certainty, productivity and efficiency, technical competency, risk allocation and avoidance, price competition for ensuring a low price and quality level of work and aesthetics. Factors with RII lower than the mean were flexibility in accommodation design change, motivation, availability of competent contractor, technology, complexity, expatriate and arbitration/dispute resolution. The factors with RII greater than the mean RII are considered to be very important and of high consideration when selecting appropriate procurement method for maintenance of residential buildings. The ranking of cost and time certainty as the most important factor that influence the choice of procurement methods employed for maintenance of residential buildings suggests that when clients are considering selecting procurement methods for use, they tend to adopt procurement methods with less procurement cycle time and this results in time savings, hence, cost savings. This result is in consonance with the work of Adenuga and Dosumu (2012) which reported that time and price certainty were major factors influencing the choice of building procurement methods.

Table 3: Factors Influencing the Choice of Maintenance Procurement Methods.

Criteria	Mean	Relative Importance Index (RII)	Ranks
Cost and time certainty	4.31	0.862	1st
Productivity and efficiency	4.07	0.814	2nd
Technical competency	3.77	0.754	3rd
Risk allocation and avoidance	3.75	0.750	4th
Price competition for ensuring a low price	3.58	0.716	5th
Quality level of work and aesthetics	3.54	0.708	6th
Speed (during both design and construction)	3.51	0.702	7th
Flexibility in accommodation design change	3.05	0.610	8th
Motivation	3.04	0.608	9th
Availability of competent contractor	2.98	0.596	10th
Technology	2.96	0.592	11th
Complexity	2.42	0.484	12th
Expatriate	1.49	0.298	13th
Arbitration/dispute resolution	1.39	0.278	14th
Mean RII	0.627		

Summarized in Table 4 is the result of the mean scores of the performance impact of the various procurement methods in terms of time. Direct labour or in house method (MS = 4.18) was ranked first; next in rank was public private partnership method (MS = 3.63), while outsourcing method (3.35) was ranked third. However, least ranked among the performance impact of procurement methods for residential building maintenance was partnering method (MS = 3.16). The result implies that in terms of time, the direct labour or in house procurement method is considered to have the highest performance impact. Hence, adopting this procurement method for residential building maintenance will amount to time savings which will in turn constitute cost savings.

Presented in Table 5 is the result of the mean scores of the performance impact of the various procurement methods in terms of cost. Direct labour or in house method (MS = 3.95) was ranked first; next in rank was public private partnership method (MS = 3.63), while design and build method (3.56) was ranked third. However, least ranked among the performance impact of procurement methods for residential building maintenance was Labour only method (MS = 3.23). The result implies that in terms of cost, the direct labour or in house

procurement method has the highest performance impact. It is therefore deemed to be the most appropriate strategy for the maintenance of residential buildings.

Table 4: Performance Impact of Procurement Methods in Terms of Time.

Procurement methods	Mean Score (MS)	Rank
Direct labour or in house method	4.18	1st
Public private partnership method	3.63	2nd
Outsourcing method	3.53	3rd
Design and build method	3.35	4th
Traditional method	3.28	5th
Labour only method	3.23	6th
Partnering method	3.16	7th

Table 5: Performance Impact of Procurement Methods in Terms of Cost

Procurement methods	Mean	Ranks
Direct labour or in house method	3.95	1st
Public private partnership method	3.63	2nd
Design and build method	3.56	3rd
Outsourcing method	3.53	4th
Partnering method	3.49	5th
Labour only method	3.23	6th
Traditional method	3.16	7th

Presented in Table 6 is the result of the mean scores of the performance impact of the various procurement methods in terms of quality. Direct labour or in house method (MS = 3.81) was ranked first; next in rank was design and build method (MS = 3.75), while public private partnership method (3.63) was ranked third. However, least ranked among the performance impact of procurement methods for residential building maintenance was traditional method (MS = 3.19). The result implies that in terms of quality, the direct labour or in house procurement method has a very high performance impact of the maintenance of residential buildings and thus represents the most appropriate strategy that should be adopted for maintenance of residential buildings.

Table 6: Performance Impact of Procurement Methods in Terms of Quality

Procurement methods	Mean	Ranks
Direct labour or in house method	3.81	1st
Design and build method	3.75	2nd
Public private partnership method	3.63	3rd
Outsourcing method	3.44	4th
Partnering method	3.39	5th
Labour only method	3.23	6th
Traditional method	3.19	7th

CONCLUSION

This study concludes that the direct labour or in house procurement method is the most frequently employed procurement method for the maintenance of residential buildings. Despite the fact that the direct labour or in house procurement method is characterized by some shortcomings such as project abandonment resulting from lack of contractual obligation; it continues to be a relevant procurement method in Ondo State. Furthermore, there is usually no standard labour and there may be inadequate incentive for workers involved in direct labour procurement.

The study further concludes that cost and time certainty, productivity and efficiency, technical competency, risk allocation and avoidance, price competition for ensuring a low price and quality level of work and aesthetics are major factors influencing the choice of procurement methods employed for the maintenance of residential buildings.

Furthermore, when it comes to cost, time and quality, most clients prefer the adoption of direct labour or in house procurement method for the maintenance or residential buildings. This study therefore recommends the use of direct labour method for residential building maintenance because of its high performance impact in terms of cost, time and quality. Furthermore improved utilization of emerging procurement methods designed to fast track residential building maintenance projects and promote teamwork is highly encouraged in order to have better maintenance results.

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Towards Achieving Low Cost Housing: Use of Traditional Building Materials (A case study of Fayose Estate, Ado-Ekiti, Nigeria)

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ABSTRACT

There is a widespread shortage of housing in several urban areas in Africa. This shortage is growing both from the increase in rural-to-urban migration rates and the relatively high cost of urban building materials. In Nigeria, it has become obvious that most of the urban residents live in dehumanizing housing environment while those that have access to standard housing do so at abnormal cost. The fact must also be faced that government and people do not have the capital resources to construct convectional buildings. Given the limited resources available for low-cost housing programs, and the limited funds of the families who acquire such housing, it is important that the cost of construction and buildings be kept to a minimum by the use of appropriate technique and materials. This study critically appraises some local building materials available in Nigeria. Research revealed such materials as Stone, Timber, Laterite, Bamboo, Mud, Thatch, Cornstalk amongst others, are readily available and relatively cheaper than the convectional materials imported from outside the country. However, only stabilized laterite bricks and bamboo are discussed in details in this paper. The neglect of these materials should be discouraged. This study pays attention to the use of these materials as an alternative to the foreign materials, in other to reduce the increasing cost of housing and encourage more housing construction in the country and a comparative cost of stabilized laterite bricks and sandcrete blocks were carried out. This comparison is to further establish the fact that the use of our local building materials can go a long way to lessen the cost of construction. It also offers some recommendations at accomplishing housing delivery using indigenous building materials.

Keywords: Housing environment; housing materials; urban building materials; low- cost housing; traditional building materials

INTRODUCTION

Low cost housing can be considered affordable for low and moderate-income earners if household can acquire a housing that (owned or rented) for an amount up to 30% of its household income (Miles 2000). In developing countries such as Nigeria, only 10% of the population are high-income earners, who are able to afford normal housing units, the low-income groups in developing countries are generally unable to access the housing market (Adegbehingbe, 2011). Cost effective housing is a relative concept and has move to do with budgeting and seeks to reduce construction cost through better management, appropriate use of local building materials, skills and technology but without sacrificing the performance and structure life (Tiwari et al, 1999). It should be noted that low cost housing are not houses which are constructed by cheap building materials of substandard quality. A low cost house is designed and constructed as any order house with regard to foundation, structure and strength. The reduction in cost is achieved through effective utilization of locally available building materials and technique that are durable, economical, and acceptable by users and not requiring costly maintenance (Miles, 2000).It is also about the usage of traditional building materials, local skills, energy servers and environment-friendly options (Kumar, 1999, civil engineering postal, 2008).

According to Olayiwola, Adeleye and Ogunshakin (2005), the provision of housing as for long been seen as a government concern and the Federal Government has tried in different ways to tackle the nation's housing problems. A breakdown of government activities reveals

Adegbehingbe, V. O. (2016). Towards Achieving Low Cost Housing: Use of Traditional Building Materials (A case study of Fayose Estate, Ado-Ekiti, Nigeria). In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 178-189

that during the past few years, a series of constructive program and far reaching actions were taken by the government to combat the housing problem. However, it is a fact that the housing problem is far from being solved, and this can attributed to flaws in the strategies adopted by the government. Such flaws include: Government intervention through direct housing construction; even though the government possesses the resources and managerial capacity to embark on direct home construction, it should not have done so given the past experiences to the high cost and slow pace of construction of government projects. Apart from the fact that the Ministry of Housing and Environment was faced with many challenges which affected its performance level, the houses built were usually very expensive which put them beyond the reach of the low-income group, and they did not meet the requirements of the people e.g. provision of one bedroom houses for low group when the average family size is put at 6 persons.

Secondly, the adopted practice and system of granting loans makes it difficult for the really low-income people to benefit. The bulk of the mortgage loans went to the family in the upper class, making it necessary to re-examine the loan policy of the country.

Thirdly, other means of encouraging housing construction were not given adequate attention. For example the government agreed to lay emphasis on the provision of basic infrastructure in various layouts on which individual could build their own houses, but this was not done. Also, cooperative societies were not given much encouragement as planned.

Fourthly, many government housing projects were embarked upon without effective program of action and appropriate institutional arrangement for their execution. This means that the project lacked adequate and sound planning which led to their failure. Adequate shelter for all the people is one of the pressing challenges faced by the developing countries, Nigeria is currently facing a shortage of about 20.65 million houses. The dream of owing a house particularly for low-income and middle-income families is becoming a difficult reality. Hence, it has become a necessity to adopt cost effective, traditional.

Fifthly, there was too much corruption in high quarters. Often times, money meant for house project are diverted into private hands thereby allowing the project to suffer.

Finally, the problem of party policy in Nigeria has affected the Federal Housing Project extents. For instance, the uncooperative attitude adopted by some state government is simply because a different party other than their own controlled the federal administration. These states saw themselves as competing with the Federal Government and did all they could to slow down the pace of the Federal Housing Projects. In a nutshell, one may conclude that lack of financial prudence, public integrity and accountability, incompetent and ineffective administrative machinery, mass importation of foreign technology, material, personnel and inflation, as well as incomprehensive study of the nation's housing requirement has led to the low performance of public housing in Nigeria. This paper focuses on how the use of our traditional building materials can aid affordable housing delivery scheme in the country, with more emphasis on two major materials: stabilized laterite bricks and Bamboo.

Classification of available building materials

According to Adekoyejo (2005), building materials refers to those requisite raw substances used for erecting or constructing structures (shelters), after undergoing processing using available finance, technology of production and personnel (professionals) to achieve building

products, which are assembled to put in place the required or desired shelter, house or other structures.

According to Adekoyejo (2005), the identified available building materials could be classified as follows;

i. Convectional Building Materials
ii. Improved Building Materials
iii. Indigenous/Traditional Building Materials.

i. Convectional Building Materials; these are materials were transformed from their raw state and applied in building construction using modern methods or techniques. They are produced locally using imported techniques or directly imported as finished products. Such materials include; cement, steel, burnt bricks, precast concrete slab, glass, and plastic.
ii. Improved Building Materials; these are materials of improved quality, transformed from its original raw state through further research and development effort toward providing alternatives to expensive imported materials. Examples of such are bricks, Bamboo-crete, laminated-leaf composite boards, clay tiles, lightweight concrete with oil-palm clinkers and coconut shells.
iii. Indigenous Building Materials: these are materials from its raw state, which are transformed and applied by local technological means, such as earth, stone, timber, bamboo and organic products. These materials were widely used in the pre-independence era.

A review of traditional building materials in Nigeria

Traditional materials that are used in their natural conditions, or slightly altered by primary energy without any industrial influence. They could also be referred to as materials from its raw state, which are applied by local technological means. They include wood, stone and pebble, earth, thatch, bamboo and organic products. They could also be referred to as local materials. Local materials are the resources that can be found readily in large quantity at a particular location or area at a certain time. It could also be referred to as materials that can be used to fabricate a finished element. Gooding and Thomas (1995), identified that the traditional building materials common in Developing Country maybe considered to fall into four broad groups; un-stabilized soil, fired brick, wood and stone.

Traditional building materials should be;

i. Locally sourced
ii. Affordable
iii. Readily available
iv. Renewable.

Most traditional buildings in Africa and particular in Nigeria generally are made from the following traditional materials;

i. Bamboo; from palm tress
ii. Mud; from selected earth
iii. Mud and Stone; earth mixed or used as mortar
iv. Stone; used as masonry works and mortar
v. Cornstalk; found in guinea corn

Compressed stabilized laterite bricks

Many things are done with Laterite after it has been dried. An example is the addition of cement (about 5-10%) to stabilize the blocks and make it stronger and thus produce landcrete or sun-dried blocks or ordinary blocks in a process similar to adobe. The compressed stabilized Laterite block is the modem descendant of the moulded earth block, more commonly known as the adobe block. The term "Compressed Stabilized Laterite Bricks"

(CSLBs) is also a name used to cover a wide range of derivative building materials from Laterite/soil/earth in which a stabilizer or soil additive has been added to alter the properties of the soil and to improve its engineering properties including compaction, density, bearing strength and safety (i.e. fire)

.According to Arumala and Gondal (2007), compressed stabilized Laterite bricks are safe alternatives to masonry. They are low cost and can be designed to be earthquake resistant. They are non-toxic, are sound resistant, fire-resistant, and insect-resistant. Furthermore, research has also shown that compressed stabilized Laterite bricks have excellent insulating properties - reducing heating and cooling costs. In addition, they are inexpensive, strong, made with locally available materials and are dimensionally uniform. Also, workers with little prior building knowledge and experience can be used for the wall construction. They are resistant to sound transmission, fire, insect damage and durable if properly protected. Little energy is needed for their production compared to other wall systems and soil is an environmental friendly material.

Other Products

i. Floor tiles: the main type of floor tiles from laterite is called quarry tiles. These are laterite quarried out of the ground with sands removed and made to plastic and therefore rolled out and cut into different sizes .e.g. 100m* 100m, 150*150m.
ii. Roof tiles: this is another product of Laterite which has limited use in Nigeria because of shortage of supply and fixing technique.
iii. Sanitary wares: water closet, basins are produced with the application of modem technology. Pipes are also possible for sewage and other related purposes.

Production of stabilized laterite bricks

This can be done traditionally and in the factory or workshop

i. Preparation; traditionally, it could be moulded by hand and formed into a plastic state by adding water. In the factory, it is ground by rollers to eliminate large structures like sands. It is passed through a sieve to finalise the elimination and later, water is added to it during the rolling process.
ii. Shaping; traditionally, it is done in a box mould. In the factory or workshop it is extruded and cut into different shapes. Laterite is fired out from roller machine and it comes out with force in a rectangular form. This is later cut into required rectangular shape as it goes through by conveyor's belt.
iii. Drying; traditionally, it is sun-dried since it has to be dried before it can be used. In the factory it is artificially dried by the use of warm air passing through the kiln. Also tunnel dryer, by passing it through a tunnel with a dryer is another system. This normally takes about 24hrs because rapid drying makes the brick liable to crack.
iv. Firing; this is carried out by traditional kiln. The process here is the ordinary firing for about three days to produce three types of dried blocks which are used as follow high dried blocks used for foundation.
    a. Medium dried blocks used for load bearing walls.
    b. Less heated blocks used for partitioning walls.

There is also a different type of kiln being used in the factoiy. An example is the Hoffman kiln which is also called continuous kiln. It is divided into four compartments and each compartment is built with bricks and containing about 20,000-40,000 bricks. There is the process that as one-third is fired, one-third is drying, and one-third cooled. Fadamiro (1996), Ogunsemi (1996).

Application of laterite in Building construction:

The specific areas of application of Laterite as a building material in the components of a

typical building are as follows;

i. Foundation
ii. Walls
iii. Floors and
iv. Roof

Advantages of the application of laterite

i. It is readily available in large quantities.
ii. It has favourable climatic performance in most regions due to its high thermal capacity, low thermal conductivity, and high fire resistant ability.
iii. The use of Laterite is suitable for most part of the building, because it is easy to work with, even without the use of special equipment.

Disadvantages of the application of laterite

i. They have low resistance to abrasion and impact if not sufficiently stabilized or reinforced.
ii. They have not been generally accepted amongst institutions and social groups because of numerous examples of poorly constructed and poorly maintained earth structures.
iii. Disintegration occurs due to excessive water absorption, arising from swelling and shrinkage (if not sufficiently stabilized) leading to cracks.

Bamboo

Bamboo is a group of perennial evergreens in the true grass family *Poaceae,* subfamily *Bambusoideae,* tribe *Bambuseae.* It is a type of grass with a hard, woody, hollow stem. Giant bamboos are the largest members of the grass family.

It is also one of the traditional building materials with potentials for variety of application. It is a perennial plant found mostly in tropics and some temperate region. Bamboos are some of the fastest growing plants in the world. They are capable of growing 100 cm (39 in.) or more per day due to a unique rhizome-dependent system. However, the growth rate is dependent on local soil and climatic conditions. They shed their leaves annually and grow new branches. They can provide an ecological alternative to wood as a structural, siding and flooring material. There are several varieties of bamboo; some are as short as one foot (30 cm) in height while others can grow to ten times that size. The root structures of bamboo plants vary and they are often scientifically classified by root type. Many different climates support bamboo, although it is commonly associated with the tropics.

Bamboo is being currently looked upon as an alternate low cost material for the enormous housing problem faced by several developing countries. It is an extremely hard substance,although it should be chemically treated to prevent insect infestation and rot. Since it is a quickly growing grass and can grow in dense conditions, it is considered one of the best renewable resources on the planet. It is a green building material.

Apart from its use in building construction, bamboo can also put to several uses. Bamboo is commonly used as a food source. Bamboo has a crisp texture and light, sweet flavour. It generally assumes the flavour of ingredients it is combined with, so bamboo shoots are often used as fillers in Asian cuisine. While some bamboo can be eaten raw, some varieties must be cooked to remove some toxic elements. The giant panda enjoys it too; pandas subsist almost completely on bamboo plants. Bamboo was used to create the earliest suspension bridges in China and today it is used in a variety of building projects. It has also been used to craft boats, zeppelins and airplanes. Bamboo is also used to make a variety of household goods. You can find furniture, dinnerware, sporting goods, jewellery and handbags comprised of it. It has also been used for flooring, cutting boards, wind chimes and nearly any other good that

is commonly made of wood.

Bamboo is a beautiful landscape plant and is often used to create a privacy screen. However, it must be planted with a bamboo specific root barrier to keep it from spreading into other areas. It reproduces as quickly as it grows so it can quickly take over a garden.

It is important to note that the "lucky bamboo" many people have growing in their homes is not actually a member of the bamboo family; instead it is a Dracaena, an easy to grow house plant.

Characteristics of Bamboo:

i. Bamboo is the fastest growing plant: Bamboo timber can be harvested every year Bamboo is a natural water-control barrier Bamboo generates 30 percent more oxygen Bamboo can restore degraded lands vi. Bamboo plants are further characterized by long life span of the culms/hollow stalk and the development of woody tissues/fibres. The height of the clams of some species reaches 35m or more within the first 6 months of growth, but it takes about three years to develop the required strengths for construction. Full maturity is generally realized after 5-6 years of growth.
ii. Bamboo as a potential environmental friendly material for housing and construction has the following advantages in its application.
iii. High tensile strength compared to that of mild steel.
iv. High strength to weight ratio and high specific load bearing capacity.
v. Requires less energy for production.
vi. Service life of bamboo can be enhanced by suitable preservative treatment.
vii. Can be converted into panel and composite material possessing enhanced strength properties suitable for structural applications.
viii. Bamboo also possesses high residual strength to absorb shocks and impacts - highly suitable material for construction of houses to resist seismic and high wind forces.
ix. Bamboo is very efficient in sequestering carbon and contributes to the reduction-of green house.

Uses of Bamboo

Bamboo is useful in the following areas;

i. Medicine; Bamboo is used in Chinese medicine for treating infections and healing. It is a low-calorie source of potassium. It is known for its sweet taste and as a good source of nutrients and protein.
ii. Musical instrument; Bamboo's natural hollow form makes it an obvious choice for many instruments, particularly wind and percussion. There are numerous types of bamboo flute made all over the world, such as the dizi, xiao, shakuhachi, palendag, jinghu.
iii. Constructions; bamboo has been applied in building construction in areas such as bamboo reinforcing bar, bamboo fencing, and so on.
iv. Transportation; it is surprising to see that bamboo has been put into other uses such as bicycle making, trailers, e.t.c.
v. Clothing; Clothing from bamboo is soft and comparable to cashmere. Bamboo has natural antibacterial and anti fungi qualities that help the plant fight off disease and insects. These properties come from a naturally occurring substance in bamboo called Kun. Because these qualities are not lost during processing or washing, bamboo fabrics are able to retain these qualities and do not hold odours like some fabrics do.
vi. Water processing; Bamboo as a versatile material is demonstrated by its use in water desalination. A Bamboo filter is used to remove the salt from saltwater.
vii. Cooking; The shoots (new bamboo culms that come out of the ground) of bamboo are edible. They are used in numerous Asian dishes and broths.(wikipedia.org)

Photo survey of Fayose estate, ikere-ekiti, Ekiti state (Fig. 1- 5)

Gallery of the arrangement of buildings in the Estate

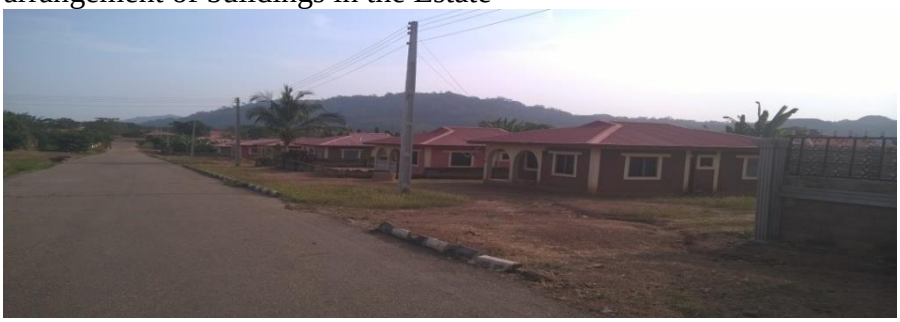

Fig. 1: Picture showing bricks used as a wall material as well as road network to some portion of the estate

Fig. 2: Picture showing unapproved Fencing work under construction using Sandcrete blocks

Fig. 3: Picture showing proper ventilation of the buildings

Fig. 4: Picture showing open space at back of a building transformed to another building using sandcrete blocks

Fig. 5: Picture showing new construction still at Foundation stage

The fundamental features of the components of the buildings in the estate are as following:

i. Walls: the materials used for the walls are mainly medium dried Laterite bricks. The bricks were mainly used for load bearing walls. Few of the residents applied paints on their walls while others just left it bare.
ii. Roof: Timber was used for the roof structural members and the convectional roofing materials (galvanizes aluminium roofing sheet) was used for the building.

METHODOLOGY

The study made use of data and information collected from both primary and secondary sources. Primary data were collected through physical investigation of some buildings that were made use of traditional building materials in the study Estate (Fayose Estate) located on the outskirt of Ikere- Ekiti, Ekiti state, a state in south west, Nigeria. At the time of this study, the estate is made up 180 units. Each housing unit is a single detached three/two bedrooms bungalow (photo survey above). The most common traditional building material employed for the construction of buildings in this estate is the stabilized Laterite bricks. These bricks were used mainly for load bearing walls, the only wall materials used for each building in the estate.

In order to achieve cost reduction (which is the essence of this study),all the walls of the buildings(180units)in the study estate(Fayose Estate),which constitute the major part of a building are constructed with Laterite bricks which makes cost reduction significant as the buildings were constructed in mass and this is illustrated in this study by carrying out the cost analysis of stabilized Laterite bricks with sandcrete blocks because they are the common walling materials used for construction in Nigeria. This comparison is to further establish the fact that the use of our local building materials can go a long way to lessen the cost of construction (even if it's only by a few percent) because analysis has also shown that although stabilized Laterite bricks are relatively cheaper than sandcrete blocks, the percentage difference in cost guideline for housing affordability is a housing cost that does not exceed 30% of a household's gross income (Struyk, 2005; Wikipedia, 2007).

Comparative cost of stabilized Laterite bricks and sandcrete blocks

In this study, the cost of constructing a wall using stabilized Laterite bricks were compared with that of sandcrete blocks because they are the common walling materials used for construction in Nigeria.

The analysis shows that stabilized Laterite bricks are cheaper than sancrete blocks; the percentage difference in cost did not swing away people from using sandcrete blocks. However the percentage difference in cost could be significant when many buildings are constructed in a given location as in the study estate (Fayose Estate, in ikere, Ekiti state). This study emphasis on reducing the cost of construction, because when cost of construction are reduced, in the long run, it directly or indirectly affects rental fees.

In this study, the plan of one of the two bedroom bungalow constructed on the study estate is used for the analysis below:

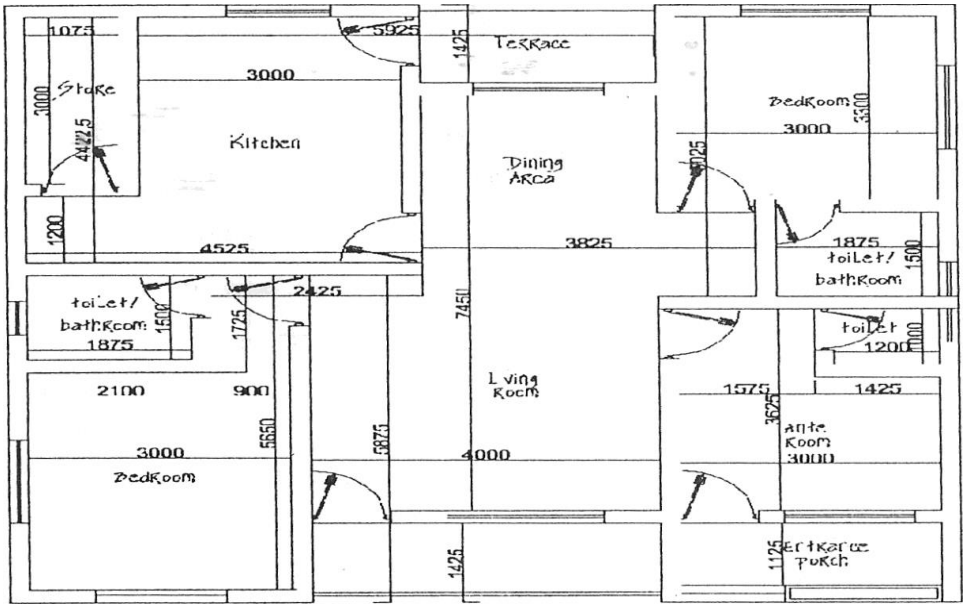

Fig 1 Plan of a Two Bedroom Bungalow on the study estate

The plan was developed taken into consideration the family size of an average Nigerian (1-6) and level of salary of the low- income and middle-income earner. It also adopted a simple shape, which will cost less during construction. The plan consists of the following facilities;

i. Ante room
ii. Living room
iii. Dining area
iv. Two bedrooms (en-suite)
v. Kitchen and a store

Unit Cost of Sandcrete Blocks

There are two types of hollowed sandcrete blocks. The first one is of the dimension 450mm *225mm*225mm. This size is typically referred to as the 9 inches block while the second type of sandcrete block is of the dimension 450mm*225mm* 150mm. This size is typically referred to as the 6 inches block. This size of block as at the time of this research (July 2015), cost #150.00 while the 9 inches block cost #190.00. Using the typical two bedroom plan as an example, it was discovered that approximately 10 sandcrete blocks will be required to complete one square meter of wall construction. The typical two bedroom plan is 200 square meters. Therefore, a total number of approximately 2000 blocks will complete the building.

Table 1 showing unit cost of sandcrete blocks

$1m^2$	10 sandcrete blocks
$200m^2$	2000 blocks

Unit Cost of Stabilized Laterite Bricks

Arayela (2000) noted that about 4% cement stabilization would generally be adequate to soils in the South Western part of Nigeria He also affirmed that the variation from his experiment was between 2.5% and 4%. It was discovered that one bag of cement will produce about 190 units of Laterite bricks. The size of Laterite bricks produced is of dimension 290mm x 140mm x 95mm. It was discovered that 4 Laterite bricks will take up one hollow sandcrete block. Therefore, about approximately 40 bricks would be required for one square meter of wall construction. As at the time of this research, a normal sandcrete brick cost #190 while the stabilized Laterite brick (i e bricks that contain additives as cement) cost #35.00 (researchers market survey) Therefore the number of Laterite bricks for the total completion of the two bedroom en-suite was therefore calculated as an illustration to be 8,000 bricks as shown in table 2.0 below

Table 2 *showing Unit Cost Of Stabilized Laterite Bricks*

1 Sandcrete Block	4 Laterite Bricks
Lm^2	10 Sandcrete Blocks
Therefore, 10 Sandcrete Blocks	40 Laterite Bricks
Lm^2	40 Laterite Bricks
$200m^2$	8,000 Bricks

Analysis of typical two bedrooms constructed at the study estate

Analysis of quantity of materials

Table 3 Comparing Laterite Bricks and Sandcrete Blocks In Terms Of Quantity

Wall construction	Sandcrete blocks	Laterite bricks
1	(450 x 225 x 225)mm	(290 x 140 x 95)mm
	No. required per m"	No. required per m^2
Wall area: $200m^2$	2000 blocks	8,000 bricks

Analysis of cost of materials

Table 4 Comparing Laterite bricks and Sandcrete Blocks in terms of cost

Sandcrete Blocks		Laterite Bricks	
Cost of 1 sandcrete block	# 150.00	Cost of one Laterite brick	#40.00
1m2	10 blocks	lm^2	40 bricks
$200m^2$	2,000 blocks	$200m^{13}$	8,000bricks

Comparative Cost Analysis of Laterite Bricks and Sandcrete Blocks

Table 5: Comparing Laterite bricks and sandcrete Blocks (9 inches) in terms of cost

	Sandcrete Blocks	Laterite Bricks
No required	2000	8,000
Cost per unit	# 190.00	#35.00
Total cost of wall construction	# 380,000.00	#280,000.00

Note: the cost per unit of these materials is based on the market price in Akure as at the period of this research (July 2015).

FINDINGS AND DISCUSSION OF RESULT

The cost analyses as carried out in the tables above shows that Laterite brick is the cheapest for wall construction. Investigation on site shows that it is possible to mobilize labour and equipment to the site if sandcrete block and Laterite bricks were to be used. Though both types are capable of being made on site, the raw materials and labour for Laterite walls are relatively cheap and gotten from site or close to the site.

As at the period of this research, (July 2015) a bag of cement cost #1900(Dangote cement) . The cost analysis carried out in the tables above, does not include the cost of mortar. cost of labour, transportation cost and so on, it only includes the cost of the material seeded for the internal and external walls. Both wall materials require mortar, but the quantity of mortar required for sandcrete as a wall material will be more. Sandcrete block walls will also require plastering and finishes (such as paint, tiles, and so on) to make the wall aesthetically pleasing to the eye. Brick walls require little or no finishes. The fact must therefore be faced that in the long run, the cost of construction using sandcrete blocks will be more than the construction cost using Laterite bricks, as indicated in tables1-5 above.

To further reduce the cost of this typical two bed room building the application of the following traditional building material is recommended below:

Substructure: Normal strip foundation
Superstructure (Walls): Materials for external and internal walls is the Laterial bricks.
Superstructure (Roof): Bamboo purlins and rafter should be laid on fibre or micro-concrete roofing tiles.This is of 20% cement and 80% sand.

Doors and Windows: wooden panel doors are to be used, while windows are to be louvers.
Finishes (Walls): Bricks which require little or no finishes
Finishes (Floor): The bamboo flooring system could be adopted instead of normal floor tiles. Bamboo floors are durable as the timber floors.

RECOMMEDATION AND CONCLUSION

It is my belief that the following suggestions/recommendations will help significantly in solving the unaffordable housing problems in Nigeria.

The use of laterite bricks should be encouraged as it is cheaper, more readily available and the production process is environmental friendly.

The usage of bamboo and other natural fibres such as oil palm fibre, palm kernel fibre and coconut palm fibre should be encouraged as possible substitutes for steel reinforcement and steel mesh.

The aesthetics of stabilized Laterite bricks should be improved in order to attract more users.

The government and other organized private sectors should invest on the development and application of our abundant local materials. A good example of this is that of the study estate(Fayose Estate in Ekiti State)..

Government and organized private sectors should also have confidence in the results of research findings in Nigeria and adequately support their practical applications.

Finally, government officials as well as wealthy Nigerians in our society should also embark on the use of these local materials for the construction of their houses, office complexes and the likes rather than the imported building materials. This will encourage a great majority of the populace to do the same.

This study established that Laterite bricks are sustainable and cheaper alternative to sandcrete blocks. Thus, in order to provide housing for a greater majority of Nigerians, our locally sourced building materials (such as the Laterite and the Bamboo), should be encouraged as they are relatively cheaper, more readily available, requires little or no finishes (as in the case of Laterite bricks) and their production process is environmental friendly.

Also, the lifecycle of a brick generates very minimal waste, equating to approximately 1.2 per kg of the product. Other benefits include high thermal mass with balanced and responsive conditions for cold and hot periods, good sound insulation properties, and ability to absorb and diffuse water vapour and absorb odours SICCM (2010).

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Assessment of Thermal Comfort Level of Some Selected Lecture Theatres in Federal University of Technology, Akure

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ABSTRACT

Solar radiation consists of light and heat energy in the form of electromagnetic waves given off from the sun to the earth surface. Heat from the sun often raises internal temperature in buildings which in turn leads to thermal discomfort of the building occupants. This often negatively affects the ability of man to effectively carryout the expected activities within buildings and, thus, reducing man's productivity. It therefore becomes imperative to look for ways of tackling some of these challenges, especially in academic buildings where students are expected to learn in a conduicive environment throughout the day. This research examines the various negative effects of heat on the thermal comfort of students in some selected Lecture Theatres within the Federal University of Technology, Akure (FUTA). Three Lecture Theatres were chosen for case studies, namely: Big Lecture Theatre, '3-in-1' Lecture Hall and SEMS Lecture Hall. From the analysis of the case studies and questionnaires administered to users of the theatres, it was discovered that the users often experience serious thermal discomfort, especially in the afternoon due to excessive solar radiation and overcrowding by the students. Some of the recommendations for controlling excessive solar penetration into the lecture halls, in order to enhance thermal comfort of users while learning or carrying out other educational activities include the use of effective shading devices, adoption of good building form, good building orientation, appropriate use of building materials and the use of vegetation for landscape around the theatres.

Keywords: building orientation, heat, shading devices, solar radiation, thermal comfort

INTRODUCTION

The main purpose of designing buildings is to provide a comfortable environment for the inhabitants of such buildings. In Nigeria today, ensuring spaces are at desired temperature largely depends on mechanical air conditioning which requires high amounts of energy that is presently insufficient in the country. Therefore, there is the need to provide a comfortable indoor climate with minimum energy utilization. It is worth noting that a comfortable thermal environment makes people healthy, both physically and psychologically, and this will positively influence productivity.

In schools, students can comprehend well only within a very narrow range of temperature, hence the need for research into the selection of materials and methods that will help make school buildings habitable and conducive for students' learning purpose.

Thermal Comfort in Educational Buidings

The American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE, 2001) defines thermal comfort as the condition of mind that expresses satisfaction with the thermal environment. Thermal comfort exists when a body's heat loss equals its heat gain or vice versa. Deep body temperature is about 37°C, while the skin temperature can vary between 31°C and 34°C under comfort conditions (Audris & Steven, 2007). Understanding the indoor thermal comfort helps Architects and Building designers in providing a comfortable environment, devoid of negative impart to the health of users of such buildings.

The thermal performance of a building determines how well a building can modify the prevailing outdoor climate to create a unique indoor environment. Many factors such as

Ganiyu, S. A. & Ojo, T. E. (2016). Assessment of Thermal Comfort Level of Some Selected Lecture Theatres in Federal University of Technology, Akure. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 190-196

shape, orientation, absorption of solar radiation, window to wall ratio, materials, etc., contribute to the way buildings are able to respond to their external environment.

Studies have revealed that reducing moderately high classroom air temperatures by providing sufficient cooling, improves the performance of students and that moderate changes in room temperature, even within the comfort zone affect student's abilities to perform mental tasks requiring concentration, such as addition, multiplication, and sentence comprehension. Therefore it is important not only to look at the energy consumption and Indoor Air Quality, but also at the thermal comfort performance of schools (Wim, Gert and Mark, 2011).

The skin should always be at a temperature less than the deep body, and the environment should be below the skin temperature in order ensure a sense of physical well-being. The table below summarizes the critical body temperatures.

Table 1 Showing critical body temperatures

Skin temperature	Deep body temperature	Regulatory zone
Pain: 45°C	42°C	Death
		Hyperthermia
	40°C	Evaporative Zone
		Vasodilation
		Comfort
31- 34°C	37°C	Vasoconstriction
		Thermogenesis
	35°C	Hypothermia
Pain: 10°C	25°C	Death

Source: Audris and Steven, (2007)

Effects of Solar Radiation in Lecture Theaters

Solar radiation from the sun could be a source of delight and other times discomfort of building occupants. The effects of solar radiation on the comfort of building occupants include: extreme luminance resulting in glare and extreme heating resulting in discomfort.

Extreme Luminance Resulting in Glare

Glare can be caused by a direct view of the bright sky from the interior of a building. It can be an impediment to vision and even a direct hazard as in when on a stair way. Glare is a direct function of both the size of the window and the brightness of the sky seen through it and an inverse function of the brightness of the room interior. It can therefore be reduced by cutting down the size and brightness of the visible patch of sky and by increasing the interior brightness by the judicious use of surface areas of high reflectance so as to reduce contrast in brightness of light which is the major cause of glare in buildings.

Extreme Heating of Building Interior Resulting in Thermal Discomfort

Thermal discomfort in buildings often occurs when heat stored up in some building elements or properties of occupants in the building transmit absorbed heat accumulated through solar radiation into interior spaces of buildings. This results to people residing in the building experiencing increase in body temperature and subsequently sweating. Thermal comfort can be maintained when the heat generated by human metabolism is allowed to dissipate, thus maintaining thermal equilibrium with the surrounding.

THE STUDY AREA

The buildings used for the purpose of this research were three lecture theatres selected from the Federal University of Technology, Akure. They were studied to ascertain how their designs were able to control the effects of solar radiation thereby enhancing the comfort conditions of the users of the buildings. The selected lecture theatres are: Lecture Theatre 1 (Big Lt), 3-in-1 Lecture theatre, and SEMS lecture hall.

Lecture Theatre 1 (Big LT)

The lecture theatre, known as Big LT, is located in Obanla between the School of Engineering (SEET) and School of Agriculture (SAAT) of the Federal University of Technology Akure. The lecture theatre can accommodate 300 students at once.

Fig. 1: A side view of the the Big LT showing the horizontal fins and the eave projection
Source: Ojo (2013)

Merits

The use of vertical fins reduces the penetration of solar radiation into the theatre. Number and positioning of the windows provides good ventilation and enhances thermal comfort of in the theatre. The use of Celotex material for the ceiling reduces the penetration of heat from solar radiation into the building just as vertical fins of about 75mm thickness and 750mm projection attached to windows control the penetration of solar radiation into the theatre. The roof gutter eave projection of about 750mm serves as horizontal shading device to complement the shading provided by the vertical fins. The presence of some trees close to the theatre provides a level of shade for the building (see Fig. 1).

Demerits

The orientation of the building is bad because the longer side of the building is positioned in the East-West direction. As a result of this there is penetration of solar radiation into the interior space of the building thereby leading to excessive heat gain in the building in the afternoon hours of the day resulting to thermal discomfort.

'3 in 1' Lecture Hall

The '3 in 1' lecture theatre is located behind the PGD Research Laboratory (Phase1) and adjacent School of Science (SOS). The building is a combination of three prototype halls with a central reception yet to be roofed.

Fig. 2: Showing The Approach View Of The '3 In 1' Lecture Hall With Verandas Serving As Horizontal Shading Devices.
Source: Ojo (2013)

Merits
The interior of the lecture halls are relatively cool owing to the colour of wall paint used inside the building and the effective use of hard and soft landscaping elements outside the building as shown in Plate 2. The building has horizontal shading devices in the form of verandas 1200mm wide and eave projection of the roof. The number and positioning of the windows provide parallel ventilation for the space which in turn enhances thermal comfort of students.

Demerits
Due to the Y shape form of the building some of the halls are exposed to solar radiation in the cause of the day thereby leading to thermal discomfort in the afternoon to evening hours of the day. The absence of trees among the landscape elements minimizes the effectiveness of the soft landscape.

SEMS Lecture Hall
The hall is located behind the School of Earth and Mineral Sciences (SEMS), FUTA. The building has three lecture halls.

Fig. 3: Showing a side view of the SEMS lecture hall. Source: Ojo (2013)

Merits
The use of the vertical fins helps in reducing excessive heat gain in the building. Effective combination of hard and soft landscape and vertical fins of 225mm thick by 600mm projection as used between the windows, as well as the roof eave projection and verandas at the entrance into the halls aids thermal comfort of users. Window blinds were also provided in one of the halls because in some hours of the day the hall was exposed to penetration of solar radiation. Plate 3 shows the effective use of shrubs and flowers to enhance therm comfort in the building.

Demerits
Some of the lecture halls are exposed to solar radiation penetration at some time of the day due to the shape and orientation of the building.

FINDINGS AND DISCUSSION

For the purpose of this research, questionnaires were administered to a total of 110 students in all of the three lecture theatres to determine comfort level, thermal discomfort (intense heat) and time of the day thermal discomfort is experienced. Results were graphically represented as follows:

Comfort Level

In terms of comfort level below is a table showing a breakdown of data of respondents in each lecture theatre examined.

Table 2: *Showing data for the comfort level of respondents in the theatres*

S/N	Lecture theater	Highly comfortable	Comfortable	Not comfortable
1	Big Lt	-	19	21
2	3 in 1 Lt	1	20	19
3	SEMS Lt	10	15	5

The Table 2 above shows that none of the respondents in Big Lt was highly comfortable, 19 (47.5%) of them were comfortable and 21 (52.5%) of them were not comfortable while learning or carrying out other educational activities.

In the case of the 3 in 1 Lecture Theatre, 1 (2.5%) of the respondent was highly comfortable, 20 (50%) were comfortable and 19 (47.5%) were not comfortable. The provision of sufficient windows in each of the three lecture rooms here facilitated good ventilation which was felt on visit to the building.

Data from the SEMS Lecture Hall indicate that 10 (33.33%) of the respondents were highly comfortable, 15 (50%) were comfortable and 5 (16.67%) of themwere not comfortable. The positioning of the windows and ventilation generally was good just as the case of the 3 in 1 Lecture Theatre.

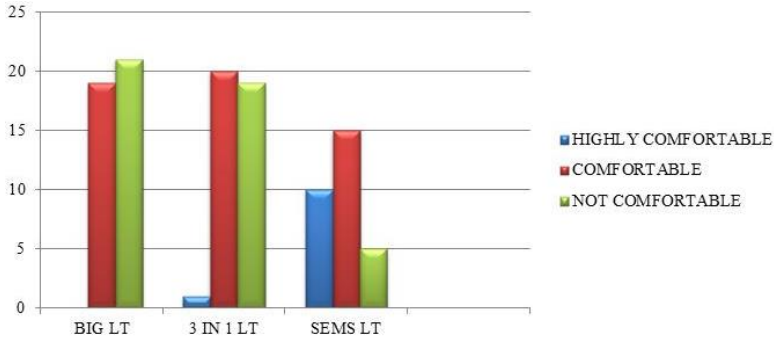

Figure 4: A chart showing the comfort level of respondents

Thermal Discomfort (Intense Heat)

In terms of thermal discomfort, 40 respondents stated that they often experience intense heat during the day. The same was observed in the other two lecture theatres, where a large number of respondents affirmed that they experienced similar thermal discomfort.

Table 3: Showing thermal discomfort data of respondents

S/N	Lecture theater	Yes	No
1	Big Lt	40	-
2	3 in 1 Lt	13	7
3	SEMS Lt	17	13

From Table 3 above, it can be deduced that most of the respondents in each of the lecture theatre experience thermal discomfort in all the three buildings.

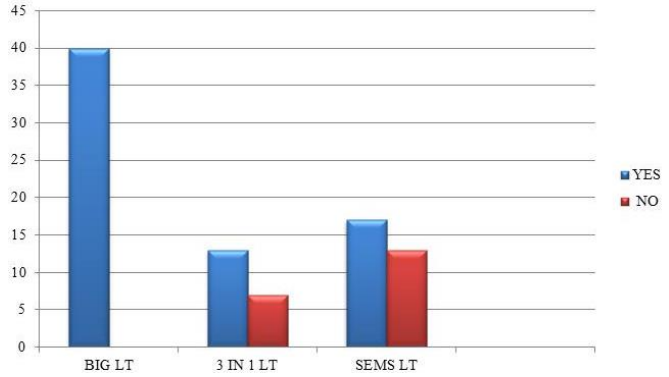

Figure 5: *A chart showing thermal discomfort data from the respondents*

Time of the Day Thermal Discomfort is experienced

In each of the theatres, thermal discomfort was observed to be experienced by virtually all of the respondents in the afternoon hours between 12pm – 4pm as shown in Table 4.

Table 4: Showing the time thermal discomfort is experienced in the theatres

S/N	Lecture theater	10am – 12 pm	12 – 4pm	4 – 6pm
1	Big Lt	4	35	1
2	3 in 1 Lt	-	30	-
3	SEMS Lt	2	15	-

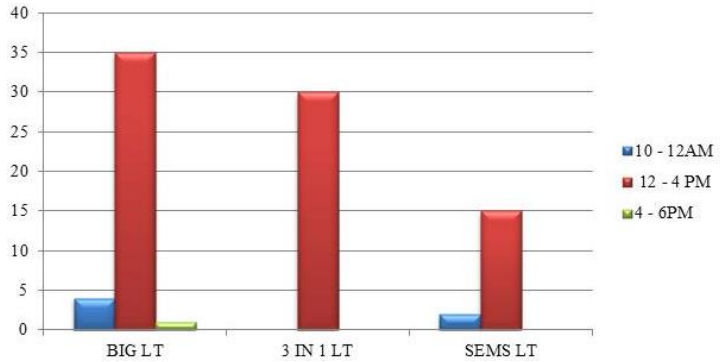

Fig 3: *A chart illustrating time of the day thermal discomfort is experienced in each of the Lecture theatres*

From the research carried out, it was gathered that factors responsible for poor thermal condition of lecture theatres include: bad orientation of theatres such as the Big Lt, bad form of the 3 in 1 Lt and ineffective vertical fin design, as in the case of the SEMS lecture halls.

RECOMMENDATIONS

From the information gathered through the research carried out, here are some recommendations that are of great importance to be considered for enhancing thermal comfort of students during the design of lecture theatres:

i. Shading devices should always be used on windows facing the east and west sides of buildings to reduce the penetration of solar radiation into the theatres so as to enhance students' thermal comfort while learning in school.
ii. Roofs should be of light and reflective surfaces to reduce solar heat gain through the roof.
iii. Materials used for the construction of wall should be of light weight and low thermal capacity. Wall finishes should be light in colour to reflect solar radiation.
iv. Building orientation and form should minimize the area of the building exposed to solar radiation all through the day. It is best for the longer sides of buildings to be positioned along the east-west axis.
v. Spaces should be provided around buildings for plants such as shrubs, lawns, trees among others as this will help in reducing solar heat gain in the building.
vi. Theatres where students are been taught should not be over populated but should always be occupied by the number of students the space was designed to accommodate.
vii. Internal shading devices such as blinds can be used in existing school buildings where some classes are exposed to solar radiation penetration due to ignorance or negligence on the part of the designer.

CONCLUSION

Apart from the need for acoustic and visual comforts in educational buildings, it is imperative for building designers to give great attention to thermal comfort of students who are to occupy the buildings. Learning in good acoustic, visual and thermal comfort conditions help

in improving students mental ability to comprehend what they are been taught in school and their academic performance. The use of the identified methods of solar radiation control in buildings as showcased in this paper will help in reducing the reliance on mechanical equipment in enhancing thermal comfort of building occupant.

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Building Information Modelling Integration to Education as an Antidotes for Nigerian Construction Industry (NCI) Hitches

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ABSTRACT

Construction industry is the largest employer of labour, and more importantly; it is one of the largest contributors to economic growth in many nations. However, this industry has been troubled with a lot of drawbacks that impede its achieving as much as it ought to achieve. Building Information Modelling (BIM) is a new paradigm employed in the delivery of construction projects in most developed world, and it has proven to mitigate various hitches that have bedeviled the industry for ages. This paper therefore seeks prominent works of researchers, experts' opinions and the apparent benefits that have been gained in the employment of BIM in construction industry for project delivery in many developed economy. These facts are further confirmed by the survey carried out in this study among professionals and specialties in the industry. This paper thus, submits that Building Information Modelling (BIM) should be integrated into higher education curriculum as an antidote for the various hitches that confront the construction industry in Nigeria. Hence, facilitating an adequate BIM adoption in the construction industry in Nigeria will invariably boost building project delivery in terms of time, cost, quality and management of construction project and also mitigate against shortcomings of the traditional delivery processes.

Keywords: Antidotes, Building Information Modelling (BIM), Delivery Process, Education, Hitches, Nigerian Construction Industry (NCI)

INTRODUCTION

Construction industry plays an important and vital role in the socio-economic growth of a country. The industry contributes significant improvements in the overall GDP of a nation and positively influences the quality of life by providing necessary infrastructure such as housing, roads, hospitals, schools and other basic facilities (Abdul Rahman et al., 2013). Furthermore, construction industry is one of the most challenging industries in this present age, but it still remains within low reliable rate of profitability, little investment in research, education and development, of which the Nigerian Construction Industry (NCI) is not an exception. In addition, the problem of training beginners for replacement of aging work force and people without adequate modern technological training is among the issues raised by the Construction Task Force Report (1998) as cited in (Ahmad, 2013).

Building Information Modelling (BIM) is a modern delivery tool that is widely in use in the construction industry. It is said to be the international benchmark for efficiency in Architectural, Engineering, and Construction (AEC) and a host of other building services. It is the platform that brings about collaboration and integration of environmental professionals and all other stakeholders. Ibrahim affirms that every professional practice have particular tasks needed to achieving a successful BIM platform (Ibrahim and Krawczyk, 2003). Thus, BIM can now be said to encompass all phases of project development from investment conceptual stage through to architectural, civil/structural, mechanical/electrical, cost evolvement and analysis, procurement, tendering and award, construction to completion and occupation, facility maintenance and operation, and finally, the demolition of the building with a positive resultant returns on investment at the end of its life span. These are very enormous and cumbersome tasks that can be rolled into a series of integrated tasks for easy

Yusuf B. Y., Ali K. N., Embi M. R. & Tukur R. B. (2016). Building Information Modeling Integration to Education as an Antidotes for Nigerian Construction Industry (NCI) Hitches. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 197-205

project delivery with the use of BIM. Of course, it can be argued that these various tasks have been initiated and executed successfully before the introduction of BIM, but BIM is a coordinated and integrated method where time, money, decision making and precise predictions of project characters are of advantage. Besides, more potentials of BIM are still yet to be exploited and explored (Abubakar, 2012).

Recent studies revealed that construction industry is vital to the economic growth of most developed countries (Macdonald, 2012) and that maximum utilization of BIM benefits cannot be fully harnessed because of lack of adequate manpower in the sector. The education sector, especially higher education is still behind in balancing the differences of the industrial needs in terms of manpower to the current turn-out (Macdonald, 2011b).

Objectives of study

This paper sets out to evaluating the NCI performance and the global practices in the construction industry. It is also to unveil the inherent benefits of BIM adoption in some countries of the world and how it profits economic growth and industrial practises. The objectives of the study is therefore to: 1- establish the needs for paradigm shift in the NCI so as to meet-up with the best of global practises; 2- highlight the importance of building information modelling (BIM) as an antidote for alleviating most of the challenges in the NCI; 3- show BIM education integration to higher institution of learning in Nigeria as the best alternative to mitigating the NCI problems of this age. In line with these objectives, this paper tends to adopt literature review of benefit deliverables that are characteristics of BIM when fully adopted while also noting that the impediment against achieving these objectives is lack of adequate knowledge of BIM. This is therefore the motivation necessary for integrating BIM into educational curriculum for the new generation of AEC professionals. Thus, information technology era has no space for the 'wait and see' syndrome that has been historical characteristics of the education sector in Nigeria.

LITERATURE REVIEW

Nigerian Construction Industry (NCI)

Nigeria is commonly referred to as the giant of Africa; this is due to its size, population, human and material resources and the economic growth potentials at its disposal (Zulu, 2009). In the same vein, the Nigerian Construction Industry (NCI) can also be referred to as giant within its continental neighbourhood because of the volume of construction projects and numerous services delivery offered to its clients (Kolo and Ibrahim, 2010). Tunji-Olayeni et al. (2014) noted that NCI is very vibrant and one of the largest in Africa. The industry is made up of 78% indigenous firms and 22% foreign firms. The indigenous firms are largely made of small and medium scale (SMs) firms. However, due to the sizes of these firms, the NCI has been challenged to improving its performance, due to large problems in terms of cost over runs, time over runs, poor quality of work, low productivity, and lack of best practises including poor team work of professionals (Tunji-Olayeni et al., 2014). Also, poor project implementation, poor planning and budgetary provision, project over invoicing, poor service delivery, abandoned non-functional facilities, building collapsed and poor satisfaction among the clients (Kolo and Ibrahim 2010) are the hitches pulling the NCI down. In another study, it was determined that globalization has also significantly affected the NCI, with evident threats and opportunities which industry players should as a matter of urgency recognize and adequately respond to, for the survival of the industry at this age (Mbamali and Okotie, 2012).

BIM as a Process of Change

Building Information Modelling (BIM) is also called n-D Modelling or Virtual Prototyping Technology. It is a revolutionary developmental phenomenal that is fast reshaping the

construction industry. BIM is both a technology and a process. The technology component of BIM makes the project appreciable for stakeholders to visualize what is to be built in a simulated environment to identifying any potential design, construction or operational issues; while the process component allows collaboration and encourages integration of the speciality roles of all stakeholders on a project. (Azhar, et al.: 2012). In another argument, BIM is a technology that revolves round three base components; people, process and digital technology. The inter-relationship of these elements make up a system called building information modelling. This is a very important reason why using BIM eliminates lone working for all stakeholders in the industry (Kiviniemi, 2013). BIM can therefore, be said to be a methodology for managing building design and project data in digital format throughout a building's lifecycle (Succar, 2009) and it is considered as paradigm shift within the industry.

BIM global developmental trends

BIM has rapidly spread around the world. Many countries around the world have expressed great interest towards implementing BIM within the construction industry but each country has its own arrangements and different levels of progression (Bataw, 2013). Below are some of the countries that have adopted BIM and how they fare within the new paradigm.

BIM in United Kingdom (UK)

In 1997, the construction industry in the UK was perceived as under-achieving in terms of meeting its own needs and those of its clients. It was at this instance that the government set up a task force under the chairperson of John Egan to advise on the ways to improving the efficiency and quality delivery of construction. It was contained in Egan report (1998) that manufacturers should make interchangeable component parts, investing in performance tools by Building Research Establishment (BRE) and standardization of construction industry which is hoped will lead to improving performance that would speed up construction and lowered capital cost (Murray and Langford, 2003; Egan, 1998). Also, consideration was given to an alternative building delivery pack, that was BIM, with full awareness of its benefits in controlling cost, time and quality and the advantages it could offer to everyone involved in the construction industry, including clients, designers, contractors, suppliers and facilities managers. With the assurance gained on BIM; in May 2011 the government finally announced the adoption of BIM technologies, processes and collaborative behaviours into all stages of the life-cycle of public projects worth more than £5 million by 2016 (Bataw, 2013). In addition, KOUIDER and PATERSON (2013) reported that the principle objectives behind the legislation of adopting BIM for all government projects above £5m as from 2016 include:

i. Achieving 20% savings on the overall cost of projects
ii. Building a reliable and effective data sets for the efficient management of assets using COBie (Construction Operations Building Information Exchange)
iii. Carbon reduction to meet international and local targets
iv. Improving competitiveness in the construction industry (KOUIDER and PATERSON, 2013)

BIM in the United States of America (USA)

The adoption of BIM in the public sector started in USA as far back as 2006, when the US General Services Administration (GSA) issued a BIM-guideline for the integration of BIM within the US AEC sector in general and Public Building Service (PBS) in particular. Also, the following year; 2007, marked the start of the mandatory usage of BIM by all planners while applying for GSA's funding schemes. This was based on the reorganization of benefits that the public sector stands to gain. Consequently, there emerged a success story as approved

by American Institute of Architects (2010) that 60% of US architects are using BIM holistically. (Bataw, 2013)

BIM in Australia

In Australia, it was identified that various problems facing AEC industry could be extinguished through the implementation of BIM as industry operational language. This gave rise to the development of 'National BIM Initiative Blueprint' which was developed by 'BuildingSmart', meant to promoting the education and adoption of BIM at higher education level. Also the blueprint was to facilitate Australia government's adoption of full collaborative BIM for all government building projects procurement coming year 2016. This follows the same line of BIM development in UK, US and other government world over (Kriengsak et al., 2013). Besides, Gu and London (2010b) revealed that limited understanding of industry needs and technical requirements pose a major factor hindering the advancement and adoption of BIM related technologies within the Australian AEC industry. Aksamija and Ali (2008) studied and identified "inadequate training and education" as a major hindrance to the adoption of BIM in the Australian AEC industry which is consistent with that being faced globally.

The development and the adoption of BIM in Malaysia

Malaysia has always been at the forefront of imbibing new technology and always wants to be at the same level with the developed nation of the world. This is evident in the government's approach to any new paradigm that is perceived to have the potential of aiding economic progress and serve the citizenry better. This competition is also entrenched in their early recognition that a trained, skilled and well-educated workforce with ICT-driven knowledge-based society will undoubtedly fuel high economic performance and sustainable economic growth in Malaysia (Awang, 2004). This has given more energy to government agencies, professional bodies, individual practices organization and education sectors to be involved in the BIM awareness campaign.

METHODOLOGY

The study employed a case study research design, where countries that have adopted BIM for project delivery are reviewed and lessons are derived. Also, interview survey of practitioners in the industry both in the academic and in business practices was carried out. Fifteen professionals were interviewed across major specialty in the industry, such as architecture, engineering, quantity surveyors and others. The findings revealed that the problems militating against the industry can only be arrested with full adoption of BIM. It is also noted that full BIM adoption is not obtainable without the educational institutions featuring prominently.

FINDINGS AND DISCUSSIONS

Influence of BIM on the Construction Industry

Building Information Modelling adoption and understanding vary from country to country, discipline to discipline and from client to client; this then affects the level of adoption and usage among various building project teams. This has posed challenges to building information modelling adoption in construction industry (Gu and London, 2010a). Although, building information modelling is a collaborative work process, Ford et al. (1995) noted that despite the abundance and complexity of information in the construction industry, the non-corresponding management of the information is increasingly resulting to fragmentation among industry practitioners. It is also worthy of note that the construction industry has always been very slow in adopting strategies, methodologies and techniques. In another study, Macdonald (2011a) noted that the construction industry is vital to the economies of most developed countries, but studies have shown that despite this importance, productivity

has declined over the past 30 years and the industry is extremely inefficient compared to other industries. The construction industry has also been described as extremely fragmented and lacking integration. To this end, to improve this situation it is necessary to enhance communication among the different disciplines through BIM technology, which is, contributing to greater construction industry efficiencies and boosting collaboration among project delivery teams, reducing collisions and removing rework (Darius et al., 2013; Ford et al., 1995). This can only be achieved with full adoption of BIM throughout the project lifecycle.

In other words, efficient information-technological solutions are needed and these can only be supported by complete design information of a building consisting of several domain specific design BIMs; such as architectural, structural, HVAC and electrical, with building construction processes and overall building environmental management operations. Therefore, in this context, Building Information Modelling (BIM) is a platform for performing complex building performance analyses to ensure an optimized sustainable building design (Azhar et al., 2009; Gray et al., 2013) and to carry out some of the basic sustainable building task such as; Service life design, Environmental assessment, Energy consumption estimate, Maintenance manual, Optimization on building refurbishment and sustainable building rating. The benefits that the building industry stands to accrue from the adoption of building information modelling for project delivery can be appreciated in the Table 1.

Challenges of BIM adoption

Despite the fact that BIM is seen to be the way out of the challenges facing construction industry at this age, it is not without factors that are delimiting its efficacy and usability. A standard is a measure of quality and it guides the level of acceptance of a product; BIM is still a product without standards which allows an array of BIM software products that lack the ability to produce interoperable files; lack the strict BIM implementation standards and rules for certain project participants, and contract obligations and unified documentations to be adopted for BIM operations (Darius et al., 2013). These are problems affecting the collaborative working together of professionals as they use different software thereby reducing the benefits to be gained (Gray et al., 2013). Darius et al. (2013) further noted that the under-listed are some of the challenges delimiting the adoption of BIM:

i. lack of adequate knowledge and training
ii. high initial investment cost
iii. conservative approach of professionals
iv. Interoperability among disciplines
v. the fears of low success and big failures
vi. lack of organizational and professional qualification alignment
vii. Lack of standardization of BIM practice

These enumerated BIM challenges are very normal and these will challenge the construction industry to look for the solutions. From the survey, all respondents acknowledged the existence of these problems and believed that the problems can be solved with educating young generation; who are believed to be computer native than the computer immigrants of the present generation.

Benefits of BIM adoption

Despite the challenges militating against construction industry globally and the problems preventing the adoption of BIM, its adoption in some countries have attested to its competency in solving construction project problems throughout its lifecycle.

Table 1:- BIM Qualities and Usage across Project Delivery Phases

Phases	BIM Qualities	Use of BIM
Design / Conception Phases	Virtualization	Use for visualizations of a design, accurate and consistent 2D Drawings at any stage of the design; this enables easy production of design drawings (Eastman et al., 2011), (Rwamamara et al., 2010)
	Earlier Collaboration Of Multiple Design Disciplines	-Earlier collaboration of multiple design disciplines. This allows simultaneous work by multiple design disciplines, shortens design time, reduces errors and omission and also unveils design problems and possible improvement opportunities (Eastman et al., 2011), (Poerschke et al., 2010)
	Cost Extraction At The Design Stage	BIM enables accurate extraction of bill of quantities and spaces that can be used for cost estimation at early design stage. (Eastman et al., 2011), (Gray et al., 2013)
	Clash Detector	It is very useful in the design stage, single model with conglomeration of the interwoven components e.g. Pipes, electrical, beam structure can be united to detect any clashes. (Sacks and Barak, 2008; Sacks et al., 2004).
	Clash Resolution	Practical, as with this case study, BIM software will notify you of these clashes and adjustments can be made so that the error that have arisen will not become a problem during actual construction. (Sacks and Barak, 2008; Sacks et al., 2004)
Construction Phase	Work Schedules	It also enables automated material take-offs, cost estimation and construction schedules. (Azhar et al., 2009)
	Construction Management	BIM also can be used as source of information for analysis of the building solutions as well as to store the results of analysis; in addition, it can be used to represent the entire lifecycle (LC) of buildings including the processes of construction and facility operation (Häkkinen and Kiviniemi, 2008)
	Construction Delivery Time	BIM can influence time management with a 7% reduction in time for project completion. Issa and Suermann (2009) also share the same opinion that BIM helps to deliver projects on time.
	Cost	Another cost effective evidence was a US study from 2009, with two thirds of over 1,000 BIM users attested to positive return on investment (ROI) (Young et al., 2009).
Operation Phase	Project Management	Easy evaluation of design, construction and management of project before the actual project implementation. Ellis (2006).
	Positive Return On Investment	BIM enables the investors to monitor the profitability of their investments before actually embarking on such projects. (Young et al., 2009)
	Sustainable Design	BIM facilitates complex processes of sustainable design such as daylighting and solar access, it also enables automated material take-off, cost estimation and construction schedules, all these from a single integrated building model. (Azhar et al., 2009)
	Data Management	BIM is an excellent tool for data management, that facilitates easy and fast access to information in a single centralized database through the 3D model (Meadati and Irizarry, 2010).
	BIM As A Learning Tool	Meadati and Irizarry (2011) submitted that due to the characteristics inherent in BIM, it is a better option as a learning tool. Some of BIM characteristics are: reducing accessibility time to data information and easy visual correlation with real world.

The phases of construction of any project must be respected for such to be a success. The NCI is therefore challenged to adopt BIM at all phases of project life to earn these benefits.

i. *Conception / Design phase:* - the problems of working in solitary of project team members, wasting time due to reworking at the design stage, unresolved design conflict at the project inception, cost and time overrun and virtualization and space appreciation problems; are problems bedeviling the NCI. However, with adoption of BIM through education and training of the up-coming generation, the problems will be solved as evidenced from the experiences of some countries around the world.

ii. *Construction phase:* - most construction problems at this phase emanated from the conception/design phase. This is because a lot of unresolved design conflicts are

passed over to this phase, such as; members of the same project team not communicating, construction sequence, work schedules, construction management plans, construction delivery time, and actual project estimates not planned or known. But upon the full integration of BIM education and training into academic institutions with a clear curriculum plan in Nigerian higher institutions, these challenges will be non-existence as the graduates produced will be BIM competent graduates with adequate knowledge.

iii. *Operation phase:* - the problem in this phase is also deferred from the previous phases. This entails the overall management of resources, time, capital, land, authorities and other logistics throughout the lifecycle of the project. BIM education and training is all-encompassing; as adequate management of construction project in NCI through the whole lifecycle of projects can be handled with utmost benefits and adequate returns on investment to the nation.

Education Response to BIM

Traditionally, academic institutions are found to be slow in adopting changes especially if they are pressured by a continuous flux of new technologies. In the university, curricular change takes longer time, thus serving as impediment to building environmental academic disciplines to match the speed at which the AEC industry is advancing in this arena. In addition, there tends to be reluctance on the part of these institutions in the adoption of digital and computational approaches (Sharag-Eldin and N., 2010). Sharag-Eldin and N. (2010) further noted that academic exercises tend to challenge technology with new needs, applications, and possibilities. This tends to delimit full integration of information technologies into academic curricular, which is a problem that affects both the practitioners and the academic, causing them to miss opportunities for developing the industry as a whole. Also, the success factor perceived of the BIM and the envisaged potentials, the embracement and the adoption of these opportunities have remain low due to lack of education and training (Becerik-Gerber et al., 2011).

CONCLUSION

BIM is very likely to be the construction industry standard in the nearest future, thus, the teaching and training of this technology in higher institutions of learning is inevitable (Kelly, 2010). However the growth of BIM globally is without limits while more breakthroughs of its usage are still unfolding. Therefore, for maximum benefit to be achieved now and for making solid foundation for the upcoming generations, an unrelenting effort in producing skilled and qualified work force to the construction industry is unavoidable.

Thus, taking clues from the successes in the UK, the US, Australia, and Malaysia, where BIM adoption and its integration into higher education is vigorously being pursued; and for NCI to follow suite, will enable achieving maximum BIM benefits at all levels, thereby checking the problems of NCI. This cue will also facilitate the adoption of international practices with education as the foundation.

Therefore, as a prospect to the industry, this research and some recent studies submit that BIM is full of potentials that will significantly change and improve performance and documentation in the Nigerian Construction Industry (NCI). This prospect will also invariably reduce inefficiencies, enhancing productivity, and increasing collaboration and communication (Goedert and Meadati, 2008), with the intent that BIM will achieve decreased project costs, increased productivity and quality, and reduced project delivery time (Azhar et al., 2008).

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Drivers and Barriers of Compressed Stabilized Interlocking Earth Blocks for Building Construction in Nigeria

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ABSTRACT

Compressed Stabilized Interlocking Earth Block (CSEIB) is fast gaining recognition among construction professionals in Nigeria, and this can be attributed to its enormous benefits. Despite this increasing popularity, its usage is still low. It is in view of this that this research was carried out to identify and assess the drivers and barriers of CSIEB for building construction in Nigeria. A questionnaire survey and semi-structured interview were conducted with a group of 67 professionals in the construction Industry (Architects, Builders, Engineers and Quantity Surveyors). While the questionnaire assessed the opinion of professionals on the drivers and barriers of CSIEB, the purpose of the interview was to get first hand information from the professionals on the challenges faced during the use of CSIEB for building construction. Data collected were analyzed using Relative Importance Index. Findings revealed that the major drivers of the CSIEB for building construction are the aesthetic nature, low cost of raw material, suitability of material and reduction in cost of finishes and maintenance. High cost of machine, lack of trained machine operator and skilled personnel to handle production process and low acceptability among most social group were some of the identified barriers. This study recommends that the use of CSIEB should be encouraged among stakeholders due to its enormous benefits, while tariff on import duties should be reduced by the government thus, minimizing the high cost of importing machines. Appropriate training of personnel to handle the machines and production process through organized skill workshop should be encouraged, and proper sensitization of the public as to the benefits and reliability of earth construction should be carried out by the professionals in the Nigerian construction industry.

Keywords: CSIEB, Drivers and Barriers, Dry stacking, Earth, Nigeria

INTRODUCTION

The construction industry today is faced with the day to day challenges of trying to keep up with the speed of technological advancement and the rising taste of the end users. In commissioning a building project, a client will expect to obtain a building that satisfies his needs as to form and quality, of which he can take possession at the agreed time and for which he will pay optimum price (Aghimien and Oke, 2015). Thus, it is the duty of the construction expert to develop new methods of construction that will meet the demands of the end users in terms of quality, sustainability and affordable cost. Bankole-Ojo, (2008) stated that the human taste and needs have gone beyond just having a structure as a shelter, but has gotten to a level of concern for durability, flexibility, functionality, short construction processes, cost effectiveness, aesthetics and in most cases comfortability.

Ghosh (2002) stated that in most developed countries, it has been noticed that the conventional technologies used for construction of buildings are inefficient and resource wasteful due to huge amount of resources consumed. This was corroborated by Adedeji (2005) who stated that the enormous waste associated with conventional masonry works facilitated the search and subsequent development of more rapid and less workmanship dependent building methods and materials. One of such development is the use of Compressed Stabilized Interlocking Earth Block (CSIEB).

CSIEB is made from laterite, stabilized with cement (in most cases) and compressed in an interlocking block making machine. According to Adedeji and Fasakin (2008) when used for construction, it has unparallel advantages such as shorter period of construction, lesser gang

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of labour and reduced cost of construction. Despite these advantages, its usage in construction of building is low when compared to the conventional sandcrete blocks. This is partly due to the ignorance of the people towards the advantageous use of this material for building construction (Adewole, 2008). This research therefore assessed the various drivers and barriers of CSIEB in building construction in Nigeria with a view of providing a more suitable, cost effective and faster method of construction. To achieve this, the drivers of CSIEB in building construction and barriers were assessed and possible solutions to reducing the barriers and possibly increasing the drivers were proposed.

LITERATURE REVIEW

Building Materials

Comfortability has been a major priority for man since the time of creation, and to achieve this lot of developments have been carried out over the centuries (Olaleye and Sangodina 2001). In achieving a comfortable environment, the choice of material is critical. Hence the complete life span of the material, environmental impact, cost, social requirements such as: thermal comfort; good mechanical properties; aesthetic characteristics, and an ability to construct quickly must be greatly considered (Adedeji and Fa 2012). Abeysundara, Babel and Gheewala (2009) observed that the combination of all environmental, economic and social factors can give a clear description of a material, and helps in a decision making process regarding the selection of the materials suitable for buildings.

Earth for Building Construction

Earth as a building material has been in use for thousands of years all over the world and according to Olotuah (2002) it is the indigenous material for building construction in Nigeria. Pollock (1999) opined that earth as a building material has been in used since the Ubaid Period in ancient Mesopotamia (5000 – 4000 B.C.) and ancient monumental structures which are still objects of tourist attraction such as ancient temples, the pyramids, the Great wall of China and even the walls of Benin city which was the worlds' largest man-made earth structure (Wesler, 1998) were all built with earth. Adam and Agib (2001) observed that earth still continued to enjoy patronage as a building material but with varying degrees of improvement in techniques as a result of improved technologies. Many different techniques have been developed in using earth as a construction material and these methods vary according to the local climate and environment as well as local traditions and customs.

Alagbe (2011) also observed that earth building technique was popular in Nigeria until the influx of cement blocks into the country immediately after independence. Most pre-independence houses were built of earth building techniques of mud wall or sun-dried bricks. The houses served their purpose of providing adequate shelter for the inhabitants and they were also durable to the extent that some of the buildings dated between 50 and 100 years.

Production and Features of CSIEB

In production of CSIEB soil is gotten from at least 1m below the top soil. The soil must be free of dirt in other to achieve a fine finish product. This dirt free soil is achieved with the use of sieve. The clay content of the soil must be low enough not to require reduction with sharp sand and high enough to make the blocks easy to handle. The soil is mixed with cement in predetermined ratios by hand or in a pan mixer and water added at an average proportion, making sure that the mixture is not watery. The mixture is loaded into the block making machine in which it is hydraulically compressed. It takes an approximate 15-20 seconds per block, after which the compressed block is then stacked and left to cure (Hydraform, 2004).

CSIEB is moulded by pressing along its length from the ends. It is also a solid block, slightly short, wide and thick in size (225x225x112mm). It has a Bed underneath and a Ridge at the

top. The recessed under surface of the block is referred to as the bed while the raised top surface of the block is called the Ridge. The ridge of one interlocking block is designed to key in to the bed of another, thereby providing a perfect lock in masonry (Hydraform, 2004; Bansal, 2010). Kintingu (2009) observed that the stability of the wall built from the CSIEB is not provided by the locking mechanism but by the width and weight of the block. CSIEB has proven to be suitable for the construction of load bearing walls, framed structures, boundaries etc. and this is because of its strength and stability (Bansal, 2010).

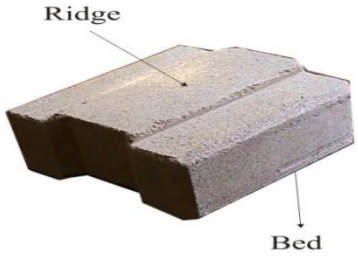

Figure 1: Full scale dry-stack block unit
Source: Adapted from Bansal (2010)

Use of CSIEB for Building Construction

The use of CSIEB for building construction follows the principle of dry stacking. In dry stacking construction, the interlocking blocks are laid without mortar thereby leading to considerable savings in cost associated with mortar. This method of construction according to Uzegbo and Ngowi (2003) has existed in Africa for thousands of year. Pave and Uzoegbo (2010) observed that ancient dry-stack masonry consisted of robust construction and the huge structural elements which were both material and time consuming construction process. At the time, attention shifted from dry-stack construction to research on new materials and applying new methods of construction. Adewole (2008) stated that these research activities that ultimately led to the development of the interlocking block technique, which is gaining popularity in Thailand, as well as Malaysia and the Philippines. Olusanya (2001) stated that the first documented usage of the interlocking masonry construction in Nigeria was that of a 60-unit housing estate experimented in 1991 at the University of Lagos, Lagos. Since then interlocking masonry has gradually gained recognition within the country, especially with the introduction of the Hydraform system of building, the use of CSIEB is increasing like the clinic, hostel and staff quarters in Elizarde University, Ilara-mokin, Ondo state, the Electronic Testing Centre in Federal University of Technology, Akure, and the construction of a caring heart mega school, Famese, Isokan, Akure, Ondo state.

Drivers of CSIEB in Building Construction

Deboucha and Hashim (2011) observed that although the stabilized earth blocks have been an area of interest for researchers in the past, its potential as a commercial construction material and the ability to fulfill several functions such as structural integrity, thermal transmittance and durability, makes the material an excellent walling material when compared to other masonry materials used in construction today and this has brought about the resurgence of renewed research interest in recent years.

The major drivers to the use of CSIEB for masonry construction include: shorter period of operation, lesser gang of labour, reduced cost of construction, aesthetic nature of the system, low cost of raw material, suitability of the system, reduction in cost of finishes and maintenance, time saving during construction, availability of materials, adaptability of blocks to tropical climate, better quality construction, less wastage, versatility as all other elements such as doors, windows and slabs used in the conventional system can be used with it, and

genuine eco-friendliness (Adewole,2008; Adedeji and Fa 2012; Taiwo and Adeboye 2013; Bansal, 2010).

Barriers of CSIEB in Building Construction

Despite the immense benefits of CSIEB for construction of sustainable homes, the level of usage is still low when compared to the popular conventional sandcrete blocks. This according to Wazir, Kadai and Biu (2014) is as a result of problems related to production which includes: delays in the production process, absence of quality control, lack of skilled machine operators, lack of trained personnel handling production; and those related to the construction, which includes: absence of trained masons for wall construction, high cost of block construction and slow rate of construction. Alagbe (2011) and Ng'ang'a, (2013) further identified some barriers to the use of laterite as a major material in building construction today. These includes: reduced durability of structures built with earth if not regularly maintained and properly protected, particularly in areas affected by medium to high rainfall; low resistance to abrasion and impact if not sufficiently reinforced or protected and; low acceptability amongst most social groups as it is considered by many to be a second-class and cheap material, hence it is meant for the poor.

METHODOLOGY

The aim of this paper is to identify the drivers and barriers of the use of CSIEB for building construction in Nigeria. In achieving this, a survey design was used. This involved the use of questionnaire and interview. A total of 60 questionnaires were distributed to respondents in Lagos and Ondo state, while 10 professionals who have been involved in the use of CSIEB for building construction in these two states were interviewed in other to ascertain the challenges faced during the course of the projects. Out of the 60 questionnaires distributed, 57 were returned and were found fit for analysis. Relative Importance Index (RII) was used to analyze the drivers and barriers of CSIEB for building construction while Content Analysis was used to analyze the information gotten from the interview.

RII according to Megha and Rajivis (2013) is written as:

$$RII = \frac{\sum W}{A * N}$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight, and N is the total number of respondents.

FINDINGS AND DISCUSSIONS

General information of respondents

Respondents profile showed that Quantity surveyors and Engineers formed the bulk of the respondents sampled with 28.1% while Architects and Builders form 24.6% and 19.3% of the total population. 29.8% of the respondents have between 0 to 5years working experience, 35.1% of respondents have between 6 to10 years working experience while 24.6%, 7% and 3.5% have between 11 to 15, 16 to 20 and 21 to 30 years of experience respectively. Since a total of 70.2% of the respondents have between 6 to 30 years working experience, it therefore implies that the result gotten from the respondents can be relied upon as answers were given based on experience. Also 89.5% of the respondents are aware of CSIEB for building construction, while 10.5% are not. This high awareness rate can be attributed to the vast years of experience of the respondents in the construction field. 50.9% of the respondents have been involved 1 to 10 construction projects where CSIEBs were used, while 38.6% have not. This 38% respondent includes those that have not heard of the material and method of construction before and those that have but have not actually been involved in its usage.

Drivers of CSIEB for building construction in Nigeria

Table 1 below shows the driver of CSIEB in building construction in Nigeria. Result shows that low cost of raw material and suitability of system and reduction in cost of finishes and maintenance as they are the top four major drivers with a RII of 0.800, 0.788, 0.776 and 0.770 respectively. Versatility of CSEIB was ranked last with a RII of 0.492.

Table 1: Drivers of CSIEB for building construction in Nigeria

Drivers	RII	Ranking
Aesthetic nature of the system	0.800	1
Low cost of material	0.788	2
Suitability of the construction system	0.776	3
Reduction in cost of finishes/maintenance	0.770	4
Time saving during construction	0.738	5
Availability of raw materials	0.734	6
Cost Effectiveness of the overall building system	0.724	7
Adaptability of CSIEB to tropical climate	0.722	8
Better quality construction	0.716	9
Lesser waste	0.704	10
Use of reduce Labour	0.674	11
Genuine eco-friendliness	0.642	12
Versatility of the CSIEB	0.492	13

Barriers of CSIEB for building construction in Nigeria

Table 2 below shows the barriers to the use of CSIEB for building construction in Nigeria. Result shows that the major barriers to the use of CSIEB are high cost of machine, lack of skilled machine operators, lack of trained personnel handling production and low acceptability amongst most social groups, as they are the top four major identified barriers with a RII of 0.919, 0.838, 0.819 and 0.808 respectively. Absence of quality control and Low resistance to abrasion and impact if not sufficiently were ranked last with a RII of 0.542 and 0.512 respectively.

Table 2: Barriers of CSIEB for building construction in Nigeria

Barriers	RII	Ranking
High cost of machine	0.919	1
Lack of skilled machine operators	0.838	2
Lack of trained personnel handling production	0.819	3
Low acceptability amongst most social groups	0.808	4
Delays in the production process	0.746	5
Absence of trained masons for wall construction	0.665	6
Slow rate of construction	0.627	7
Reduced durability of structures if not regularly maintained and properly protected	0.585	8
Absence of quality control	0.542	9
Low resistance to abrasion and impact if not sufficiently reinforced	0.512	10

Interview Findings

In other to get first-hand information on the challenges faced during the use of CSIEB for building construction, interview was conducted for those that have been involved in its usage. Quantity surveyors formed the bulk of the respondents with 40% while Architects, Engineers and Builders formed 20%, 30% and 10% respectively. 70% of respondents have between 6-10 years working experience while only 20% and 10% have 11 to 20 years and above 20 years of working experience respectively.

From the interview conducted, respondents outlined the following challenges faced during course of construction using CSIEB. This includes:

80% of the respondents stated high cost of acquiring the machine needed for the production of CSIEB as a major challenge faced in the decision to use CSIEB for construction.

Need for skilled machine operator trained in the handling of the machine is also a major challenge stated by 80% of the respondents. It was observed that only few trained machine operate are available and this usually leads to delay in the production process.

60% of the respondents stated that as a result of the technicality involved in the usage of CSIEB, not just any mason can lay the blocks hence leading to slow construction process.

Also 60% of the respondents stated that the opinion of people about earth construction is also an important factor, as it is generally believe that earth is a cheap and poor material for building construction.

Difficulty in determining the construction cost from the onset since interlocking stabilized earth blocks are not sold in the market was a challenge faced by 50% of the respondents. Unlike the conventional sandcrete blocks, the CSIEBs are not available in the market, hence the need to estimate the cost of hiring/purchasing the machine, materials and labour. This has proven to be a challenge for both the contractors and the clients, as approximate estimates are used and this in most cases leads to variation during the course of construction.

50% of the respondents stated that getting the required laterite type and quality from the proposed site was a major challenge, hence the need for a borrow pit elsewhere. This most times leads to increased cost and considerable time wastage.

40% of the respondents were of the opinion that the use of CSIEB for construction needs to be predetermined before the architectural design is done. Due to the irregularity in the length of buildings, the blocks would need to be cut to different irregular sizes on site, giving a non appealing look after construction. Also the irregular colour of blocks which is as a result of usage of laterite gotten from different pits, if not properly managed, could lead to a non-appealing finish. This might lead to the painting of these blocks leading to increase in cost.

Discussion of Findings

It was observed that the CSIEB is gaining popularity among professionals within the Nigeria building construction industry as 89.5% of the respondents are aware of it. The drivers and barriers to its usage in building construction are discussed below

Drivers of the CSIEB for Sustainable Building Construction in Nigeria

Findings corroborate Adedeji and Fasakin (2008) assertion that the high level of acceptability of the stabilized interlocking earth blocks is as a result of its cost effectiveness, adaptability to tropical climate, accessibility and suitability. While almost all the listed drivers showed considerable importance level, the aesthetic nature, low cost of raw material, suitability of the material for building construction and reduction in cost of finishes and maintenance have high relative importance in the use of the material for building construction in Nigeria, as they have a RII of 0.800, 0.788, 0.776 and 0.770 respectively. The versatility of CSIEB had a mean score RII of 0.492. This can increase with time if the material is used more often for building construction.

Barriers of the CSIEB for Sustainable Building Construction in Nigeria

Based on the responses from the questionnaires and interviews the problems associated with the use of CSIEB include:

High cost of acquiring the machine needed for the production of CSIEB and the need for skilled machine operator trained in the handling of the machine as they both have an RII of 0.919 and 0.838 respectively. This twin problem poses a big challenge during construction as observed by 80% of the professionals interviewed. This problem can be associated to the huge cost of buying and importing these interlocking block machines and also the lack of adequate skilled personnel that can handle the machines (Waziri et al, 2014).

The technicality involved in the usage of CSIEB and the lack of skilled personnel to handle the production with an RII of 0.0819 are also challenge identified by respondents during the course of using CSIEB. This can lead to slow production and construction process.

Low acceptability among most social group is another barrier to the use of CSIEB with an RII of 0.808. Finding revealed 60% of the professionals interviewed stated that the opinion of people about earth construction is also important factor militating against its use. It is generally believe that earth is a cheap material, hence it is meant for the poor (Ng'ang'a, 2013) but this can be address through proper sensitization of the public of the immense benefits of stabilized earth construction. Furthermore, several researches have been carried out on the strength of CSIEB and it has been proven that it is structurally suitable for any type of construction (Bansal, 2010; Chaibeddra and Kharchi, 2013).

Findings revealed that there is always difficulty in determining the construction cost from the onset since CSIEBs are not sold in the market unlike the conventional sandcrete blocks. Since the blocks are made on site, lot of 'guess work' are done during estimation which may lead to possible errors.

Absence of quality control ranked 9th with a RII of 0.542. This is contrary to waziri et al, (2014) research were absence of quality control on site which often leads to the production of poor quality blocks ranked highest. These two extreme views of respondents can be attributed to the capability of the organization handling the project in terms of quality control in construction.

Findings revealed that getting the required laterite type/quality from the proposed site is always difficult as observe by 50% of the professionals interviewed, hence the need for a borrow pit elsewhere. This can be attributed to the nature of soil in the proposed site as the nature of soil differs from one location to another. This is somewhat contrary to the general idea that materials can be gotten from anywhere as laterite earth is readily available (Adewole, 2008).

CONCLUSION AND RECOMMENDATION

Conclusively, the research has been able to determine the drivers and barriers to the use of CSIEB for building construction in Nigeria. The study showed that CSIEB is gaining recognition among construction professionals in Lagos and Ondo state, Nigeria. The study revealed that the major drivers of the CSIEB for building construction are the aesthetic nature, low cost of raw material, suitability of the material for building construction, reduction in cost of finishes and maintenance, time savings during construction, availability of raw materials and adaptability to tropical climate.

The study shows that while the benefits of using CSIEB are enormous, certain challenges might affect its adoption if not properly checked. These include; the high cost of machine, lack of trained machine operator and skilled personnel to handle production process, low acceptability among most social group as they have the opinion of the earth construction as being too cheap and structurally unfit for construction, difficulty in getting right material on proposed site leading to the need for a borrowed pit, difficulty in determining the cost of

construction from the onset, and a non-appealing look resulting from cutting of blocks and different types of laterite used.

The study therefore recommends that the use of CSIEB should be encouraged among stakeholders as a material for building construction due to its enormous benefits, while tariff on import duties should be reduced by the government, thus, minimizing the high cost of importing machines. Appropriate training of personnel to handle the machines and production process through skill workshops should be carried out in order to increase the number of available machine operators hence increasing the speed of production and construction. This training can also serve as a means of providing employment for members within the community. Proper sensitization of the public as to the benefits and reliability of earth construction should be carried out by the professionals in the Nigerian construction industry through workshops.

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Managing Wastes on Construction Sites in Akure, Ondo State

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ABSTRACT

This paper is aimed at providing an insight into the management of wastes on construction sites in Ondo State, Nigeria with a focus on Akure, the state capital. Nigeria being a developing country is experiencing an increase in the rate of construction projects in almost all the states of the country. As a result of the construction activities, huge wastes are generated on the construction sites with little or no proper waste management methods put in place. Effective waste management on construction sites is therefore an important factor in construction management. This study reviews construction waste materials, type of wastes and the method of collecting wastes on construction sites. It also discusses the method of sorting wastes and the various means of waste disposal. Data for the study were collected through a structured questionnaire administered to site architects, project managers, quantity surveyors, contractors and masons on construction sites. Mean Item Score and Percentile were used to analyze returned questionnaires. The findings revealed that, most wastes are generated during construction as a result of broken or shredded materials. It also revealed that, inexperience on the part of the masons is the major cause of material wastage on construction sites and that most construction sites in Akure depends on Ondo State Waste Management Authority for the removal of wastes on sites. This study in conclusion suggests efficient technical training for the masons and the revitalization of technical colleges in Ondo State and Nigeria as a whole. This study then makes a succinct recommendation on the need to minimize wastes and proper disposal of the wastes generated on construction sites.

Keywords: Construction, Wastes, Management, Construction sites, Akure

INTRODUCTION

The management of waste is an essential aspect of sustainable building construction. Managing waste means eliminating waste where possible; minimizing waste where feasible; and reusing materials which might otherwise become waste (Napier, 2012). Construction waste is generally defined as by-products generated from construction, renovation and demolition workplaces or sites of building and civil engineering works. Construction waste issues have become more a part of the focus on a project due to cost and environmental awareness (Dajadian and Koch, 2014). Construction project costs increase significantly due to the amount of waste generated which also have negative impact on the environment by consuming landfills, and natural unrecoverable resources. Bossink and Brouwers, (1996) identified design, procurement, materials handling, operation, residual, and other as the six main causes of waste. Over production, poor handling, incorrect storage, incorrect ordering, design change, manufacturing defects and rework are factors that contribute in material waste. Other factors that contribute in a way or another in generating construction wastes are lack of training and poor craftsmanship. In general, a very high level of waste is assumed to exist in construction. Although, it is difficult to systematically measure all wastes in construction, but studies from various countries have confirmed that waste represents a relatively large percentage of production costs (Sagoe, 2011).

Construction activities are on the increase in most developing countries as most of these nations are striving to provide shelter for its citizenry. Developing nations normally want provision of more essential infrastructural facilities which includes major building projects, road construction, bridge construction etc. The construction industry in Nigeria is fast growing with the involvement of the Government at all levels, Public Private Partnership,

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International Organizations and individuals in various construction activities ranging from buildings to roads and bridge constructions. The construction industry generates large quantities of waste and contributes to the problems of environmental degradation in Nigerian cities due to ineffective waste management systems. This has inevitably led to the generation of waste at different stages of projects (Wahab and Lawal, 2011). Studies have shown that, not all materials procured for construction or renovation projects in Nigeria are used during the construction process. The left-overs are either sold to interested buyers or left as wastes that may not be accounted for by the contractor.

Waste management is a major challenge in many cities in Nigeria. The nature of this challenge is in effective management, ability to reduce, re-use and recycle wastes generated. Concerted efforts are being made by the Government at all levels through the establishment of Waste Management Agencies and Private Support Partnership (PSP) to curtail it. This is evident in Lagos state where the state waste management authority (LAWMA) collaborates with private partners to manage wastes generated. Studies however, show that improper disposal of waste has resulted in high rate of morbidity and mortality in a developing society such as Nigeria (Oluwaleye, 2012). Waste therefore affects success of construction projects significantly. More specifically, it has major impact on construction cost, construction time, productivity and sustainability of the project.

This study reviews the management of wastes on construction sites in Akure, the capital city of Ondo State, Nigeria with a view to identifying the causes, effects and the material that generates most wastes. This is done by investigating the stage at which most wastes are generated and the sources of waste as well as the waste management methods adopted on the construction sites. The study is justified in the sense that, it will support and enrich existing few data on construction and demolition wastes in Nigeria. It will serve as a reference material for professionals in the construction industry in Akure and Nigeria as a whole. This study is also an eye opener for all stakeholders in the Nigerian construction industry on the need to employ an effective waste management methods which will in turn reduce cost and ensure prompt project delivery. This paper is divided into five (5) sections. The first section being the introduction which is followed by literature review. The literature review is important as it identifies and acknowledge previous studies on construction wastes. It is followed by a description of the study area and the methodology adopted for the study. Section four gives a detailed analysis of the data collected and also discusses the results and findings. The fifth section contains the conclusion and concise recommendations.

LITERATURE REVIEW

The Building Research Establishment (1981 cited in Ekanayake and Ofori 2004) define construction waste as “any materials apart from earth materials, which needed to be transported elsewhere from the construction site itself other than the intended specific purpose of the project due to damage, excess or non-use or which cannot be used due to noncompliance with the specification, or which is a by-product of the construction process”.Mohanty and Deshmukh (1999), state that “any non-value adding activity carried out in any work system at any time can be defined as waste”. Also, Formoso et al. (1999 Cited in Yahya and Boussabaine 2006) define waste as “any losses produced by activities that generate direct or indirect costs but do not add any value to the product from the point of view of the client”. All the definitions cited indicates that, construction wastes are materials that becomes useless during and after the completion of the construction projects. Evidence from previous research shows the classification of wastes to include their sources, physical state, material composition and the level of risk associated with waste substances. Such

classification of waste provides a basis for the development of appropriate waste management practice.

The source classification of waste is based on the fact that, waste emanates from different sectors of society such as residential, commercial and industrial sources. A study conducted in Asia by World Bank (1999) identified residential, commercial, industrial, municipal services, construction and demolition, processing and agricultural as the source sources of waste. In the *Stakeholders' Guide: Sustainable Waste Management*, the UK Environment Council (2000 cited by Sagoe 2011) also employed source classification to identify the major sources of waste as municipal sources, commerce and industry, agricultural sources, demolition and construction activities, dredged spoils, sewage sludge and mining and quarrying operations. Waste from razed building and other structure are classified as demolition waste while waste from the construction, remodeling, and repairing of residential, commercial, and industrial buildings and similar structures are classified as construction waste. These wastes may include dirt, stones, concrete, bricks, plaster, lumber, shingles, and plumbing, heating, and electrical parts.

Stokoe et al. (1999) reported that around 1994/1995, construction and demolition waste took up about 65% of Hong Kong's landfill space. Ferguson et al. (1995), also reported that, over 50% of the waste in a typical United Kingdom landfill could be construction waste. According Serpell and Labra (2003), out of the 3.5 million tons of construction and demolition waste generated in Chile, only 10% is placed in authorized and controlled landfill sites. In Brazil construction industry, the level of waste at construction sites is 20 – 30% of the total weight of materials on site (Bossink and Brouwers, 1996). According to UK Statistics on Waste, UK generated 200.0 million tonnes of total waste in 2012. Based on the Nomenclature of Economic Activities, 50 per cent of this waste was generated by Construction. Commercial & Industrial activities generated almost a quarter (24 per cent), with households responsible for a further 14 per cent.

Wahab and Lawal (2011) grouped the construction activities which produce wastage into off-site and on-site operational activities. According to them, off-site activities include prefabrication, project design (architectural, structural, mechanical and electrical design), manufacturing and transporting of materials and components while on-site construction activities relate to construction of a physical facility which consists of the substructure and superstructure of the building. Their study indicated that, some degrees of waste materials are inevitable in the construction process. Neo and Koh (1995) also grouped the wastes produced at construction sites into physical and non-physical wastes. The physical wastes are mainly from broken concrete, bricks, metals, packaging waste, etc. Whereas the non-physical wastes are cost overruns and time delays in construction projects. Wastage may also lead to delays that cause costly idle time for other resources. Most loss of materials occurs as a result of the decision of the site management. Decision taken at the initial stage (design stage) of any project, either by the manufacturer or supplier of materials is capable of increasing waste level (Wahab and Lawal, 2011).

Solid waste management has emerged as one of the greatest challenges facing state and local government environmental protection agencies in Nigeria. The volume of solid waste generated continues to increase at a faster rate than the ability of the agencies to improve on the financial and technical resources needed to parallel this growth. According to Ogwueleka (2009), solid waste management in Nigeria is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal of solid waste. The study revealed that, Nigeria has solid waste management problems that are different from those

found in industrialized countries in areas of composition, density, political, and economic framework, waste amount, access to waste for collection, awareness and attitude.

STUDY AREA

The study area utilized for this paper is Akure, the capital city of Ondo State, Southwest, Nigeria. Akure is a traditional Nigeria city and like other traditional Yoruba towns in the country, it existed long before the advent of British colonial rule. Akure has a population of 360,268 (National Population Census, 2006). Using 2% yearly increase, it is expected that by 2015 it would rise to 430, 553 and 475,365 by the year 2020. It is located approximately 700 kilometres South West of Abuja, the Federal Capital of Nigeria and about 350 kilometres to Lagos the former capital of Nigeria. It lies on longitude 5^0 $18^/$ East of the Greenwich Meridian and Latitude 7^0 $17^/$ North of the Equator. Akure is a medium- sized urban centre and became the provincial headquarter of Ondo province in 1939. The rapidity of the city's development within the last twenty-five years stemmed from the political status of the town which was initially a provisional headquarter and later a state capital thus serving as the seat of both the local (Akure South and Akure North) and State Governments since 1976. Akure has been classified as a Millennium Development City.

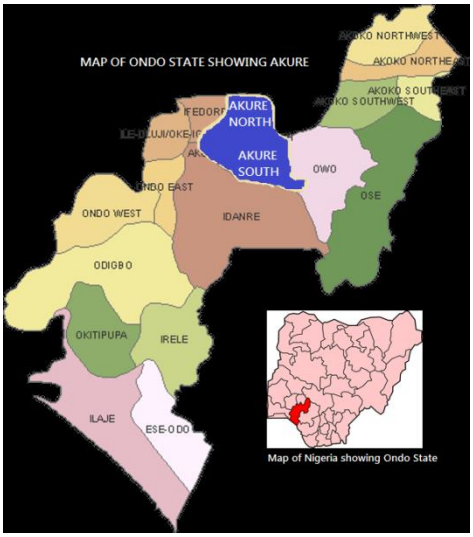

Figure 1: Map of Ondo State showing Akure
Source: https://www.ondostate.gov.ng/

RESEARCH METHODOLOGY

Data for this study were collected through a structure questionnaire which was administered to construction professionals and contractors that were directly involved at design and construction activities in Akure. Out of the Two hundred (200) copies of questionnaire administered, 153 were returned and found useful for this research which represents a response rate of 76.5%. The research instruments used for this study are the 300Level Architecture students of the Federal University of Technology, Akure. Data for the major causes of waste on construction sites and building materials that generate wastes were derived from the literatures and used for the study.

A list of 8 factors that contributes to waste on site were preliminarily identified through extensive literature review. This was followed by a questionnaire survey to collect the relative importance of the factors. The responses to the items on the questionnaire were obtained on a 5-point scale ranging from 1 to 5. "Strongly Agree" responses were scored 5, "Agree" were scored 4 and "indifferent" were scored 3, "Disagree" were scored 2 while "Strongly disagree"

were scored 1. Tobe able to rank the factors perceived by the respondents to impact the various aspects of the study, it was necessary to highlight the relative importance of the factors (Kangwa and Olubodun, 2003). Therefore, Relative Significance Index, RSI (also known as Index of Relative Importance, IRI or Relative Importance Index, RII) was used for ranking the factors.

Bakhary (2005) gave an equation that could be useful for determining relative Importance Index (RSI) in prevalence data as:

$$RSI = \frac{\Sigma \mu}{A * N}$$

Where μ is the weighting given to each factor by respondents;
A is the highest weight (i.e. 5 in this case);
N is the total number of respondents.

For this research, the RSI was computed using the formula below:

$$RSI = \frac{5a + 4b + 3c + 2d + 1e}{JN}$$

Where a = number of respondents who responded "Strongly agree".
b = number of respondents who responded "Agree".
c = number of respondents who responded "Indifferent".
d = number of respondents who responded "Disagree".
e = number of respondents who responded "Strongly disagree".
N = sample size = 153.
J = number of response categories = 5.

FINDINGS AND DISCUSSION

Table 1 shows that 68.6% of the respondents are males while 31.4% are females. Some 38.56% of the respondents possess 1 to 5 years of experience in design and construction activities; the period of the experience of the remainder were; 6 to 10years 11.11%; 11 to 15years 5.88%; 16 to 20 years 7.20%; 21 to 25 20.26% and above 20 years 16.99%.

Table 1: Respondents' Characteristics

RESPONDENTS' CHARACTERISTICS		
Gender	**Frequency**	**Percentage**
Male	105	68.6
Female	48	31.4
Total	**153**	**100**
Years of Experience		
1-5	59	38.56
6-10	17	11.11
11-15	9	5.88
16-20	11	7.20
21-25	31	20.26
Above 20	26	16.99
Total	**153**	**100**

Table 2 reveals the stages of construction where most wastes are generated. 17 of the respondents indicated that 11.11% of wastes are generated during the pre-construction stage while about 106 of the respondents showed that 69.28% of wastes are generated during the construction stage. 30 of the respondents were of the opinion that 19.61% of wastes are generated during post-construction stage. Some 86.24% of the respondents agreed that most wastes generated on construction sites are from building materials while 13.76% indicated that it is from human waste or wastes from the labourers. A further investigation into the sources of wastes on construction sites in Akure revealed that, 39.87% are from broken or

shredded materials, 13.07% from off-cuts, 21.57% from packaging and bagging of materials and 25.49% are from excess materials brought to site.

Table 3 presents the material that generates most wastes construction sites according to the findings of the survey. It shows that, majority of the respondents agreed that wood (RSI = 0.492, Rank = 1) contributes the largest wastes on their sites. This is contrary to previous findings by Chu (2004), Ameh and Itodo (2013) and several other researchers whose studies identified mortar as being the material that generates most wastes on site.

Table 2: Types and sources of construction wastes

STAGE OF CONSTRUCTION WHERE WASTES ARE GENERATED		
Stage	**Frequency**	**Percentage**
Pre-construction	17	11.11
During construction	106	69.28
Post construction	30	19.61
Total	**153**	**100**
TYPES OF WASTES GENERATED		
Type	**Frequency**	**Percentage**
Building material	132	86.24
Human waste/labour	21	13.76
Total	**153**	**100**
SOURCES OF WASTE ON SITE		
Source	Frequency	Percentage
Broken materials	61	39.87
Off cut	20	13.07
Packaging/bagging of materials	33	21.57
Excess material	39	25.49
Total	**153**	**100**

Table 3: Construction material that generate most wastes

Materials	**SA**	**A**	**N**	**D**	**SD**	**R.S.I**	**Rank**
Roofing material	0	3	16	53	81	0.322876	10
Wood	8	19	37	61	28	0.49281	1
Tiles	3	15	39	52	44	0.444444	3
Sandcrete block	0	29	42	49	33	0.487582	2
Concrete	5	17	41	34	56	0.444444	3
Glass	0	3	11	36	103	0.287582	11
Paint	0	2	27	41	83	0.332026	9
PVC	0	4	27	56	66	0.359477	7
Asbestos	0	9	21	70	53	0.381699	6
Metal	4	12	16	38	83	0.359477	7
Rubbles	6	19	29	43	56	0.437908	5

The first five materials (Wood, Sandcrete blocks, Tiles, Concrete and Rubbles) contributes the largest wastes on construction sites in Akure with wood being the largest. This finding agrees with the study conducted in the United States between 2009 and 2010 where the percentage material wastage indicates wood 30%, concrete 5%, gravels, aggregate and fines, 20%, dry wall 3%, Asphalt roofing 5%, ferrous and non-ferrous metals, 9%, plastic 1%, cardboard and paper 3% and disposal as refuse 5% (Napier, 2012). The result of a study conducted in Hong Kong by Tam et al (2007) also identified the following percentage wastage; concrete 8.99%, reinforcement 7.7%, formwork, 20%, block/brick 8.9%, and tiles 15.58%.

Table 4: Causes of construction wastes

Causes	**SA**	**A**	**N**	**D**	**SD**	**R.S.I**	**Rank**
Poor design	43	57	31	20	2	0.755556	5
Inexperience labour	63	57	24	9	0	0.827451	1
Poor site practice/organization	26	73	42	12	0	0.747712	6
Over estimation	46	50	35	22	0	0.756863	4

Faulty design	30	52	46	18	7	0.704575	8
Use of non-professional	43	71	26	8	5	0.781699	2
Wrong construction methods	44	54	42	12	1	0.76732	3
Site constraints	37	54	46	9	7	0.737255	7

Table 4 reveals the major causes of wastes on construction sites in Akure. It shows that, most wastes are generated on the sites as a result of inexperience labour (RSI = 0.827), this is followed by use of non-professionals (RSI = 0.781). Wrong construction methods (RSI = 0.767) occupies the third position, it is closely followed by over estimation. Poor design (RSI = 0.7550), poor site organisation (RSI = 0.747) and site constraints (RSI = 0.737) occupies fifth, sixth and seventh position respectively while faulty design (RSI = 0.704) is the last on the list.

The means of collection and disposal of wastes generated on construction sites in Akure as practiced by the respondents are presented in table 5. It shows that, 45.10% of the respondents use big waste bins for collecting wastes, 41.83% uses waste pits which are dug on the sites and will be covered up after the completion of the project, while 20% of the respondents litter the sites by throwing wastes around. A further enquiry on how the wastes collected are disposed revealed that, 43.80% of the respondents dispose the wastes by burning, as back fills and some other ways. 50.98% uses the Ondo State Waste Management Board vehicles which are provided by the government for easy collection of wastes in and around Ondo State. 5.22% uses private companies for the disposal of the wastes generated on sites.

Table 5: Methods of collection and disposal of construction wastes

METHODS OF COLLECTION AND DISPOSAL OF CONSTRUCTION WASTE		
Means of collection	**Frequency**	**Percentage**
Waste bin	69	45.10
Waste pit	64	41.83
Littering	20	13.07
Total	153	100
Method of disposal	**Frequency**	**Percentage**
Self-disposal	67	43.80
Government owned	78	50.98
Private company	8	5.22
Total	153	100

The respondents were asked to identify the effects of poor waste management on construction sites. Their responses were presented in table 6. Some 39.22% were of the opinion that, it brings about material wastage which could leads to extra cost of construction. 3.33% said it causes pollution while 27.45% indicated that, it could lead to injury.

Table 6: Effects of poor construction waste management

Effect	**Frequency**	**Percentage**
Injury	42	27.45
Pollution	51	33.33
Material wastage	60	39.22
Total	153	100

Based on the above findings, it has become expedient to include waste management in building contracts as this could assist in its effective management. All stakeholders in the building construction industry have specific roles to play if construction waste is to be managed effectively on construction sites. Table 7 shows action required to be taken by some identified stakeholders.

Table 7: Actions required

S/N	**Actions**	**Stakeholder**

1.	Good site practice	All stakeholders on construction sites
2.	Appropriate building design	Architects
3.	Technical Training	Labourers/Masons
4.	New policy and enforcement of existing policies	Government
5.	Appropriate material estimation	Quantity Surveyors

CONCLUSION

This study has reviewed the management of wastes on construction sites in Akure, Ondo State, Nigeria using a well-structured questionnaire. The answers provided by the respondents were scrutinized carefully and the following can be summed up as conclusion:

i. Most wastes are generated during the construction stage.
ii. Building materials (86.24%) constitute the largest wastes on construction sites in Akure.
iii. The source of wastes on construction is from broken materials.
iv. Wood constitutes the largest waste on construction sites in Akure.
v. Majority of the respondents said inexperience labour is the major cause of construction wastes in Akure.
vi. The method of waste collection in Akure is by dumping the wastes in waste bins provided on the sites.
vii. The method of waste disposal is through the Ondo State Waste Management board.
viii. The main effect of poor construction waste management in Akure as revealed by the study is material wastage.

It is based on these findings that we conclude that, there is need for efficient technical training for the masons and the urgent resuscitation of technical colleges where such training can be undertaken. Finally, this piece of research is a result of survey conducted so far on managing wastes on construction sites in Akure, Ondo State. Further research could benefit from focusing on the characterization of construction wastes and the effective construction waste management methods.

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Effects of Climate Change on Spatial Structures in South-western Nigeria

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ABSTRACT

The built environment or structural aspects of cities, streets, buildings, and infrastructure systems contribute significantly to the emission of greenhouse gases, hence, the amplification of its effect on climate changes. Current planning strategies for future urban development often target issues such as housing, transport, water, and infrastructure; but very few strategies comprehensively consider the urban climate and its interaction with the built environment as well as the resultant effects. For the purpose of this research, the study areas are Ikeja, in Lagos State and Akure in Ondo State, rapidly growing urban centres with an annual growth rate of between 3.4 - 5 per cent. The methodology employed in this study involves the categorization of respondents according to required data and the dominant use. Samples were taken using the simple random sampling technique. Maps, tables and charts were used in presenting the data collected. This study exposes the fact that the study areas currently experiences a modified urban climate, as a result of gross development, with the research demonstrating that urban areas are often warmer than surrounding rural landscapes. This is due to the emission of greenhouse gases and industrial wastes generated from commercial activities and industries. This paper concludes by emphasizing the need for governance network in mitigating climate change impact on land use planning and development. This will promotes sustainable urban development with reduced effect on the urban climate of Nigeria.

Keywords: Urban Development, Climate Change, Environment, Spatial Structure, Climatic Impact

INTRODUCTION

Climate change has been one of the most engaging environmental subjects of debate in recent times. Indeed, the environmental problems associated with the potential impact of expected climate change may prove to be among the major environmental problems facing many countries. In Nigeria, it has been realized that serious environmental problems are likely to arise in association with the anticipated global warming resulting from emissions of greenhouse gases into the atmosphere. These problems in one way or the other affect location and planning of features and economic activities in Nigeria (Odjugo, 2010). The urban planning system is a key tool for adaptation in the face of changing climate. The quality of the planning system and its operation constitute an important dimension in institutional vulnerability (Campbell, 2006).

The changing climate is a challenge for both current and future generations. Climate change is increasingly threatening human lives, infrastructure, economic and social activities (Rodolfo and Siringan, 2006). Climate variability and future climate change impacts will increase the vulnerability of societies around the world. Especially in developing countries, the impacts will be severe, but also those living in high risk areas in developed countries could be greatly affected (Stern, 2006). Many sectors are important elements in responding to the challenges and potential opportunities afforded by a changing climate. Due to its role in regulating the development and use of land, spatial planning is particularly significant (Blanco and Alberti, 2009; Davondi, Crawford and Mehmood, 2009).

Human activities have modified the environment for thousands of years. Significant population increase, migration, and accelerated socio-economic activities have intensified

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these environmental changes over the last several centuries. The climate impacts of these changes have been found in local, regional, and global trends in modern atmospheric temperature records and other relevant climatic indicators. An important human influence on atmospheric temperature trends is extensive land use/land cover change (LULCC) and its climate forcing. Studies using both modelled and observed data have documented these impacts. Thus, it is essential that we detect LULCCs accurately, at appropriate scales, and in a timely manner to better understand their impacts on climate and provide improved prediction of future climate.

The primary focus of this research is to provide a policy documents for decision-makers and stakeholders regarding the implications of climate change on the efficiency of spatial structure and the impacts at the local level of the various adaptation options using Ikeja and Akure in Southwestern Nigeria as case studies. This was done through the assessment of the present state of land use development in the study areas and examination of the socio-economic patterns in both cities. There was also identification of factors responsible for the land use development in the area, assessment of situation of climatic components in the area and finally, investigation of the effects of climate change on spatial structure in the study area.

MATERIALS AND METHOD

Data for this research work was obtained through several methods, which include qualitative research method, direct conversation, and personal research among others. The qualitative research method involves interviews that are semi-structured in nature in which one or more areas will be explored through a number of questions. The flexibility of a qualitative research method makes it suitable for interviews in this paper.

of the research made use of the primary and secondary sources. The instrument used in collecting data includes the use of a structured questionnaire to collect information from the target population. Other instruments of data collection for this research were telephone interview and observation of situation on site. The questionnaires asked questions related to the socio-economic, infrastructure, land use information and climate ratings of the area were articulated and administered amongst the sampled population. In all, 350 questionnaires were administered in both States. 200 Questionnaires were administered in Ikeja, while 150 questionnaires were administered in Akure. The variation in the numbers is because of differences in population of the two cities. 300 (86%) questionnaires were for households, 32 (10%) questionnaires for specialized professionals, and 18 (6%) questionnaires for government establishments. The mode of questionnaire distribution and the various inputs of the respondents are summarized in the Table 1.

DISCUSSION OF FINDINGS

Planning for future urban growth and development amidst threats from climatic conditions is a difficult task for urban planners. Given the present state of land use development in the study area and the combined threat of global warming and the climate, strategies need to be developed to incorporate initiatives that can marry a change in climate with the need for land use planning of Southwestern Nigeria. Planning professionals need to incorporate climate change scenarios into both short-term planning decisions and longer term strategic regional planning decisions, using a more integrated approach than is currently adopted in modern day planning strategies.

Ratings of Climatic Components Affecting Land Use Development in South Western Nigeria

The assessment of climatic factors affecting land use development in the areas of study is limited to the below four basic climatic components namely; temperature, rainfall, precipitation and wind. Among all the climatic factors that constitute threat to spatial planning in the study area, rainfall seems to be the most prominent due to the damage caused.

Table 1: Categorization of Questionnaires Administered

Respondents	No of Questionnaires Administered	Percentage (%)	Remarks
Households (Major respondents and inhabitants in the study area)	300 (Lagos, 165; Akure, 135)	86	They provided information based on their perception of the research variables (climate change and land use development). In addition, they provide information on the socio-economic characteristics of the people in the study area.
Specialized Professionals (Comprise of professionals involved in climate studies and trends of land use development)	32 (Lagos, 20; Akure, 12)	8	They provided information based on their expertise and experiences in the study of trends of climatic changes and land use planning and development in Ikeja and Akure
Government Establishments (Ministry of Planning and Environment in Lagos and Ondo State)	18 (Lagos, 15; Akure, 3)	6	They provided information regarding development matters, land use development, government activities on climate and development etc.
Total	350 (Lagos, 200; Akure, 150)	100	Satisfactory

Source: Authors' Computation, 2015

Table 2: Climatic Components that Affects Land Use Development in the Study Area

Climatic Factors	Responses	Percentage (%)
Temperature	76	25.3
Rainfall	169	56.3
Precipitation	32	10.7
Wind	23	7.7
Total	300	100.0

Source: Field Survey, 2015

The rate at which rainfall as a factor that affects land use development was put at 56%. The factor that is seen to be close in its impact on land use planning is temperature with a 25% rating followed by precipitation 11% and the wind 8%. Some of the respondents who spoke further believed that their opinion of rainfall as the major climatic component affecting land use development in both cities were connected with the recent rise in amount of rainfall experienced in the whole of region.

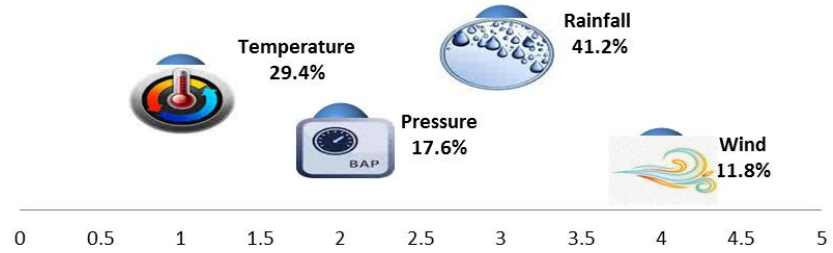

Figure 1: Impact of Climatic Change on Spatial Structure in the Area
Source: Field Survey, 2015

The Professionals in the study of climate changes in the environment both from NIMET and from the climate change department at the ministry of environment, in both states asserted that in the south west, the overriding climatic component that has a major impact on land use development and planning is the rainfall putting it at 41.2%. They then confirmed this fact with analysis of climatic components as observed by institutions working on climate data, which shows that amount of rainfall in the study area, has been on the increase. This will amount to 1,960 mm total annual amount of rainnfall. It was also gathered during the research that the main constraint to land use development in Southwestern Nigeria is the amount of rainfall. The other climatic factors that can hinder land use planning and development are temperature (29.4%) which is due to grossly urban heat island, general warming from heat caused by industrial activities etc. Others are pressure (17.6%) and wind-like actions (11.8%).

Climate Ratings in the Study Area

Generally, the climate rating as seen by both professionals and household respondents were similar as both believed that the climatic condition achievable in the study area was good. Of the 300 respondents who were asked to rate the climatic condition of the area, 171 people (57%) responded with a fair report believing that the overall climatic condition is fair enough. 90 respondents (30%) reported that climate rating is generally good while 39 respondents representing 13% believed that the climate condition is poor.

Effects of Climate Change on Land Use Planning in the Study Area

Climate Change Effects on Land Use Development

The investigation of the effect of climate change on land use planning in the study area is informed based on the results of analysis of data collected from households, private professionals and government institutions. As earlier discussed, the impact of rainfall as a major climatic component that affects land use planning is again manifested in the study area. Respondents believed that an effect of climate change on land use development is the increase for rainfall experienced in the study area, which has limited construction activities because of the lengthy rainfall periods. 85 households, which represented 28.3%, believed that the results of the rainfall i.e. flooding has more impact on the development of land uses in the study areas. These respondents claimed that almost every part of the study area is liable to flooding and hence any development around such vicinity is risky.

Table 4: Effects Caused by Changes in Climatic Conditions in the Study Area

Effects of Climate Change	Responses	Percent (%)
Others Effects	85	28.3
Increased Rainfall	102	34.0
Inconsistent Seasonal Changes	6	2.0
Increased Temperature	17	5.7
Flooding	84	28.0
Rise in Sea Level	6	2.0
Total	300	100.0

Source: Field Survey, 2015

In addition, some other 28% respondents believed that other effects that cannot be seen explained or easily measured but are a result of changes in climatic interplay, which is caused by anthropogenic action of man. It was also observed that the present climatic condition in the study area is not the best and hence it affects the overall health condition of inhabitants. This resulted in poor industrial outputs, and unbalanced mental well-being. Other climate change effects on land use development are in the aspect of increase in temperature, which affects building life and causes cracks. Inconsistent seasonal changes, which hamper development planning and rise in sea level also increases flooding in areas that are close to water bodies. From the perspective of the professional and climate researchers, the overriding

effect of changes in climate on land use planning and development are in various forms. However, the ones that are discussed here are those ones peculiar to the study area.

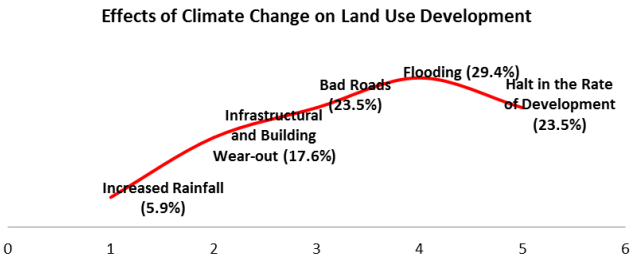

Figure 2: Effects of Climate Change on Land Use as seen by Private Professionals
Source: Field Survey, 2015

Contrary to the response from households that increased rainfall is the major effect of climate change on land use planning, professionals believed that increase in rainfall is only an action that can be manage and curtailed. However when it is not well managed, it affects land use planning in form of flooding. Hence, professionals concluded that rise in sea level and increase in rainfall contributes to flooding which makes it the overriding effect of climate change on land use development in the study area. Other associative effects caused by climate changes are seen on the impact it has on transportation network, infrastructural and building wear-out and total halt in the rate of development.

The respondents believed that flooding and inadequate drainages brings about bad roads in the study area thereby causing traffic congestion, which then hinders economic activities and other socio-economic spheres of the populace. In addition, the in-ability to define season's i.e. inconsistent seasonal differentials has been traced to be a major threat to development and has the potential of totally halting the steady rate of land use development in the study area. Infrastructure and buildings wear-out easily due to flooding, increased rainfall, temperature and other effects.

Climate Change Effects on Land Use

With respect to the discussed effects of climate change on land use development, land uses that are grossly affected by these changes are mostly commercial developments (29%), transportation land use (24%), industrial development (24%) and residential developments (23%). Commercial developments are been affected in terms of reduction in patronages recorded by commercial actors in the area as well as other economic activities.

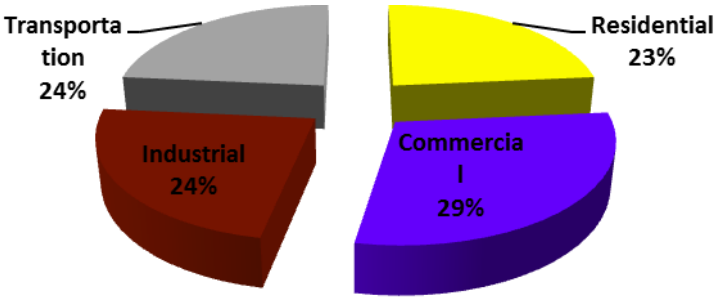

Figure 3: Land Uses Affected by Climate Changes
Source: Field Survey, 2015

Figure 4: Traffic Congestion along Ijare Road, Akure due to heavy rainfall that resulted in Erosion
Source: Field Survey, 2015

Property value has been diminished in some areas due to inaccessibility and lack of good roads. Since building wears out easily, residential development has also been reduced to just shelter other than housing as the available houses are not in the best living condition. Transportation is a means to every other land uses and hence contributes greatly to economic, social and other activities. However, the result of effects caused by climate change has reduced the potency of transportation network in the area to serve its main purpose of easy access. In view of this, industrial developments too have been affected in the right proportion as service vehicles finds it uneasy to access industrial zone, either when bringing raw materials or when distributing finished products.

Figure 5: Flooding and Corrosion Effects on Residential Property at Isolo Quarters, Akure

RECOMMENDATIONS AND CONCLUSION

Uncertainties in climate change and impacts projections are a characteristic feature that poses a challenge for anticipatory adaptation for any country. The key to adaptation to climate change with respect to land use planning and development in most instances is competent, capable, accountable urban governments that understand how to incorporate adaptation measures into most aspects of their work and departments. Many needed measures may seem to be quite minor adjustments to current practices – for instance in adjusting building codes, land sub-division regulations, land-use management and infrastructure standards - but the sum of all the minor adjustments over time can build greater resilience without high costs. The recommended interventions needed to adapt to climate change threats as it applies to land use planning and development includes the development of an information based system on current conditions. This should seek as much detail as possible; drilling down to include "small disasters" (disasters that do not get included in international disaster databases) as well as serve as data-bank for private individual who seek detailed information concerned with climatic conditions and land use of Ikeja. Initiation of risk/vulnerability assessments for the city with as much geographic detail as possible This needs to link hazard maps with details of what is currently located within the hazardous zones – including identifying population groups or settlements at risk and activities that may pose particular risks. They are needed for

climate change network governance/ government policies. This understanding must be modified with view on the demands of effective adaptation and mitigation governance.

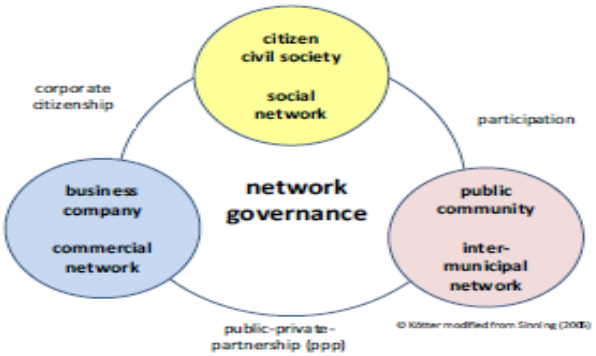

Figure 6: Network Governance and Stakeholder Participation on Climate Change
Source: Friesecke etal, 2012

In conclusion, the effects of climatic changes on land use development are enormous. Experts assume that rise in global temperature and sea levels will intensify climate change-related risks, such as floods, droughts, landslides, and extreme climate events (Friesecke, 2012). In order to be prepared for these disasters in the future, interdisciplinary and precautionary measures concerning land management are needed. In particular, urban planning with respect to the development of urban settlements plays an important role in disasters and risk management. Ordinarily, city and municipal governments have the main responsibilities for planning, implementing and managing most of the measures that can diminish risks (and the high vulnerabilities of sections of the population) from the direct and indirect impacts of climate change – through provision of infrastructure and services, disaster preparedness and the planning and regulatory framework. It is important to understand the scale and scope of local government involvement in urban centres, if their role in adaptation to climate change is to be understood. Urban governments typically have a range of roles that can include financing, Engineering/Public works, Social/community/safety services and Development planning and development control. In view of this, there is a need for governance network in mitigating climate change impact on land use planning and development. In addition, it is not just enough for development to take place in our cities there must be policies put in place to ensure that the concept of sustainable development is been adhered to when developments are arising.

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Impact of Integrative Arch-entrepreneurial Design Project on the Students' Business know-how, Value Creation and Self-employment Intention

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ABSTRACT

The demand for innovative teaching approach for the development of entrepreneurial spirit among the graduating students is a critical issue in the Nigeria's Higher Learning Institutions (HLIs). Especially, now that both the government and general public request HLIs to produce graduates that can create jobs rather than job seekers in the labour market. Therefore, this article employed Ajzen's theory of planned behaviour to assess the impact of Arch-entrepreneurial Design Project (ArchDeP) teaching method on the architecture students' business know-how, value creation competence and intention to be self-employed. Quantitative approach with ex-post research design employed for the study. Statistical Package for Social Science (SPSS) and Structural Equation Modelling (SEM) tools of analyses were used to analyse the data collected from 150 students and to test the research hypotheses proposed. The research findings indicated a significant impact of the ArchDeP teaching approach on the students' self-employment intention. Hence, students' attitudes toward business know-how and perceived value creation mediate the relationship between exogenous and endogenous variables. In fact, the new market-oriented design project scheme has created an entrepreneurial cutting-edge for the students and for future jobs creation. More practical initiatives such as extended entrepreneurship teaching in the core architecture courses and across the program years of training recommended. Specifically, ArchDeP teaching model could provide the innovation required for the advancement of future entrepreneurial-architects.

Keywords: Architecture, Arch-entrepreneurship Education, value creation and Self-employment

INTRODUCTION

Entrepreneurship is connoted as a stimulant for the economic growth, wealth and jobs creation in Nigeria and other developing nations (Arogundade, 2011; Gafar et al., 2012). At the same time, entrepreneurship teaching in the HLIs has been deemed as one of the agents of change (Mars, 2013) to impact entrepreneurial capacities and self-employment intention on the potential future embryonic entrepreneurs (Okolie et al., 2014; Gafar et al., 2014). Currently, the graduates' unemployment has been a critical issue in Nigeria (Maina, 2014; Agboola, 2014). More so, the number of graduates entering into the labour market increase every year (Afolabi & Ehinomen, 2015). On this account, it is crystal-clear that more graduates will not be successful in getting employment. Given this, Nigerian HLIs need to inculcate more entrepreneurial spirit among the students. Particularly, now that employment opportunity for the architecture graduates is becoming more competitive (Mimarlik, 2013; Gafar et al., 2012). However, several scholars stated that effective entrepreneurship teaching in the HLIs is an indispensable channel for developing dynamic graduating students (Fayolle & Gailly, 2015). In fact, entrepreneurship education is denoted as the panacea to the graduates' unemployment dilemma in Nigeria (Oladele et al., 2011; Gbagolo & Eze, 2014).

Nevertheless, demand for the innovative pedagogical approaches for the inculcation of entrepreneurial spirit on the students of Higher Learning Institutions (HLIs) is critical in the academic circles. In this regard, the research aimed to assess the impact of the newly introduced teaching approach: Arch-entrepreneurial Design Project (ArchDeP) on the

Gafar, M.; Kasim, R. & Ahmed, M. D. (2016). Impact of Integrative Arch-entrepreneurial Design Project on the Students' Business know-how, Value Creation and Self-employment Intention. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 232-246

architecture students' entrepreneurial capacities and self-employment intention. ArchDeP is an integrational model to infuse entrepreneurship concept into the architectural design course. The essence of this teaching model is to inspire business creativity and foster enterprise innovation. Hence, to provide the necessary business-oriented skills, competence and capacities lacked to compete in the competitive labour market, locally and globally upon graduation.

The research applied a quantitative research approach and ex-post self-administered questionnaire instrumentation used to collect data from 150 architecture students. Statistical Package for Social Science (SPSS) and Structural Equation Modeling (SEM) tools of analyses were used to analyse the data collected and for the test of seven research hypotheses empirically.

This study advocates the reinforcement of the architectural curriculum content with the entrepreneurial know-how and the capacities imperative to inculcate entrepreneurial concept in the architectural project design process that could foster unlimited employment opportunity. The subsequent sections briefly discuss graduates' unemployment in Nigeria, the need for more entrepreneurship approach in the architecture education while the last section provides implications for future research.

REVIEW OF LITERATURE

Nigeria as a nation could be rated as the richest country in Africa based on her bountiful petroleum and solid minerals resources as well as enormous population capacity. Inharmoniously, Nigeria as a rich nation is a fallacy that is characterised by huge realistic unemployment among the students of HLIs. In fact, over 40 million Nigeria youth are unemployed, and Nigeria is classified as one of the countries prone to a socio-political, economic crisis as a result of increase poverty echelon (Salami, 2011). In fact, graduates of Higher Learning Institutions (HLIs) make up a larger percentage of the youth unemployment and some remain unemployed for over five years after graduation (Awogbenle & Iwuamadi, 2010).

In addition, Innocent (2014) stated that not less than 1.8 million graduating students are entering the labour market yearly. Apart from the current economic uncertainty as a result of the crash of the oil revenue, other possible reasons for the graduates' unemployment are the mismatch between the knowledge acquired by graduates and labour market skills demand (Gbagolo & Eze, 2014). This is further aggravated by graduates lacking entrepreneurial capacity such as critical thinking, creative skills and competence that are crucial in the current job market (Afolabi & Ehinomen, 2015).

In this regard, Nigerian government have established certain economic policies and several national agencies to advance employment opportunities for the youth. Recently, Youth Enterprise with Innovation in Nigeria (YOU-WIN) and Subsidy Reinvestment and Empowerment Programme (SURE-P) established. Also, compulsory entrepreneurship education was introduced across all the HLIs' curriculum structure as a way to develop more entrepreneurial consciousness among the graduating students, particularly, to shrink the unemployment problem. Conversely, Agboola (2014) and Afolabi and Ehinomen (2015) claimed that deficiency in the HLIs' curricula and use of ineffective pedagogical approach are the key factors responsible for the inability to provide the students with the appropriate skills and competence required to be job creators rather than being the job seekers. The critical challenge is how to improve the educational entrepreneurship ecosystem (Innocent, 2014; Salami, 2011). Particularly, to develop integrative course content and creative pedagogical

approach that could promote entrepreneurial reorientation and self-employment as a viable career substitute for the Nigerian HLIs students (Gafar et al., 2014).

Research's Theoretical Framework

In the literature, the concept of entrepreneurship education is ever revolving around opportunity discovery, formation and innovation of business ventures, and risk taking proficiency in conjunction to self-employment. The teaching development for the inculcation of the entrepreneurial skills and competence among the HLIs' students is defined as entrepreneurship education. Till date, scholars have stressed the merit of entrepreneurial activities as self-discovery that serves as a pathfinder for self-realisation and self-reliance (Gafar et al., 2012). Galloway (2006) stated that nations' economic growths are the valuable rewards for entrepreneurial success. In summary, Jones, et al. (2012) reaffirmed the important of entrepreneurship teaching for the graduating students as one of the fundamental channels for professional success in the current competitive economy.

The scholars' ideological stand on the subject of entrepreneurship education has always been a lasting debate in the HLIs. However, the dispute on the teachability of entrepreneurship in the HLIs is put to past (Fayolle, 2007). Even though, some commentators argued that renowned entrepreneur such as Bill Gates quit HLIs to seek for entrepreneurship experience in the world outside university environment. The fact remains that for an individual to become an entrepreneur he/she must have undertaken a learning process and such process is an education that could be formal or informal.

In the same perspective, Garavan & O'Cinneide (1994b) argued that "learning" entrepreneurship either from successful entrepreneurial family members, past work experience or through a proper education both would obviously add to the probability of entrepreneurial success. He advocated that "entrepreneurs are often made, not born" and believed that education of entrepreneurship can be taught, and the knowledge can impact on the potential future entrepreneurs in the HLIs. He further stressed that the teaching responsibility does not rest completely on the academic environment. Therefore, society has its role in providing an enabling environment and right atmosphere for the development of entrepreneurship ecosystem.

However, Hytti and O'Gorman (2004) suggest different ways to offer entrepreneurship education that should be based on the program's objectives. They noted that if the program's objective is to increase understanding of entrepreneurship, then the appropriate channels to fulfill this objective is to provide information through public channels such as media, seminars, or lectures. And that if the objective is to equip students with entrepreneurial skills then the best way is to provide education and training that would enable students to have a direct contact with the entrepreneurial process. Lastly, they noted that if the program's objective is to prepare students to act as entrepreneurs after graduation then most effective approach is to facilitate a practical experiment by caring out entrepreneurship in an environment close to a real-life situation such as role playing and teamwork projects.

Edwards et al. (2009) reported that it is a challenging task for the entrepreneurship educators to introduce entrepreneurship idea into the non-business disciplines. The question is, how and where do we start? Assuming entrepreneurship education as a new product of the University and academician as natural marketers, market research on the motivation of potential candidates (mainly technical and engineering students) on entrepreneurship curricula could provide us with better insights on their interest and awareness on the subject. In a discipline of marketing, individual acceptance of the new product is a result adoption process, which started with awareness and interest before reaching the adoption stage. In other words, it is pertinent to start with the understanding of needs and wants of the students which in many

cases is reflected in their knowledge, interest and acceptance of the new product idea – in this case, entrepreneurship course.

Hynes' (1996) study outlined the structural clarification to the challenge of introducing entrepreneurship ideas into the technical education. Hynes' entrepreneurship education framework outlined that entrepreneurship teaching must start with the students as input before the educators focusing on the course content; teaching approach and; assessment method as a process that ought to output/develop potential future entrepreneurs. Also, outputs should be measured based on a tangible and intangible parameters as listed in Table 1.0.

In sum, the majority of universities have long been known to encourage entrepreneurialism. About 93 percent of American professors in one research survey believe that entrepreneurship can be taught (Matlay & Carey, 2006). Survey of 15 "leading entrepreneurship educators" stated that their main objectives of entrepreneurship education are to teach students about the process involved in starting and running a new business (Fayolle, 2015). More so, the current Nigerian competitive economy demand entrepreneurship education's objective that focused on teaching for entrepreneurial inculcation, particularly, on the non-business disciplines in the HLIs.

For the purpose of this research, theory of entrepreneurial intention is applied to assess the perception of architecture students toward the impact of ArchDeP on their business know-how; perceived value creation and self-employment intention. The justification is that entrepreneurship intention theory has been tested and validated by renowned scholars to assess entrepreneurship education program (Fayolle et al., 2006; Kolvereid et al., 2011; Linan, 2008). More so, past researches have showed the capacity of intention as a predictor for an individual's desirability to be self-employed which equally has the capability to evaluate entrepreneurship education programs' impact.

Formulation of Research's Hypotheses

In the 21st century, entrepreneurship education has become a subject of upmost interest in the HLIs worldwide. The concept of entrepreneurial capacity is an amalgamation of individual's knowledge/skills, attitudes and perceived behaviour control that predicts his/her entrepreneurial intention (Ajzen, 1991). Okolie (2014) also outlined entrepreneurial capacity as a collection of interrelated building block such as attitudes, behaviour and skills that connect to the individual disposition to act entrepreneurially which can be enhanced through an educational teaching approach. Notable studies have showed that entrepreneurship education does play a significant role in cultivating entrepreneurship know-how, particularly, entrepreneurial capacities and competence in business start-up and value creation among the graduating HLIs' students (Fayolle, 2007).

Conversely, Matlay (2008) and Fayolle et al. (2006) noted that it may not be possible to develop graduates' entrepreneurial reorientation absolutely through education only, but it does have significant influence on the students' entrepreneurial know-how in the capacities of entrepreneurial attitude, entrepreneurial business start-up and capacity/aptitude in entrepreneurial skills.

Subsequently, Pihie and Akmaliah (2009) stated that entrepreneurship education plays a critical role in identifying and shaping entrepreneurial traits. In the same light, other studies have pointed out that entrepreneurship education, especially education that provides technological training is crucial to promote the development of entrepreneurs. To inculcate new product/project innovation skills on the architecture students is vital in an increasingly challenging Nigerian economic downturn.

Souitaris et al. (2007) claimed that students who major in related technical disciplines have greater interest to become entrepreneurs. In fact, those students have more confident in attitude toward business, venture creation and self-employment intention upon graduation.

More so, past entrepreneurship empirical studies have applied Ajzen's entrepreneurial intention models to assess entrepreneurship education program and appropriateness of the model has been validated. Reviewed literature support the existence of a strong relationship between students' participation in entrepreneurship education and positive attitude toward business knowledge and self-employment intention (Kolvereid & Isaksen, 2006; Fayolle et al., 2006). Therefore:

H_1: Participation in integrated ArchDeP has a significant impact on the students' self-employment intention.
H_2: Participation in integrated ArchDeP has a significant impact on the students' attitude toward business know-how.
H_3: Students' attitude toward business know-how has a significant relationship with their self-employment intention.
H_4: Participation in integrated ArchDeP has a significant impact on the students' value creation.
H_5: Students' value creation has a significant relationship with their self-employment intention.

In addition, individuals' nature to react positively/negatively toward an incident is called attitude that is a behavioural intention's foremost determinant (Ajzen, 1991). As claimed in the Ajzen's model that the more optimistic individuals' attitude toward the behaviour, the more definite intention to perform that behaviour by individuals. In the same perspective, the Career Choice Theory underlined that individuals' judgment about a choice of career is determined by their perception of past experiences and most importantly the attitudes and close relatives' expectations of toward those careers. This implies that beliefs and experiences determine a person's attitudes toward a given career preference.

More so, a meta-analytical study conducted by Bae et al. (2014) showed that early participation in entrepreneurship education plays a significant role in the formation of positive attitudinal values toward entrepreneurial development and self-employment inclination. The study maintained that students of HLIs will develop a positive attitude towards self-employment intention if they partake in an effective entrepreneurship education program. As a matter of fact, Okolie et al. (2014) provided an empirical evident that holistic education for entrepreneurship does influence the development of entrepreneurial-related attitudes in business know-how and necessary skills for self-employment. This implies that attitudes will mediate the relationship between integrated architecture-entrepreneurship education (ArchDeP) and self-employment intentions, given that the theory of entrepreneurial intention predicts that individuals' attitude positively direct intention to entrepreneurship. By the above-given literature, the sixth research hypothesis formulated as:

H_6: Attitudes toward business know-how mediate the relationship between integrated ArchDeP and self-employment intention.

Consequently, perceived behaviour control denotes an individual's conviction that he/she can fruitfully achieve a goal. Several researchers have showed that individuals' high perceived behaviour control predict that they are confident in their capacity to act and achieve a venture creation (Ajzen, 1991). Also, education of entrepreneurship has been documented as a facilitator of value added knowledge on how to start-up and manage a new venture creation among the HLIs' graduates (Linan, 2008; Gbagolo & Eze, 2014). Likewise, it provides value

gained experience in business reality that cultivates positive attitudinal change towards entrepreneurial proclivity (Lackeus & Williams Middleton, 2015). Above and beyond, it is a value enhancer that strengthens students' perceived behaviour control (self-efficacy) and increases their desirability of self-employment as a viable career option.

According to Okolie (2010), exclusive academic qualification cannot guarantee job prospect, particularly, graduating architects need to be more entrepreneurially inclined in the current competitive larbour market to survive the economic turbulent. More so, architecture graduates need a job before they get their professional license to establish a firm. As a matter of fact, Gafar et al. (2012) stressed that pure technical knowledge is not enough for the graduates to compete in the larbour market. Therefore, architects need to be entrepreneurial to sustain their professional relevance and increase market share. He believed that there was need for "more entrepreneurship architectural education". And that education of this nature could provide consolidated business experience in architectural project "design, build and dispose" market analysis for graduating architects who intend to start their business ventures upon graduation.

Ajzen's (1991) theory of planned behaviour also asserted that perceived behaviour control provides the individuals' subjective norms require in determining their degree of willingness to start a business venture and become self-employed. As aforementioned, entrepreneurship education is a teaching process for self-discovery that serves as a pathfinder for self-realisation and self-reliance (Gafar et al., 2012). More so, students develop self-attributes through this teaching process that is both meditative and behavioural-action oriented. The pedagogical reflective teaching process is expected to enhance individuals' behaviour that in turn employed to understand their entrepreneurial value creation competence and how they will probability behave after graduation.

In the same perspective, Linan (2008) outlined entrepreneurial value creation capacities in the context of perceived skills and competence. They further stated that an effective entrepreneurship education programmes should enable students of HLIs to be more innovative, creative (skills) and increase their risk loving (attitude, perceived behaviour control and motivation) in business start-up. On the account of above-given literature and the meritorious expectation on the newly introduced entrepreneurship teaching in the architecture education, this research further set out to test hypothesis formulated as:

H_7: Perceived behaviour control in value creation competence mediates the relationship between integrated entrepreneurship education (ArchDeP) and self-employment intention.

Conclusively, this research hypothesizes that architecture students' participation in an integrated entrepreneurship education (ArchDeP) has a direct and indirect effect on their self-employment intentions. In general, the relationships are buttressed in the validated theory of Ajzen (1991). Therefore, the entire research constructs illustrated in Figure 1.0

Therefore, the proposed assessment framework is to assess integrated ArchDeP that would be empirically validated. Hence, the model is to provide ways for improving entrepreneurship teaching methodological approaches that could facilitate the development of future entrepreneurial architects among the Nigerian architecture graduating students.

RESREACH METHODOLOGY

The research employed a quantitative methodological approach to testing the set hypotheses. The new arch-entrepreneurial teaching concept – ArchDeP was introduced into the architectural design studio module with a purpose of inculcating skills and competence in business know-how, value creation and self-employment spirit on the architecture students.

Ex-post research design approach was employed for this study. Statistical Package for Social Science (SPSS) and Structural Equation Modelling (SEM) tools of analyses were used to analyse the data collected from 150 architecture students and to test the three research hypotheses empirically.

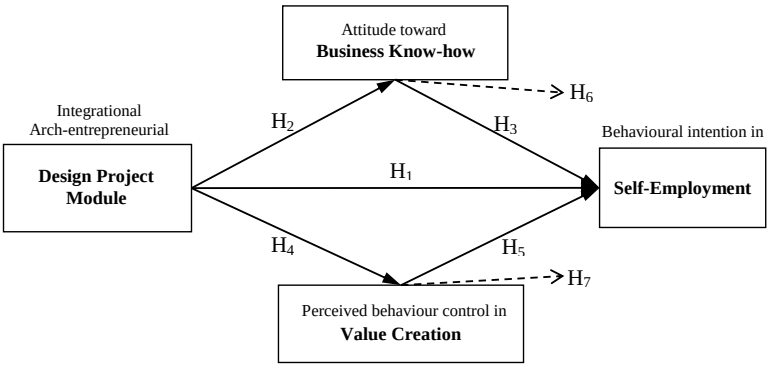

Figure 1.0: Hypothesised Research Framework for the Assessment of ArchDeP

Foremost, the architectural design studio (housing) module covered fifteen weeks within which the students carried out the learning process in and outside the university environment, specifically, in a team. The first two weeks focused on teaching the theoretical aspect of entrepreneurship principles. The topic of discussion covered idea development to venture creation in the context of architectural design and project development that focused on design, build and sell initiatives that are to create lifelong job creation prospect. Afterward, the students were divided into six (6) groups that consisted of twenty-five students as a team. In totality, 150 students of architecture participated in the design module.

After that, the remaining weeks focused on action-oriented entrepreneurial activities and architectural design planning. Every team were required to conduct a market analysis based on the module mentor's detailed design brief that promoted flexibility on the project design scope, type and site location. More so, the teams were expected to pass through all stages of creative thinking and problem-solving design schemes that focused on buyers/customers-oriented business approach from the project conceptualisation to actualisation and all for sustainable jobs prospects.

Consequently, the teams were taught and instructed to conduct a market analysis (feasibility and viability studies) on the potential buyers in a preferred location. The purpose was to establish their housing need, housing types' preference and retailing price range (purchasing power). The project's site selection was based on market analysis outcomes. The teams were then educated and directed to source for funds from the available commercial banks. The essence was to establish the pro and cons of project financing, determination of interest rate and repayment plans for the loans.

After the preliminary project's feasibility and viability studies, the teams then proceeded to the studio for the production of detailed architectural drawing plan with the approximate estimate of the project cost. The essence was to establish the selling price with the percentage profit margin. Also, the teams were requested to document their marketing strategies on how to package and sell the products. Finally, each group was demanded to present orally at the end of ArchDeP's program, and this was to advance the students' entrepreneurial spirit in communication, marketing and networking skills. In the end, the teams were assessed by examiners that comprise of module co-ordinator, entrepreneurial developers, bank managers and selected prospective buyers.

At the end of the examiners' assessment, every student was surveyed through a purposive sample technique because it focused on only the third-year students who have participated in the design module. To this end, an ex-post survey was used because EArDeP is a new studio teaching approach that was expected to strengthen students' entrepreneurial skills at the end of the module. More so, the students were expected to have detail understanding of the business-conscious design project initiatives after the scheme participation. The questionnaires were given to these particular groups of students through a self-administered method. As earlier mentioned, the purpose is to establish empirical answers to the predetermined research question, objective and to test the set hypotheses. However, the research's scale of measurement for each construct was adapted from past researchers' studies (Cheng et al., 2009; Linan, 2008; Gafar et al., 2015). The data collected were preliminarily screened with SPSS version 22. Structural analysis was performed with SEM version 22 because it is a second generation statistical tool that provides a robust and rigorous evaluation of a multivariate research assessment model (Guerrero et al., 2008; Awang, 2012).

RESEARCH FINDINGS AND DISCUSSIONS

The preliminary data analysis of the data collected was presented in Table 1.0. As earlier mentioned, of the 150 questionnaires distributed, 100% responded rate was achieved as a result of self-administered process used. The descriptive analysis of the sample presented gender percentage distribution of male at 63.2 percent while female was 37.8 percent. The respondents' ethnicity was not given consideration because it is not relevant in the study. Hence, the research variables' (IEE, ABK, PVC and SEI) cumulative mean scores were within the range of 3.12 and 4.25 on a 5 - likert scale measurement (see Table 1.0). The research indicated that architecture students have developed reasonable capabilities in business know-how, value creation and strong self-employment intention after participation in the new studio teaching approach (ArchDeP) that was market-oriented design project scheme for entrepreneurial cutting-edge and future jobs creation.

In addition, the reliability and normality examination of the data collected were satisfactory with the cronbach alpha ranging from 0.855 to 0.928 according to Pallant (2011). Hence, the normality test presented skewness and kurtosis values within the acceptable limit of -1 to +1 (Awang, 2012) that indicated a normal distribution data. Hence, the principal component factor analysis for entire research constructs' items were examined and result presented strong factor loading that were above 0.5. Table 1.3 showed that the research variables' items of measurement were satisfactory and acceptable as KMO and Bartlett's test presented good measure of sampling adequacy value of 0.931 and significant (Awang, 2012).

Awang (2014) emphasised that it is vital to examine/check the discriminant validity of the entire research constructs before the removal of the constructs' redundant items. Also, Hair et al. (2011) supported that correlation between the exogenous variables (discriminant validity) between in the research assessment model should not exceed 0.85. The result of the examination showed that hypothesised constructs' discriminant validity is adequate and acceptable since the correlation coefficient between the three exogenous and endogenous constructs are all within the permissible value lower than 0.85 (See Figure 1.1).

After the unidimensionality, reliability and validity of the research constructs were ascertained, the next stage of analysis modelled the entire constructs into a single structural equation model and used Analysis of Moment Structure (AMOS) since the multi-collinearity problem is absent among the research variables. However, the model was used to analyse the multidirectional relationships within the entire research constructs. Figure 1.2 presented the final structural measurement model that provided the analysis of the causal effects (impacts) for the multiple constructs in the research assessment model.

First and foremost, the fitness indexes for the structural model that reflect how fit is the hypothesized model with the data at hand was observed. The result of the SEM analysis was satisfactory within the established acceptable level of Goodness of fitness indexes as presented in Table 1.4 (Awang, 2014 and Hair et al., 2011).

AMOS gives two types of text output that are the standardized regression weights and regression weights. For the purpose of this research the standardized regression was used which indicated the estimate of beta coefficient that measures the impact of the main constructs/exogenous variable (integrated ArchDep) on the two mediating variables (Attitude to Business Know-how – ABK) and (Perceived Value Creation-PVC) as well as endogenous variable (Self-Employment Intention –SEI).

The SEM analysis's result presented in Figure 1.5 showed the standardized regression coefficient of the relationship between IEE (ArchDeP) and ABK is 0.42, factor loading for the entire items, for instance, item IEE1 is 0.74 with its R2 equal 0.55. The correlation coefficient of the relationship between ABK and SEI is 0.36. Also, the correlation coefficient of the relationship between IEE (ArchDeP) and PVC is 0.60 while between PVC and SEI is 0.14 respectively. In summary, the measure of quantity and magnitude of the relationship between the entire research constructs (standardized estimates and P-values) were presented in Table 1.5. The result showed that relationship between new IEE teaching approach (ArchDeP) and the two mediating variable (ABK and PVC) and SEI have the beta coefficient of 0.417, 0.297 and 0.602 respectively and IEE, ABK as well as PVC all have significant positive impact on the dependent variable (SEI).

For the H1, the p-value is less than 0.001. Thus, the correlation co-efficient for IEE in the prediction of ABK is significant at the 0.001 level, and this implies that impact of integrated ArchDeP teaching approach on architecture students' attitude toward business know-how is significant. For the H2, the p-value is less than 0.001, correlation co-efficient for IEE in the prediction of PVC is also significant at the 0.001 level that also implies that impact of integrated ArchDeP teaching approach on architecture students' perceived venture value creation capacity is significant. For other H3 and H4, the p-values are also less than 0.001, correlation co-efficient for ABK and PVC in the prediction of SEI are both significant.

Even though, the correlation co-efficient for IEE in the prediction of SEI is significant at 0.05 level because the p-value is less than 0.05. On this account, hypotheses H1 to H5 are supported. The next section dwells on the procedure used to analyse the mediating effect of the ABK and PVC variables in the hypothesised model. To test mediation effect in a structural equation modelling, the fundamental condition that must be met is that there must be an existence of a significant relationship between exogenous, mediator and endogenous variables (Awang, 2012; Hair et al., 2011). In this regard, the SEM's outcome indicated positive significant between the entire research's constructs as presented above in Table 1.4.

In the Figure 1.2, the computations for the test of mediators (ABK and PVC) showed as indirect effects. The first indirect path (IEE to ABK and ABK to SEI) equals 0.151 (0.42 X 0.36) and the second indirect path (IEE to PVC and PVC to SEI) equals 0.084 (0.60 X 0.14). The result showed ABK and PVC are mediating the relationship between IEE and SEI. The type of mediation here is called a partial mediation since the direct effect of IEE on IEE is still significant after ABK and PVC entered the model, even though, the direct effect is still greater than the two indirect effects (0.30 > 0.151 and 0.084) respectively as recommended by Awang (2014) and Hair et al. (2011).

By implication, the research finding showed that the new integrated ArchDep teaching approach has a strong significant impact on the architecture students' attitude to business

know-how, perceived behaviour control in venture value creation and strong intention to be self-employed after graduation. The possible assumption for this result may be that the following components: basic concept of firm start-up and management, skills of design presentation as marketing and cost control and monitoring as financial and strategic management principles are part of the basic rudiment core course of professional practices. This could have positively influenced the perception of architecture students' attitude in business knowledge and perceived value creation that subsequently impacts their self-employment intention.

Subsequently, the research finding support the past empirical outcomes of Fayolle (2015) and Linan (2008) who reported that there is significant relationship between students' participation in entrepreneurship education and positive attitude toward business knowledge and self-employment intention (Kolvereid & Isaksen, 2006; Fayolle et al., 2006). In fact, Souitaris et al. (2007) supported that student who majors in related technical disciplines has greater interest to become entrepreneurs. And, such students developed more confident in attitude toward business know-how, venture value creation and self-employment intention upon graduation. In summary, this research has revalidated Ajzen's (1991) theory of planned behaviour (entrepreneurship's intention model) for the assessment entrepreneurship education program. In the same perspective, Linan (2008) and Okolie (2014) stressed that perceived competence in skills of creativity and idea development to venture creation are the motivational component for business start-up. More so, an effective entrepreneurship education programmes should enable students of HLIs to be more innovative, creative (skills) and increase their business's risk loving (attitude, perceived behaviour control and motivation) in business start-up.

Based on the mediation effects' computation and the result of the hypotheses tested in Table 1.4, both indicated that architecture students' attitude toward business know-how and perceived value creation do mediate the relationship between integrated entrepreneurship education (IEE) and their self-employment intention.

Finally, the research's findings showed that the new teaching method (ArchDeP) had equipped architecture students with the business knowledge and venture value creation's skills that seem to have served as value enhancer and awake their motivation, knowledge-ability and intention toward entrepreneurship. Also, application of a holistic action-based pedagogy to teach architectural design studio seem to be more liable in generating positive outcomes that could prepare the graduating students against the challenges of larbour market employment competitiveness. Hence, the novelty of this pedagogical approach is that it accommodate the traditional studio module and integrated entrepreneurship concept into the architectural design that enrich architecture students' critical thinking and problem-solving initiatives in the context of business opportunity and employment creation.

CONCLUSION

The new arch-entrepreneurship pedagogical approach has a tremendous potential to rebrand and assist the architecture graduating students in the current competitive job market. As a matter of fact, evident from the reviewed literatures have shown that exclusive conformist technical knowledge of architecture is not enough to guarantee the students for employment and job creation prospect in the current knowledge-based economy. More so, external economic forces are changing the university's curriculum structure and expectation from the architecture graduates is huge. The competition to fit within the professional practice after graduation is exigent. In Nigeria today, the reality is that employment landscape of the architecture graduates is fast shifting ahead of the university's mainstream curriculum structure as result of the economic and political uncertainty, allied professionals and quacks

encroachment and technological revolution of the contemporary age. Therefore, a conformist approach to the architecture training could inhibit the development of flexibility and diversity required in the profession for the competitive modern-age economic landscape.

In this era, the professional practice of architecture need to be more entrepreneurially inclined rather than depending on the architectural design service that has less job prospect in the contemporary mass housing era.

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APPENDIX

Table 1.0: Hynes' Process Model of Entrepreneurship Education (Hynes, 1996)

Students as Input	Course of Actions: Course content and Teaching methods		Expected Outputs
Personality traits; Attitudes; Parental influence; Needs and Interests; Self esteem; Past background	Entrepreneurship definition; Idea development; Feasibility and viability of idea; Product development and innovation; Market research; Project finance, Business Management and marketing; Teamwork.	Didactic (read/lecture); Skill building (case studies and visit to entrepreneur site); Problem solving class discussions and presentation; Teamwork projects discovery (Brainstorming).	Knowledge – Enterprise Initiative; Skills in business, Management and Marketing, analytical problem solving and communication; Risk taking proficiency; Intention to be self-employed (diversity of ventures creation and career options).
Teaching Environment = Academic setting with real-life entrepreneurship exposure			

Table 1.1: Measure of Reliability and Normality

Constructs	Item	Mean	SD	Item-Total Correlation	Cronbach Alpha	Skewness	Kurtosis
Integrated ArchDeP Education	IEE1	3.78	.793	.702	.821	-.224	-.380
	IEE2	3.72	.744	.789		-.116	-.303
	IEE3	3.84	.702	.809		-.255	.001
	IEE4	3.83	.733	.838		-.359	.358
	IEE5	3.78	.732	.825		-.288	-.047
	IEE6	3.83	.707	.695		-.402	.604
Attitude to Business Know-how	ABK1	3.49	.870	.791	.920	-.559	.371
	ABK2	3.43	.890	.830		-.557	.707
	ABK3	3.40	.895	.763		-.657	.315
	ABK4	3.33	.896	.778		-.364	.589
	ABK5	3.38	.947	.801		-.962	.120
	ABK6	3.50	.801	.708		-.281	.143
Perceived Value Creation	PVC1	3.95	.699	.719	.855	-.367	.553
	PVC2	3.91	.723	.757		-.373	.099
	PVC3	3.89	.697	.761		-.221	-.083
	PVC4	3.84	.771	.569		-.404	.208
	PVC5	3.16	.719	.766		-.395	-.087
	PVC6	3.12	.710	.731		.093	.248
Self-Employment Intention	SEI1	3.57	.772	.763	.928	-.662	.835
	SEI2	3.66	.715	.770		-.506	.824
	SEI3	3.59	.731	.804		-.423	.848
	SEI4	3.62	.776	.792		-.409	.332
	SEI5	4.06	.782	.843		-.596	.339
	SEI6	4.25	.783	.777		-.416	.603

Table 1.2: Exploratory Factor Analysis

Rotated Component Matrix[a]

		Items	Component			
			1	2	3	4
Integrated EArDeP Education	IEE1	Entrepreneurship principles present in the architecture courses	.691			
	IEE2	I understand the role and attributes of entrepreneur	.803			
	IEE3	Entrepreneurship teaching is to inculcate entrepreneurial skills	.817			
	IEE4	Entrepreneurship module inculcate new venture creation skills	.843			
	IEE5	Enterprise exercise develop practical soft skills as value added	.855			
	IEE6	Entrepreneurship is a foundational acumen for my profession	.703			
Attitude to Business Know-how	ABK1	I have the aptitude to recognize business opportunity		.796		
	ABK2	To conduct market analysis / business feasibility is ease for me		.867		
	ABK3	To formulate business goal is not difficult for me		.798		
	ABK4	I know how to set business objectives/action for new business		.824		
	ABK5	I can sources for funds require for new business idea/start-up		.848		
	ABK6	I can manage, motivate and network for client relationship		.741		

Table 1.2 Contd.

Perceived Value Creation	PVC1	I have ability to create and control new business/firm			.831	
	PVC2	I have develop creative skill for new products and services			.827	
	PVC3	Am now skilful in business idea creation to enterprise start-up			.685	
	PVC4	I have developed more capacity to innovate existing business			.579	
	PVC5	Am self-assured to do market analysis for new venture creation			.694	
	PVC6	My career goal is to found dynamic architectural firm in future			.838	
Self-Employment Intention	SEI1	I have interest to set up my own business or architectural firm				.777
	SEI2	I am determined to create/establish a business/firm in future				.784
	SEI3	I have intention to be self-employed one day upon graduation				.809
	SEI4	My intention is to start business within 2years after graduation				.827
	SEI5	My intention is to start business 5 years after graduation				.780
	SEI6	My professional goal is to be self-employed one day				.835

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

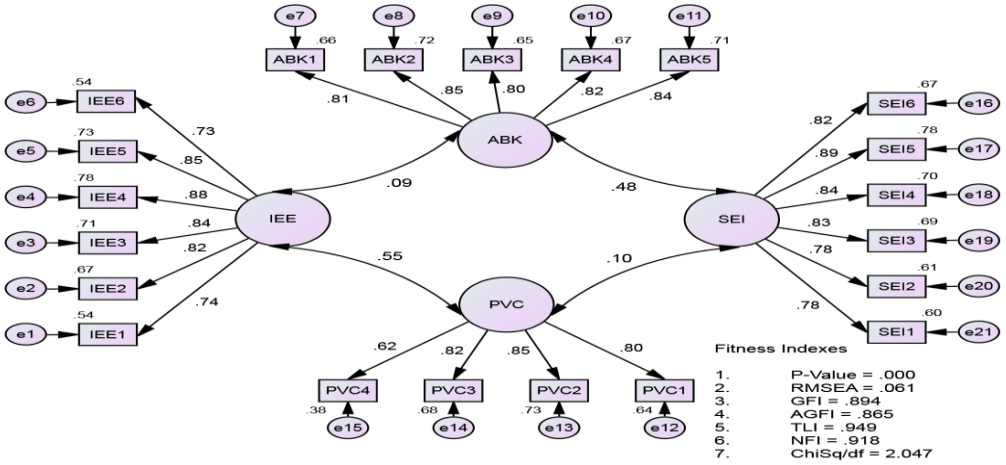

Figure 1.1: Discriminant Validity for the Research Hypothesised Constructs

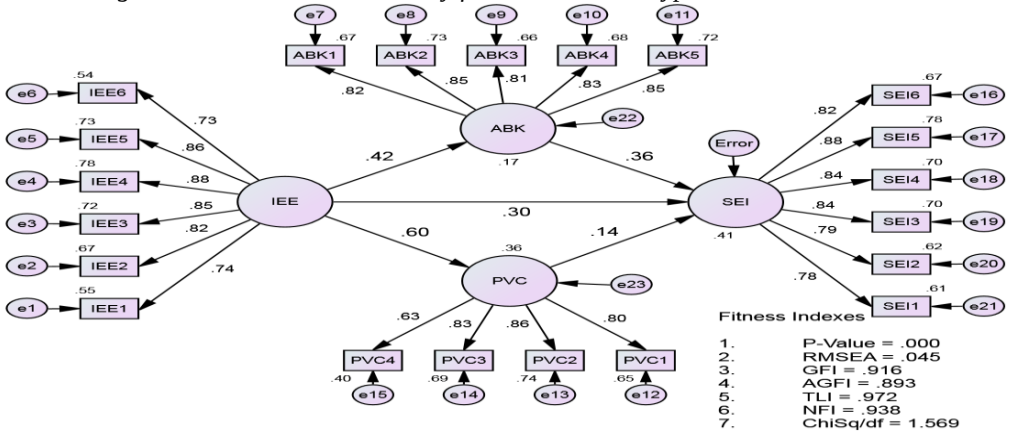

Figure 1.2: Structural Measurement Model for Entire Research Constructs and Goodness-of-fitness

Table 1.3: KMO and Bartlett's Analysis

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.931
Bartlett's Test of Sphericity	Approx. Chi-Square	4424.159
	df	210
	Sig.	.000

Table 1.4: Goodness of Fitness Indexes

Name of Category	Name of Index	Acceptable indexes values	Index value	Comments
Absolute fit	RMSEA	Less than 0.08	0.045	The required level is achieved
Incremental fit	TLI	Greater than 0.9	0.972	The required level is achieved
Parsimonious fit	Chisq/df	Less than 3.0	1.569	The required level is achieved

Table 1.5: Standardized Regression Weights and levels of Significance

S/no.	Constructs	Path	Construct	Standardized Estimates	S.E.	C.R.	P-Value	Result	Remark
1	ABK	<---	IEE	.417	0.041	13.737	***	Significant	Supported
2	PVC	<---	IEE	.602	0.113	3.989	***	Significant	Supported
3	SEI	<---	ABK	.363	0.072	3.342	***	Significant	Supported
4	SEI	<---	PVC	.141	0.057	3.408	***	Significant	Supported
5	SEI	<---	IEE	.297	0.082	2.007	0.045	Significant	Supported

Note: IEE = Integrated Entrepreneurship Education; ABK = Attitude to Business Know-how; PVC = Perceived Value Creation; SEI = Self-Employment Intention.

Perception of Residents on Impact of Proximity of Religious Camps on Residential Properties in Nigeria

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ABSTRACT

This study investigates the impact of religious camps developments on residential property with peculiar reference to selected areas along Lagos/Ibadan Expressway with a view to guiding property investors on the viability of residential property development between the year 2005 - 2014.The perception of the respondents on the proximity of religious camps on their properties were also investigated. A structured questionnaire was administered on the seven hundred and twenty (720) sampled respondents for the study. Data collected were analyzed using descriptive statistics in form of weighted mean score, moving average and regression analysis. The data collected on residential property developments in the study area revealed that most of the investors prefer to build tenement buildings as it provides more accommodation that can house many populations. The findings revealed that religious camp site development brings about increase in population, haphazard development and employment. This study recommended that government should stimulate the development of more residential properties around the religious sites assist in the provision of more infrastructural facilities to these neighbourhoods in order to cater for the population increase and areas in close proximity to religious camp sites should be strictly monitored to ensure that town planning laws and building codes are adhered to in order to curtail haphazard developments of buildings.

Keywords: Development, Religious Camps, Residential Properties

INTRODUCTION

There has been a controversy as to whether the externalities exhibited by religious centres are positive (amenities) or negative (nuisance or disamenities) in several societies (Do, Wilbur and Short, 1994); this was corroborated by Babawale and Adewumi (2011) that external factors can have either positive or negative effects on property rental value. Carroll, Clauretie and Jensen (1996) asserted further that there is usually the belief that neighbourhood religious camp, particularly the large ones, impact negatively on the values of properties in close proximity. Thus, externalities constituting a nuisance would adversely affect values of properties within close range in proportion to the distance from it. In the developed countries effective zoning regulation has curtailed indiscriminate location of religious property (Carroll *et al*, 1996). However, in developing nations like Nigeria, several religious centres are often sited arbitrarily which in turn affect property values either positively or negatively.

Recently, there is increase in number of religious camps in many parts of Nigeria, among which is the Lagos/Ibadan expressway. Siting of these camps is done without recourse to incompatibility in use and negative spill-over effects emanating to adjoining properties from religious camp development. Recai, Evert and Smith (2007) pointed out that there has been concern over property market impacts from nearby nonconforming land use. Nelson (2003) also affirmed that nauseating noise level in an area can contribute to violence and so disturb valuable activities as well as having adverse effects on health and in turn reduce efficiency and quality of life. Religious centres in Nigeria are prone to unrivalled enthusiasm, excitement, loud singing, clapping, and bell ringing, drumming which in some cases are with loud speakers mounted on roof tops. Religious centres on service days and other special

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events are faced with traffic congestion, `attendant parking problems, pollution from automobile exhaust; and sometimes robbery attack within the vicinity. This may negatively affect the ability of nearby residents to use and enjoy their property and as well create obnoxious public perception which may reduce the marketability and, therefore, the value of properties. Consequently, this study became imperative to examine the perception of residents on the influence of the proximity of religious camps on residential property in Nigeria. However, the study concentrated on religious camps along Lagos/Ibadan expressway. The restriction to the study area was informed by the increasing emergence rate of religious camps along the express way.

LITERATURE REVIEW

There is a growing recognition that property development, use and management should be evaluated against criteria that embody sustainability measures. That is, genuine sustainability evaluations should balance social, cultural and economic performance measures with environmental protection (Body, 2005). In this regard, location of churches within residential neighborhoods has been an issue of concern and controversy in several societies. The question remains whether the externalities exhibited by churches are positive (amenities) or negative (nuisance or disamenities). Existing empirical studies are inconclusive and anecdotal evidences are mixed. The notion of "externalities" is a useful concept developed in welfare economics. In real estate parlance, the notion of externalities states that external factors to a property can have either positive or negative effects on its value (Do et al., 1994; Appraisal Institute, 2008).

Due to its physical immobility, real estate tends to be affected by externalities more strongly than most other economic goods, services, or commodities. Religious camp site development attracts population to its location which in turn led to the demand for accommodation which thus makes the demand for residential land use to be on the increase (Appraisal Institute, 2008). The use to which the land can be put thus confers either owner occupied or rental values which bring about profitability of investment.

The demand for property is affected by changes in population, planning and development schemes, legislation, and availability of good road networks (Olayiwola, Adeleye and Oduwaye, 2006). Residential properties development can take diverse forms and those that are in proximity to religious camp site are not an exemption. The various types of residential properties development that are prevalent in close proximity to religious camps developments are: block of flats, tenement buildings, bungalows, mansion, detached and semi-detached properties.

According to U.S. Religious Landscape (2008), religion is the belief in the existence of a God or gods and the activities that are connected with the worship of them. It is the fundamental force through which man relates with the Supreme Being. Religion, in many respects, is a growing industry and so its importance, both social and economic, cannot be over-emphasized. One particularly successful manifestation of this growth is the religious camps. Religious camps have played a major role and have had a significant economic impact on the nearby communities. The revitalization and redevelopment of the communities which surround the religious camps have continued to improve the standard of living for many citizens living around their locations.

Religious facility is the centre for worshipping and socializing, and regarded as a symbol of morality. The provision of schools and other convenient facilities may be highly attractive for the community. In addition, churches and mosques that provide child-care centres and kindergartens have a positive externality on property value (Ooi 2004). Different

denominations of religious centres have also produced mixed externalities on housing value (Carroll *et al*, 1996). However, while neighbourhood qualities may appear to be a positive benefit to property values, they can also be detrimental. Des Rosiers (2002) submitted that seemingly negative neighbourhood qualities could also be a benefit to property values, while we might assume that neighbourhood religious centre would enhance a sense of community, and therefore, have a positive influence on property values. It is pertinent to note that, religious camps are on the increase in Nigeria, many of these camps are gradually turning to towns and sooner than expected, cities. Over the years, many of these religious camps have been generating externalities that are positively or negatively affecting the property rental values within their immediate environments and the society at large. This study is also a contribution to the volume of literature on religious camps in Nigeria as it investigates the perception of the influence of proximity of religious camp developments along Lagos/Ibadan Expressway on residential property.

While the tremendous positive benefits of religious centers may greatly outweigh the adverse effect on property rental values to the property owners, larger churches can cause impacts similar to commercial uses if they operate throughout the week and into the night. The presence of these religious camps may create a favourable or an adverse public perception which can increase or reduce the marketability and, therefore, the value of properties in the neighbourhood of the religious camps (Boyle and Katherine 2001). Chalmers and Scott (1993) pointed out that an adverse public perception regarding a property with some type of environmental defects and crime may exact a penalty on the marketability of the property and hence its value.

In certain situations, the pattern of real estate development for an entire area may be traced to a single, dominant land use (Bouvier *et al*, 2000). For instance, the location of the religious camps may possibly motivate all manner of commercial activities; warehouses, hotels, restaurants and the like - that may be desirable in terms of their effects on nearby property rental value. Thus, proximity to a religious centre has a significant impact on surrounding housing rental values. Furthermore, both the religious camp and supporting commercial real estate development generate demand for road and highway improvements to accommodate the increased vehicular traffic load that may further affect housing prices (Flynn, MacGregor, Hunsperger, Mertz, Johnson, 2004).

Weber, Bhatta, and Merriman (2007) attributed the majority of property value appreciation to demand increases created by a growing amenity base. According to Carroll *et al* (1996), real property values decrease, at a decreasing rate, as distance from neighbourhood church increases. On the contrary, Danderson (2003), pointed out that the traffic and tourist caused by religious centres cause property to lose their value. Though, religious centres by themselves do not detract neighbourhood property values, but the large size and the elaborate nature of temples is the detriment.

Do *et al* (1994), Simons and Saginor (2006) identified religious center as source of externalities and confirmed that externality-induced changes can have either a negative or positive effect on prices. Religious centers exhibit some of the same characteristics found by other externality studies to produce measurable effects on nearby residential property values. Positive externalities arising from land include neighbourhood schools (Cloffelter, 1975) and greenbelts (Correll, Lillydahl, and Singell 1978). Carroll *et al*., (1996) pointed out that some religious centres create positive externalities to nearby property values.

In Nigeria, Iroham, and Oloyode (2010) studied location of worship centres and its effect on

residential property values, a case of Living Faith Church, Ota,the findings from the study revealed that the location of religious centres had significant positive impacts on the residential rental values. The study however compared only mean of residential property values before and after the siting of the churches(see also Iroham, C.O., Oloyede, S.A. and Oluwunmi, A.O. (2011), Babawale and Adewumi (2011) conducted research on the impact of neighbourhood churches on housing prices on selected areas in Lagos metropolis, using hedonic model. The study however, based its empirical study only on rented apartments and as well on churches located within residential neighbourhood. The study revealed that there were positive as well as negative effects of churches on their immediate environments, particularly the study area. Therefore, considering the dearth of the previous studies in Nigeria, the emerging siting of camps and the uniqueness of this subject, there is the need for further studies.

THE STUDY AREA

Lagos/Ibadan expressway is one of the major controlled-access highways in the northern part of Lagos city as it serves as inter-state highways to Oyo and Ogun States respectively. About 20% of the length of the expressway falls within Lagos State, 60% falls within Ogun state and the remaining 20% falls into the Oyo state territorial boundary (Society Business and Economic News, 2012). Prior to the construction of the Lagos/Ibadan expressway, the Lagos/Sagamu/Ijebu-Ode old dual carriage-way was the only route used as entry point to Ibadan and some other South Western States of Nigeria. In order to reduce recurrent accidents and other hardships which were on high prevalence along that road, and given the importance of Lagos as the then capital of Nigeria, the new expressway was constructed.

The origin of religious camps along Lagos/Ibadan expressway dated back to 1983, when the Redeemed Christian Church of God (RCCG) began the construction of her permanent camp site located at kilometer 46 along the expressway. Before this time, many pentecostal churches made use of various mountains and hills tops as their prayer camps and these places were not easily accessible by many of their members. RCCG decided to site her camp along Lagos/Ibadan expressway in order to make it easily accessible to their members. Few years later, many other religious camps like Mountain of Fire and Miracle Ministry (prayer city), Deeper Life Christian Ministry Camp, Nasrul Lahi-il Fathi Society of Nigeria (NASFAT) Camp, just to mention a few, sprang up along the expressway, thereby bringing several socio-economic developments into the study area which have great effects on property rental values. The location map of the study area is as shown in Figure 1.

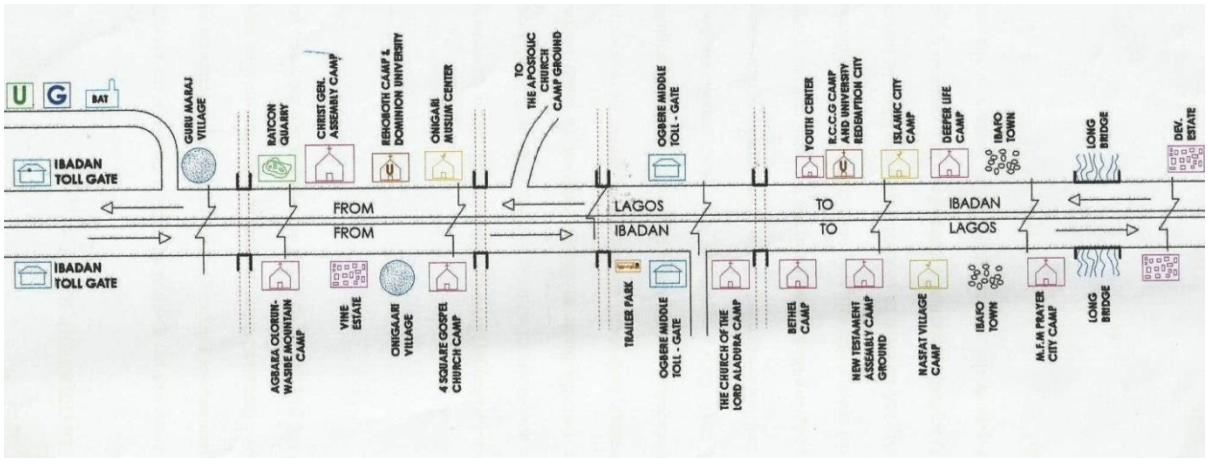

Figure 1: Locational map showing religious camps developments and other landmarks along Lagos Ibadan Expressway
Source: Authors' Fieldwork (2014)

RESEARCH METHODS

The target population comprises of residents and residential properties around the religious camps in the selected areas. The study relied on the primary data and the secondary data collected. Primary data were obtained through the administration of questionnaires on the residents of the study areas. It was administered on the residents of the areas under study for the purpose of obtaining information on housing types the perception of the residents on proximity of religious camps on their properties The secondary data were obtained from the records of; Directorate of Land Information Systems in the Lands Bureau, Abeokuta (who allocates and manages Ogun State Government properties), Ogun State Property and Investment Company (OPIC), Gateway City and Ogun State Urban and Regional Planning Board, Abeokuta (OSURPB).

The number of houses in the study areas was obtained from the Directorate of Land Information Systems in the Lands Bureau, Abeokuta (who allocates and manages Ogun State Government properties); and OSURPB, Abeokuta, who are in charge of Building Plan approval. There were 10,000 houses in Ibafo, Mowe, OPIC Estate at the Isheri/Berger axis end of Lagos State; while in Shagamu interchange there were 4,000 houses based on the approved building plan (OSURPB, 2012).

Kothari (2004) formula was adopted in determining the sample size of the residents in the study area as it made provision for the control of sampling error, specify margins of error for the items that were regarded as vital to the survey and would make the calculation of the sample size for the study areas easier.

Using Kothari (2004), the Formula for estimating Sample Size is given as:

$$n = \frac{Z^2.p.q.N}{e^2(N-1)+Z^2.p.q} \qquad \text{----------} \quad \text{(i)}$$

where,

n = sample size
z = value of standard deviation at a confidence level taken from table of normal curve at variants (z) for 95% confidence, which is 1.96
p = sample proportion **(q=1-p)** which in this study is taken as 50% (0.5)
N = number of the residents in the selected areas in selected locations which is 1km radius to the religious camps (Ibafo, Mowe, OPIC Estate in Isheri/Berger axis end of Lagos state) (10,000) and Shagamu interchange axis towards oyo state equals (4,000).
e = error margin estimated at 5% (0.05)

The estimated sample size, gives 369.9837 (approximately 370) for Ibafo, Mowe, OPIC Estate in Isheri/Berger axis end of Lagos state out of the total frame of 10,000 and 350.4781 (approximately 350) for Shagamu interchange out of the total frame of 4,000. Random sampling technique was used to solicit information from respondents for the study. Data analysis was carried out using weighted mean score. The 5- point scale was employed since it allows the respondents an option when they are not sure of their response with 5, 4, 3, 2 and 1 denoting "Very Important", "Important", "Neutral", "Less Important" and "Not Important" respectively.

Weighted Mean Score (WMS) is determined using equation (1).

$$WMS = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{n_5 + n_4 + n_3 + n_2 + n_1} \qquad \text{----------} \quad (1)$$

Where n_5 = number of responses for "Very Important", n_4 = number of responses for "Important", n_3 = number of responses for "Neutral", n_2 = number of responses for "Less Important", n_1 = number of responses for "Not Important".

RESULTS

Table 1: Types of Residential Buildings in the Study Area

Building Type	Ibafo Freq (%)	Mowe Freq (%)	Isheri Freq (%)	Shagamu Freq (%)
Block of flats	23(21.50)	28(23.93)	24(16.44)	112(32.0)
Tenement	41(38.32)	44(37.61)	40(27.40)	80(22.86)
Detached	18 (16.82)	14(11.97)	22(15.07)	51(14.6)
Semi detached	15 (14.02)	19(16.24)	32(21.92)	56(16.0)
Duplex	10 (9.35)	12(10.26)	28(19.17)	51(14.6)
Total	107(100.00)	117(100.00)	146(100.00)	350(100.00)

Source: computed from field survey, 2014

Table 1 revealed that tenement building was the most popular building type in Ibafo (38.32%), Mowe (37.61%) and Isheri (27.40%) except in Shagamu where block of flats (32.0%) was the highest while duplex was the least popular building type in all the study areas.

The analysis showed that most of the investors prefer to develop tenement buildings due to the nature of accommodation it provides, that is, can house many populations and thus solve the problem of housing need in the area which is in close proximity to religious.

The factors which influence the resident's perception include noise pollution, air pollution, traffic congestion, crime, tourist attraction, population increase, and promotion of moral value, generation of employment, security, and decline in property value, increase in property value, attraction of infrastructural facilities, haphazard development and attraction of manufacturing industries.

Table 2: Perception of the Respondents on the influence of the Proximity of Religious camps Developments

S/No	Factors	Mean Score	Rank
1	Haphazard development	4.695	2nd
2	Air pollution	4.108	6th
3	Attraction of industries	4.390	4th
4	Crime	2.113	10th
5	Noise pollution	3.099	8th
6	Population increase	4.823	1st
7	Promotion of moral value	2.958	9th
8	Generation of employment	4.413	3rd
9	Decline in property value	0.892	12th
10	Increase in property values	4.695	2nd
11	Traffic congestion	4.038	7th
12	Tourist attraction	1.080	11th
13	Attraction of infrastructural facilities	4.132	5th

Source: computed from field survey, 2014

Table 2 presents the perception of the residents on the proximity of the religious camps to their properties. The weighted mean score employed assigned 5 to "Very important", 4 to "Important", 3 to "Undecided", 2 to "Not important" and 1 to "Not Very Important" in order to obtain the mean value and rank the perception in order of its significance.

The table suggest that the siting of religious camps brings about population increase to its surrounding environment as it ranks 1st with a mean value of 4.823 while haphazard developments and increase in property values ranked 2nd with a mean value of 4.695 respectively. The general belief of the people that properties in close proximity to religious

camp sites will lack employment opportunities and attraction of industries was put to play. The perception of the residents shows that these factors ranked 4th and 5th with a mean value of 4.413 and 4.390 respectively.

CONCLUSION AND RECOMMENDATIONS

The study examines the perception of the residents about the influence of proximity of religious camps to their properties and reveals that tenement building was the most popular building type in the study area while the proximity of religious camps to the respondents' residential property increases population and causes haphazard development . Another factor affecting the residents close to the religious camps is high traffic congestion experienced around the community whenever there is religious activity in the camps.

The rental values of the residential properties in the proximity of the religious camps are on the increase as a result of more demand for housing around the camps. The proximity of religious camps to the residents was also observed to attract haphazard developments, which invariably results in generation of urban kiosk. Based on this findings, the study recommends that property developments in close proximity to religious camp sites should be strictly monitored to ensure that town planning laws and building codes are adhered to in order to curtail haphazard developments of buildings. Government should encourage the development of more residential properties around the religious sites in order to cater for the population increase.

Government should also assist in the provision of more infrastructural facilities to these neighbourhoods.

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Assessment of Factors Influencing Building Maintenance in Public Housing Estates: A Case Study of Ijaiye Medium Housing Estate, Agege, Lagos

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ABSTRACT

The study assessed factors affecting building maintenance in public housing estates in Lagos State using Ijaiye Medium housing estate as a case study with a view to developing a strategy for effective residential building maintenance to enhance the sustainability of existing housing stock. The sampled population was the residents of the estate. A simple random sampling of 2 Units of 3 bedroom flats per block were considered for the study. The data was collected through the administration of a total of One Hundred and Sixty-Three (163) structured questionnaires administered on the occupants of which a total of 120 (74%) were retrieved and used for analysis. The data collected was analyzed using descriptive statistical tools such as frequencies and weighted mean scores. The research revealed that majority of the respondents representing 61.67% opined to the fair level of management and maintenance of properties in the estate. There is also a collaborative effort of the government agency and the residents association for the maintenance of the estate services and infrastructures while the corrective method of maintenance strategy was used for the management and maintenance of the estate. The research made necessary recommendations and concluded that building maintenance management should be encouraged as it ensures that building facilities retain their structural, functional and aesthetic integrities throughout their lifespan, reduce unnecessary expenditures to facilitate the sustainability of the buildings and other infrastructure.

Keywords: Building Maintenance, Management Practice, Public Estate

INTRODUCTION

The importance of housing to man cannot be overemphasized. According to Oyenuga (2006) housing comprises immediate accommodation, environment and facilities like roads, water, electricity and a host of other facilities that make living comfortable to the habitants. Leong (2009) also affirmed that housing is a major factor impacting on the health, safety, socio-economic and political life of the occupants; it impacts all aspect of human endeavour. Thus, the state of housing and its environment is an indicator of the level of development and condition of the citizens. Despite the pivotal roles of housing in the socio-economic development of a nation and the life of its citizenry, majority of the public housing are in deplorable condition and state of disrepair, due to long period of neglected maintenance of the available facilities; lack of maintenance culture; availability of funds; inadequate maintenance plans and strategies amongst other factors.

Maintenance of residential buildings is one major factor of housing ills in many cities of the world which needs urgent attention and cure. This problem seems pronounced most especially in developing countries, Nigeria inclusive where very little emphasis is laid on building maintenance functions and management; consequently, maintenance of the existing housing stock in habitable condition still remains a great problem to be solved in Nigeria (Olagunju, 2012). Maintenance management in the public sector in Nigeria has suffered from lack of funds for a considerable time. Maintenance of the built environment has great impacts on the whole nation and the condition of the surroundings in which we live and learn, is a

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reflection of the nation's well-being. Maintainability of building has been identified as one of the key areas in which the built industry must achieve significant improvement (Nayantharas de Silva, Mohammed, Florence and George, 2004).

According to Iyagba and Adenuga, (2003) it is impossible to produce buildings which are maintenance free, but maintenance work can be minimized by good design and proper workmanship carried out by skilled experts or competent craftsmen using suitable codes of installation, requisite building materials and methods. Buildings are required to provide a conducive and safe environment for various human activities. The extent to which buildings provide the required environment for the required activity is a measure of the functionality of the building (Oladapo, 2005).

The standard of building maintenance has an important influence on the quality of the built environment. Several authors such as Olagunju (2012); Sunday, Oladele and Frank (2012); Waziri and Vanduhe,(2013); Ogunmakinde, Akinola and Shyanbola (2013) among others maintained that there are several factors influencing building maintenance. Also, poor maintenance culture of the residents and low aesthetic quality of neighbourhood centres, constitute problems that need to be solved to enhance residential buildings sustainability (Olagunju, 2012). In other words, for any meaningful approach to sustain maintainability of the existing housing stock in Nigeria like any other country there is the need to identify and assess the factors that influence maintenance of public residential buildings.

In addition, the Maintenance management sector in public section in Nigeria has suffered from lack of funds and negligence for a period of time (Owolabi, Amusan, Gani, Tunji-Olayeni, Peter and Omu, 2014). Existing building in Nigeria lack adequate maintenance attention and are in very poor and deplorable conditions of structural and decorative disrepair (Adenuga, Odunsami and Faremi, 2007). The main purpose of maintenance of facilities in a property is essentially to retain its values for investment, aesthetic, safety and durability with a view to ensuring that the property is continually in good condition for habitation to the satisfaction of the owner(s)/users and communal prestige (Brennan, 2000). According to Olatubara and Fatoye (2006), public residential estates, when compared with existing private housing estates, are known to be lacking in basic infrastructural facilities and services and the respective maintenances that are meant to enhance the livability of such estates. However, despite the various strategies adopted by the state government for maintenance of the Estate since its creation, poor maintenance culture is manifesting in various degrees in the estate; hence requiring adequate building maintenance to ensure the sustainability of the estate and ensure the properties therein are kept in a good and tenantable condition.

Odediran, Opatunji and Eghnure (2012) stated that the ability of a building to provide the required environment for a particular activity is a measure of its functionality. Therefore as the components of a building begins to deteriorate, it becomes necessary to take measures to ensure that the desired characteristics of that facility which provides safety and convenience are retained. Maintenance programme in Nigeria according to Ahmed (2000) and Kunya, Achuenu and Kolawole (2007) has not received much attention in the past as the emphasis is on the development of new properties. This is also in line with the statement of Odediran et al. (2012) who observed that there is apparent lack of maintenance culture in Nigeria, and that emphasis is placed on the construction of new buildings for public sector and neglecting the aspect of maintenance which commences immediately the builder leaves the site. This is also corroborated by Olagunju (2012) who opined that there is lack of maintenance set up in Nigeria that can sustain the current inadequate housing provision in the country.

Adejimi (2005) attributed the array of abandoned and epileptically functioning facilities in Nigeria due to poor or lack of maintenance. This therefore presents the need for studying the

various factors affecting residential building maintenance with the view to proffering relevant solutions. Hence, this study becomes imperative.

LITERATURE REVIEW

Maintenance Practice in Nigeria

Building maintenance is an important programme for the sustainability of infrastructural development. It plays an important role among other activities in the building operations (Zulkarnain et al., 2011). Maintenance according to BS 3811(1984) is the combination of all technical and associated actions intended to retain an item or restore it to a state in which it can perform its required function. Also, according to Musa (2002) maintenance denotes all actions carried-out on a building after completion to preserve it in its initial state, starting from the defects liability period of the building to its disposal. With appropriate maintenance, the building's economic life is prolonged. However, Musa (2002) took a look into some public buildings around and it reveals array of abandoned and epileptically functioning facilities. The malfunctioning of the facilities in most public buildings is a consequence of inadequate maintenance and/or poor management of the facilities. Adejimi (1998) posits that theories and hypotheses are postulated and propounded daily, but maintenance problems still remain adamantly unyielding and so unsolved and this is why there is a serious need to look at the problem from another perspective. Adejimi (1998) opined that maintenance issues can be resolved together by professionals at the project inception and planning (project conception, design, and construction to completion) stages through preventive rather than corrective or emergency approach.

The public Maintenance management sector in Nigeria has suffered from lack of funds for a period of time while the requirements for good practice in maintenance of building stock have been established over a considerable period, the achievements of good practice is by no means universal. Maintenance of the built environment impacts on the whole nation. The conditions of surrounding in which we live and learn, is a reflection of the nation's well-being ''Maintainability of building has been identified as one of the key areas in which the construction industry must achieve significant improvements".

Factors Affecting Building Maintenance

Previous studies revealed the effects of numerous factors affecting residential building maintenance. Assaf (1996) opined that design and construction faults that affect maintenance of buildings are defects in civil design, defects in architectural design, defects due to consultants firm's administration and staff, defects due to construction drawings, defects due to construction inspections, defects due to construction, defects due to contractual administration, defects of construction materials, defects due to construction equipment, defects arising from specifications and design defects in maintenance practicability and adequacy. Adejimi (2005) asserted that to a large extent, building maintenance problems can be attributed to problems originating from poor design. Adejimi (2005) further stated that the design process could be optimised to achieve adequate planning in choosing the right materials, good workmanship, plants and equipment and labour in order to reduce maintenance problem.

Adejimi (2005) in his study identified twelve relevant factors affecting the maintenance strength of buildings as design resolution, structural strength, specified material strength, maintenance manual, safety measures, skill maintenance personnel, maintenance plants, environmental factors, usage factors, quality control factors and post construction prevention strength. Kiong and Akasah (2012) analyse the maintenance factors for IBS precast structural system in Malaysia in order to produce a better quality of the IBS precast building. They identify design aspect as an important factor of the building quality. Zulkarnain et al. (2011)

reviewed the critical success factor in building maintenance management practice for University sector under four perspectives; customer (customer satisfaction, service quality, customer complaint, reaction to customer needs), internal processes (service excellence, technology capability, customer employee, competence, process efficiency, e.t.c.), financial perspective (management expectations, financial growth, cost reduction, productivity improvement, e.t.c.) and learning and growth perspective (technology leadership, continuous service improvement, upgrading staff competence, e.t.c.). They concluded that critical success factor can help in providing a successful competitive performance for the university sector in the area of maintenance management. Olagunju (2012) identified factors that influence the level of maintenance of residential building standard. In the study eight factors were identified to be significant to physical condition of building in Niger State, Nigeria. The variables are structural components condition, roof components, toilet facilities, discharge of waste water component, exterior wall condition, condition of walkway within the building premises, electrical wire and switches conditions, interior walls surface condition.

STUDY AREA

Lagos State Development and Property Corporation (L.S.D.P.C.)Estate, Ijaiye Medium Housing Estate, Agege, Lagos was built over 20 years ago, in the year 1986-1987 during Governor Muda-Shiru administration to accommodate the civil servants and curb the housing problems in the estate. The estate was sold out to citizen on mortgage in 1989 with but the Lagos State Development and Property Corporation still plays major role in its management and maintenance. The estate was designed as a storey building with 4 flats on a block, it is a 3bedroom flat with a spacious kitchen, 2 toilets and a bathroom. The estate constitutes 80 blocks distributed into seven zones with 13 blocks in a zone and 320units. Most residents of this estate are Lagos state's civil servants, entrepreneurs and professionals.

RESEARCH METHODS

The population of this study comprises the occupants of Lagos State Development and Property Corporation Medium housing estate, Ijaiye, Agege, Lagos. There are eighty three (83) housing units in the estate comprising of eighty (80) units of 4nos 3 bedroom flats in each block and a three 3nos bungalow. Thus, the sample frame for the entire residential properties is three hundred and twenty three (323).

Simple Random Sampling was adopted in selecting the occupants of the estate based on the 2 questionnaire/block ratio been set for the sample size. The sample size in respect of the study was therefore 2 units from the 4nos 3 bedroom flat in each block thus, 160nos of 3bedroom flat and 3nos of bungalows in the estate was therefore considered as the sample size. Structured questionnaires were administered on the occupants of the estate to elicit information on the factors affecting building maintenance in public estates. Descriptive statistics was employed to analyze the data.

Questionnaires were sent out to each of the occupants of the estate, thus a total of One Hundred and Sixty-Three (163) questionnaires were sent out to the occupants of which a total of 120 were completed and retrieved which was then used for the analysis.

DATA ANALYSIS AND DISCUSSIONS

The study examined the gender and employment status of the respondents as it is seen to be crucial in the knowledge of basic housing studies that make for good urban living. Table 1 and 2 shows the gender and employment status of the respondents'. The distribution shows that 68.33% are males while 31.67% are females which show a high number of males residing in the estates. The gender distribution relative to the occupation of the respondents

reveals that 4.17% of the respondents are unemployed, 49.17% are Civil Servants, 30.00% are Self-Employed, while 8.33% work in private firms and are retired personnel's respectively. These shows that majority of the respondents are those that work, have the requisite knowledge of the study area and hence their opinion can be adequately relied on.

Table 1: Respondents gender distribution

Gender	**Frequency**	**Percent**
Male	82	68.33
Female	38	31.67
Total	***120***	***100.0***

Source: field survey, 2014

Table 2: Employment status of the Respondents

Employment Status	Frequency	Percent
Unemployed	5	4.17
Civil Servants	59	49.17
Self Employed	36	30.00
Private Company	10	8.33
Retired Personnel	10	8.33
Others	-	-
Total	*120*	*100.0*

Source: field survey, 2014

Table 3: Respondents opinion on the level of management and maintenance of public services and infrastructures in the estate

Level of Management	Frequency	Percent
Poor	30	25.00
Fair	74	61.67
Good	7	5.83
Very Good	9	7.5
Total	*120*	*100.0*

Source: field survey, 2014

The respondent's opinion on the level of management and maintenance of the Public Services and Infrastructures in the estate was presented in table 3. As shown the occupants opined that the level of management and maintenance is fair with a percentage of 61.67% while those who consider it as poor represents 25.0%. 5.83% consider the level of management as good while 7.5% considers the level of management as very good.

Table 4: Respondents opinion on the adoption of any maintenance strategy in the maintenance of the infrastructures and services in the estate

Adoption of Maintenance Strategy	Frequency	Percent
Yes	44	36.67
No	76	63.33
Total	*120*	*100.0*

Source: field survey, 2014

Table 3, shows that the respondents opined that there is no maintenance strategy adopted for the management and maintenance of the infrastructures in the estate with a majority of the population representing 63.33% agreeing to the fact while 36.67% believe that the some maintenance strategies are been adopted in the management and maintenance of the infrastructures and services in the estate.

Table 5: Respondents opinion on the group that embarks on the maintenance of the infrastructures and services in the estate

Group	Frequency	Percent
Government Agency Only	10	8.33
Residents Association	32	26.67
Government agency and Residents association	78	65.0
Total	*120*	*100.0*

Source: field survey, 2014

Table 5 assesses the body majorly responsible for the maintenance of the infrastructures and amenities in the estate. The result shows majority of the occupants, agreed to the combination of the efforts of the government agency and the residents association for the maintenance of the estate services and infrastructures with the highest percentage of 65%.

Table 6: Respondents opinion as regarding the maintenance strategy adopted in the management and maintenance of the estates services and infrastructures

Maintenance Strategy	Frequency	Percent
No maintenance strategy	7	5.83
Preventive	23	19.17
Corrective	69	57.5
Condition Based	21	17.5
Total	*120*	*100.0*

Source: field survey, 2014

Table 6 analyses the maintenance strategy employed in the maintenance of the estates infrastructures and services. The research revealed that majority of the respondents opined that the corrective method was used with the highest percentage of 57.5%, this is closely followed by the preventive maintenance type with a percentage of 19.17%.

Table 7: Residents Opinion as regards satisfaction on the basic elements in the estate

Satisfaction	Mean	Rank
Satisfaction with structural components	4.6387	1
Satisfaction with dwelling features	4.6023	2
Total neighbourhood facilities and environment	3.9678	3
Total management services	3.6564	4
Overall housing satisfaction	3.3456	5

Source: field survey, 2014

The relative levels of satisfaction with the elements in the estate was also analysed and presented in Table 7. The Table 7 listed the different levels of satisfaction and ranked it on the level of importance and significance. The various opinions and reasons have being ranked to provide better meaning and interpretation to the work. The research revealed that Satisfaction with structural components is the major satisfaction derived by the occupants which is ranked as 1, followed by Satisfaction with dwelling features and Total neighbourhood facilities and environment which have been ranked 2nd and 3rd respectively.

Table 8: Table showing the Respondents Level of Satisfaction and condition of infrastructural facilities provided in the Estate

Level Of Satisfaction with The Infrastructures and Facilities in the Estate								**Condition The Infrastructures and Facilities in the Estate**				
Infrastructures	**VIS**	**IS**	**U**	**S**	**VS**	**MEAN**	**RANK**	**BAD**	**FAIR**	**GOOD**	**MEAN**	**Rank**
Water Supply	12 (10.0)	4 (3.33)	4 (3.33)	39 (32.5)	61 (50.83)	0.8217	3rd	13 (10.83)	41 (34.17)	66 (55.0)	2.442	3rd
Refuse Collection	6 (5.0)	18 (15.0)	2 (1.67)	41 (34.17)	53 (44.17)	0.7950	4th	24 (20.0)	65 (54.17)	31 (25.83)	2.058	9th
Sewage Disposal system	3 (3.33)	12 (10.0)	1 (0.83)	50 (41.67)	54 (45.0)	0.8333	2nd	14 (11.67)	63 (52.5)	43 (35.83)	2.242	8th
Drainage	24 (20.0)	29 (24.17)	2 (1.67)	24 (20.0)	41 (34.17)	0.6483	10th	11 (9.17)	59 (49.17)	50 (41.67)	2.325	6th
Road Network	10 (8.33)	15 (12.5)	1 (0.83)	68 (56.67)	26 (21.67)	0.7350	7th	3 (2.5)	68 (56.67)	49 (40.83)	2.383	4th
Schools & Educational Centers	13 (10.83)	19 (15.83)	1 (0.83)	44 (36.67)	43 (35.83)	0.7417	6th	7 (5.83)	111 (92.5)	2 (1.67)	1.958	10th
Health Facilities	30 (25.0)	50 (41.67)	3 (2.5)	6 (5.0)	31 (25.83)	0.530	11th	59 (49.17)	51 (42.5)	10 (8.33)	1.592	11th
Commercial Centers	6 (5.00)	23 (19.17)	4 (3.33)	39 (32.5)	48 (40.0)	0.7667	5th	28 (23.33)	57 (47.5)	35 (29.17)	2.058	9th
Recreational Centers	14 (11.67)	24 (20.0)	1 (0.83)	31 (25.83)	50 (41.67)	0.7317	8th	10 (8.33)	64 (53.33)	46 (38.33)	2.300	7th
Fire Fighting Equipments	16 (13.33)	73 (60.83)	5 (4.17)	16 (13.33)	10 (8.33)	0.4850	12th	69 (57.5)	50 (41.67)	1 (0.83)	1.433	12th
Electricity	12 (10.0)	10 (8.33)	2 (1.67)	31 (25.83)	55 (45.83)	0.7283	9th	5 (4.17)	64 (53.33)	51 (42.5)	2.383	4th
Telecommunication Infrastructure	11 (9.17)	25 (20.83)	-	42 (35.0)	42 (35.0)	0.7317	8th	3 (2.5)	39 (32.5)	78 (65.0)	2.533	2nd
Security Services	2 (1.67)	2 (1.67)	2 (1.67)	50 (41.67)	64 (53.33)	0.8867	1st	9 (7.5)	30 (25.0)	81 (67.5)	2.600	1st

Source: field survey, 2014

Where VIS-Very Insatisfied IS- Insatisfied UD-Undecided S-Satisfied and VS-Very Satisfied

Table 8 and 9 analyses the respondent's opinion on the level of satisfaction and the condition of the infrastructures and facilities in the estate and the building elements in the estate. The various opinions have been analyzed and ranked for better meaning and interpretation to the work. From table 7, the research revealed that majority of the respondents are very satisfied with the level of security, sewage disposal and water supply. They also opine to the fairly good state of security, telecommunication infrastructure and water supply. Tables 8 on the other hand revealed that majority of the respondents are satisfied with building components such as service appliance and level of sanitation. The condition of the building components also reveals a fair state of sanitation and structural element.

Table 9: Table showing the State and Condition of the building Element and The Users Level of Satisfaction with the Building Elements

	Condition of the Building Elements					Level Of Satisfaction with The Building Elements						
Building Elements	**BAD**	**FAIR**	**GOOD**	**MEAN**	**RANK**	**VS**	**S**	**UN**	**IS**	**VIS**	**MEAN**	**RANK**
Structural Elements (Beams, columns, Upper Floor Slabs and Stairs	12 (10.0)	64 (53.33)	44 (36. 67)	2.2667	2nd	42 (35.0)	17 (14.17)	4 (3.33)	37 (30.83)	20 (16.67)	0.640	4th
Walls (External and Internal walls)	34 (28.33)	51 (42.5)	35 (29.17)	2.008	6th	33 (27.5)	11 (9.17)	9 (7.50)	50 (41.67)	19 (15.83)	0.5917	5th
Finishes (Wall finishes, Floor Finishes and ceilings)	20 (16.67)	72 (60.0)	28 (23.33)	2.067	4th	8 (6.67)	13 (10.83)	2 (1.67)	62 (51.67)	35 (29.17)	0.4283	8th
Windows	48 (40.0)	52 (43.33)	20 (16.67)	1.700	8th	28 (23.3)	18 (15.0)	3 (2.50)	51 (42.5)	20 (16.67)	0.5717	6th
Doors (External and Internal doors)	26 (21.67)	35 (29.17)	59 (49.17)	2.200	3rd	22 (18.3)	53 (44.17)	2 (1.67)	30 (25.0)	13 (10.83)	0.6683	3rd
Roofs	24 (20.0)	83 (69.17)	13 (10.83)	1.9083	7th	7 (5.83)	20 (16.67)	3 (2.5)	80 (66.67)	10 (8.33)	0.4900	7th
Services (Sanitary appliances, building service equipment, disposal e.t.c)	17 (14.17)	83 (69.17)	20 (16.67)	2.025	5th	86 (71.67)	25 (20.83)	2 (1.67)	5 (4.17)	2 (1.67)	0.9133	1st
Fixtures and fittings	59 (49.17)	51 (42.5)	10 (8.33)	1.5917	9th	5 (4.17)	9 (7.5)	9 (7.50)	77 (64.17)	20 (16.67)	0.420	9th
Sanitation of the environment	6 (5.0)	54 (45.0)	60 (50.0)	2.450	1st	49 (40.83)	52 (43.33)	1 (0.833)	12 (10.0)	6 (5.0)	0.810	2nd

Source: field survey, 2014

Table 10 analyses the respondents' opinion on the factors affecting building maintenance in public estates. The various factors were assessed, presented with weighted mean score and ranked for better meaning and interpretation to the research. From the table, the most significant factors are maintenance culture, availability of fund and low concern to future maintenance with mean scores of 4.4250, 4.2167 and 4.1333 and have been ranked 1st, 2nd and 3rd respectively. The least considered factors are ignorance about the basic properties of building materials and components; inadequate knowledge of the importance of maintenance work and use of new materials and components in building which have been ranked 18th, 19th and 20th respectively.

Table 10: Respondents Opinion on the Factors affecting Building Maintenance in Public Estates

Factors affecting Building Maintenance in Public Estates	Mean	Std. Deviation	Rank
Maintenance Culture	4.4250	1.10509	1st
Availability of fund for maintenance of the building	4.2167	1.07049	2nd
low concern to future maintenance	4.1333	1.05267	3rd
Use of substandard of materials and building components	4.1000	.92944	4th
Design affecting Resolution	4.0500	1.01128	5th
inadequate building maintenance standard and policy	3.9500	.96013	6th
clients attitude to maintenance	3.9083	.93482	7th
availability of skilled maintenance personnel	3.9000	.92944	8th
poor management of maintenance group	3.8500	.89490	9th
Workmanship during construction and maintenance	3.7417	.97443	10th
behaviour and attitude of occupants	3.6833	1.06102	11th
Technological changes and fashion	3.6417	1.04355	12th
delay in occupancy after completion	3.6083	1.07918	13th
lack of communication between maintenance contractors, clients and users	3.6083	1.07918	14th
Iack of care/use of building components and services	3.5917	1.04918	15th
improper selection of building material component and system	3.5833	1.05785	16th
Non availability of replacement parts and components	3.5667	1.05904	17th
Ignorance about the basic properties of building materials and components	3.5583	1.01083	18th
inadequate knowledge of the importance of maintenance work	3.5417	1.06823	19th
use of new materials and components in building	3.4833	.98717	20th

Source: field survey, 2014

CONCLUSION AND RECOMMENDATIONS

The importance of building maintenance in achieving and ensuring sustainability cannot be over-emphasized. It is evident that in Nigeria both public and private sector buildings face neglect due to lack of maintenance and as a result they are subjected to rapid deterioration. The study revealed lack of preventive maintenance for public residential buildings and this presents threats to the functional, structural and aesthetic conditions of such buildings. The research also assessed the condition and users satisfaction relative to the condition of the building elements and the infrastructures provided in the estate and revealed that majority of the respondents are satisfied with the structural components and dwelling features which invariably requires adequate building maintenance to avoid deterioration and total obsolescence. The research therefore made the following recommendations;

i. The government should formulate appropriate policies and strategies and make funds available for planning and development in order to set minimum maintenance standards for buildings in the estate. This may be through repair/remedial works and renovations such as; Minor repair works, Major repair works.
ii. Educate the residents on the need for residential buildings and buildings' premises maintenance and the implications for failure to maintain buildings and building's premises through radio and television announcement and discussions. In addition,

strategic placement of posters and effective distribution of hand bills can also be employed for the enlightenment campaign.

iii. The Nigerian Institution of Estate Surveyors and Valuers and other allied professionals in the construction industry should make appropriate recommendations and guidance notes to aid appropriate maintenance of properties in the country and ensure sustainability.

iv. Preventive maintenance of buildings should be encouraged in order to avoid building failure before the designed life of such buildings.

v. Building designs should be resolved to suite owners' requirements to avoid conversions during occupancy. As unresolved buildings are frequently converted to suit other uses through which the building face failures.

vi. Clients of residential building quarters should ensure that specified materials are used during construction and thereafter make funds available for periodic and corrective maintenance.

vii. Qualified and experienced personnel should be engaged in the construction and maintenance of public buildings.

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Assessing the Sustainability of a Rainwater Harvesting System in an Academic Building Using a Triple Bottom Line Approach

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ABSTRACT

Rainwater harvesting (RWH) is the process in which rain is captured, channeled, stored, and used as an alternative or supplementary water source. This study assessed a rainwater harvesting system (RWHS) in a non-residential building at Federal University of Technology, Akure using a triple bottom line approach of sustainability. In assessing the RWHS, data were collected using quantitative data collection methods: a detailed survey questionnaire, physiochemical/ microbiological assessment of water quality, and a cost-benefit analysis. The survey result showed that 66% of respondents would be open to using untreated rainwater for toilet flushing while 82% of the respondent agreed to using treated rainwater generally. The increase in agreed percentage is related to the fear of health risk in untreated rainwater. However, on the issue of choice, only 12% of the respondents agreed to using rainwater fed toilet when borehole water toilet is not functioning. The physiochemical/microbiological assessments of rainwater suggest that it poses a low risk to public health. Also the cost-benefit analysis shows that the project is viable with cost-benefit ratio of eleven and return on investment of one year. Consistently, water was available for use in the toilet throughout the implementation of the project, relieving the stress of staff and students of the department from going to wells and boreholes to fetch water. This research has demonstrated that rainwater harvesting system is an effective intervention for the perennial water shortage and sanitation problems.

Keywords: Rainwater Harvesting, Reliability, Rainfall, Water Quality, Cost-benefit Analysis

INTRODUCTION

Rainwater harvesting (RWH) is the process in which rain falling on an impervious surface, is captured, channelled, stored, treated if necessary and used as an alternative or supplementary water source, for a variety of water requirements. RWH can be particularly be useful in areas where surface and groundwater sources are hard to exploit (Fewkes, 2006).

Rainwater harvesting systems (RWHS) is not a new system and it has successfully been tested for higher crop productivity in smallholder farming of the semi-arid world by several researchers and developmental organizations as potential measures of supplemental moisture/water supply (Botha et al. (2003), Gicheru et al. (2003), Biamah and Nhlabathi (2003) and Chilimba and Kabambe (2003)). Also with regards to domestic uses, rainwater has successfully be implemented in residential buildings (Coombes et al. (2003), Rahman et al. (2012 & 2014), Domènech and Saurí (2010), Shittu et al., 2012; Hamid and Nordin, 2011; Lade et al., 2013) showing a significant impact on the total water consumption.

Sustainability of a RWHS signifies that the existent harvesting, use and consumption of natural water resources can be continued in to the future for optimal livelihood generation. One of the typical questions raised by sustainable assessment is how well sustainability can be measured (Waheed et al. 2009). According to Pachpute et al 2009, sustainability can be based on three important attributes of RWH system: (i) reliable water supply and production potential (ii) effectiveness of water use and (iii) minimal negative impacts on natural resources (Pachpute et al., 2009). The certainty of income generation is also an added advantage to the sustainability of RWHS.

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Assessing the sustainability of a RWHS has been a major challenge as many researchers has used several methods in assessing the sustainability of rainwater system. For gardening/irrigation, Woltersdorf (2010) assessed the sustainability of Rainwater Harvesting Systems used for Gardening by evaluating ecologic, economic and social implications. Pachpute et al. (2009) undertook a sustainability assessment of storage type of rainwater harvesting systems in Makanya catchment of rural Tanzania by assessing the reliable water supply potential and effectiveness of water use by crops.

With regards to domestic use, Ghisi et al. (2009) evaluated the financial viability of a rainwater harvesting system. Rahman et al. (2012) examined the water savings potential, reliability of water supply, financial benefits, and the adequacy of the current government rebate for a RWHS implemented within a stand-alone house at ten different locations in Greater Sydney, Australia. Rahman et al., (2014) also accessed the sustainability of Rainwater Harvesting System in terms of Water Quality. The author ensures the sustainability of it system through assessing several water-quality parameters of collected rainwater with respect to allowable limits. Hamid and Nordin (2011) studied the reliability of installing a RWHS by studying the reliability of water supply and production potential at a male residential colleges in Universiti Teknologi MARA (UiTM) Malaysia. The study concluded that the installation of RWHS could result in a 90% water supply reliability for the college. The economic appeal of the RWHS was also studied and this resulted in an annual savings of RM 10460 from the campus' water bill.

With respect to the above literature, none of the previous researchers have been able to combine the 3E (i.e. Environment, Equity, and Economics) of Triple bottom approach to assess a RWHS. In view of the above, this study present the evaluation of the RWHS using the triple bottom line approach of sustainability i.e. consideration of the social, economic and health/technical aspects of RWH.

SUSTAINABILITY AND TRIPLE BOTTOM APPROACH

Sustainable development was first described by the Brundtland Commission in 1987 as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987). Since the Brundtland Commission, many alternative definitions of sustainability have been proposed and diverse interpretations of the concept made. However, the meaning of sustainability is subject of intense debate among environmental and resource economists and a concept difficult to define in a way that it is meaningful and sufficiently practical to allow it to be operationalized (Pope et al. 2004).
Sustainability Assessment is a new and evolving concept, which is being increasingly viewed as an important tool to aid in the shift towards sustainability (Pope et al. 2004). In literature, sustainability assessment is generally viewed as a tool in the 'family' of impact assessment processes, closely related to Environmental Impact Assessment and Strategic Environmental Assessment (Pope et al. 2004). Sustainability Assessment is often described as "a process by which the implications of an initiative on sustainability are evaluated, where the initiative can be a proposed or existing policy, plan, program, and project, piece of legislation, or a current practice or activity." (Pope et al., 2004). Assessing sustainability firstly requires a well-defined concept of sustainability (Pearce et al. 1996). Many concepts of sustainability are based upon the 'three-pillar'or 'triple bottom line' (TBL) concept, which is often conceptualized as three intersecting circles representing the environment, society and the economy (Figure 6) (Jörissen et al. 1999, Pope et al. 2004). It is assumed that the state of sustainability can be defined by environmental, social, and economic objectives and criteria are developed under these categories. (Pope et al. 2004, Waheed et al. 2009).

Figure 6: Three pillars of social, environmental and economic sustainability (Triple bottom line) (Wikipedia, sustainability http://en.wikipedia.org/wiki/Sustainability)

Triple-Bottom-Line Sustainability is based around the concept of the *"3 E's:" Environment, Equity*, and *Economics* (alternately, the *"3 P's:" Planet, People,* and *Profits*) as interrelated in their ultimate success or failure. Being a good steward of the environment by leaving it in a better condition than you found it is certainly a key goal of sustainability and sustainability planning. It is demonstrated, however, that an individual's concern for environmental stewardship increases as his or her prosperity increases.

The triple-bottom-line approach acknowledges the three pillars of sustainability—environmental stewardship, improved social equity, and increased economic development—as equal in their impact on allowing current generations to meet their needs while protecting the ability of future generations to do the same. Furthermore, it recognizes and capitalizes on the fact the three pillars of sustainability can be leveraged against one another to increase the positive outcomes of each beyond what would be possible if each pillar were addressed separately.

STUDY AREA

This project was carried out at the Department of Agricultural and Environmental Engineering (DAEE) workshop, Federal University of Technology Akure (FUTA), Nigeria. FUTA is located in Akure, the capital of Ondo State, South-Western, Nigeria and lies within Latitude: 7.25 °N and Longitude: 5.20 °E. Akure had a population of over 500,000 people in 2006 (Balogun et al., 2011). Akure's MAP is about 2,105mm and rainfall occurs between March and November (Encarta, 2014).

The Federal University of Technology, Akure, Nigeria (FUTA) was chosen as the study area due to the desperate need for water for toilet flushing within the university academic environment and the potential RWH holds as a viable source. There is currently no municipal water supply to the campus and the campus relies heavily on boreholes which are non-perennial.

METHODOLOGY

Assessing Sustainability of RWH System

The technical feasibility was addressed by assessing the rainfall potential and the storage reliability (Appendix 1A &B). For social feasibility (and thus, assessment), a questionnaire was developed to test for the sustainability of the project in order to ensure that the community was fully engaged at every stage of the project implementation and this included identifying their most serious water-related problems and potential solutions.

It is expected that after one or two years of implementing the RWHS, a follow-up questionnaire will be developed and administered to beneficiaries of the RWHS in order to assess the RWHS. The developed questionnaire in this study was an adapted version of the questionnaire used in Olanrewaju (2013) and obtained data on the demographic

characteristics of the respondents, practice of RWH, perceptions of rainwater quality and willingness to use the rainwater for toilet flushing. The questionnaire also solicited respondents' perceptions to using treated rainwater for toilet flushing prior to the RWHS being implemented and was administered to students registered at the Federal University of Technology Akure.

In relation to perceptions regarding using rainwater to flush toilets, the questionnaire employed the factors influencing perceptions published by Po et al. (2004) i.e. (i) Disgust or the "Yuck" factor; (ii) perceptions of risk associated with using treated rainwater; (iii) the specific uses of treated rainwater; (iv) the sources of rainwater to be treated; (v) the issue of choice; (vi) trust and knowledge; (vii) attitudes towards the environment; (viii) environmental justice issues; (ix) the cost of treated rainwater; and (x) socio-demographic factors.

The first section of the questionnaire solicits socio-demographic data such as age and status at university. The succeeding section has a number of statements requiring respondents to select the option that is most applicable to them using the 5-point scale provided i.e. *Strongly agree*, *Agree*, *Neutral*, *Disagree*, and *Strongly disagree*. The third section is open-ended and requests respondents to provide reasons (personal, cultural, religious or otherwise) why they may not use treated rainwater for toilet/flushing, and also to make whatever comments they wish to make. Table 1 provides additional details regarding the administration of questionnaires.

Table 1: Additional details regarding the administration of questionnaires

Year of administration	When administered	Respondents	Number of respondents
2013	Prior to the implementation of the RWHS	Students registered at the Federal University of Technology Akure.	50

The questionnaire was administered to 50 respondents based on the relative small number of student using the workshop facility (< 1000 students). Informed consent was obtained from each respondent before administering the questionnaire. The completed questionnaires were screened for completeness, coded and entered into the Statistical Package for Social Science (SPSS) version 16.0.

For rainwater quality assessment, samples were collected before and after pre-treatment (i.e through filter). Rainwater samples were collected in triplicate using guidelines of the American Public Health Association (APHA, 1985) and National Standard of Drinking Water Quality (NSDWQ) (2007). Water was collected aseptically in autoclaved 25 cl plastic. Samples were transported in black plastic bags containing ice to the laboratory within 2 hours of sampling, kept in a refrigerator at 4°C and examined within 16 hours of collection. Samples were analyzed using standardized bacteriological methods for water quality analysis (Cheesebrough, 1987) to determine the degree of contamination. All samples were analysed for total bacterial count and E. coli. The microbiological quality was assessed by most probable number (MPN) method (Fawole and Oso, 2001). Total coliforms were indicative of environmental contamination (from bird faeces, dead leaves, etc) and E. coli indicative of human faecal contamination (Abott et al., 2012).

RWHS cost varies considerably depending on location, materials used and RWHS capacity. The catchment area cost depends on the layout, topography, and elevation of the catchment areas with respect to the area allocated to the storage tank. The cost for the conveyance system (gutters and down pipes) also vary, based on the configuration or physical layout of the RWHS. Typically, the most expensive component in the RWHS is the storage tank. The

economic cost incorporates construction cost and operation and maintenance cost. Construction cost comprises the cost of equipment, materials and construction. Operation and maintenance cost includes the cost of filter replacement, maintenance and salaries. The *environmental cost* was not included in this analysis because of the low risk of rain water to human health.

The *economic benefit* of RWH is the money saved from not using potable water supplied via a centralised municipal system. Based on the current price of water in the city of Akure, 20 litres of water costs ₦10 (Ten naira). Benefit to Cost ratio (R_o) was calculated using equation (1).

$R_o = B_o / C_o$ .....*(1)*

C_o represents *economic cost* and B_o represents *economic benefit*. The annual discount rate employed was 10% over the 10-year RWHS design life. If $R_o > 1$, then the project is economically feasible.

Net present value (NPV) calculations discount future costs and benefits to a present value using a discount rate. A positive NPV indicates a net benefit. When evaluating different schemes, those with higher NPV values are more favourable. NPV is computed using

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 \quad \text{.....(2)}$$

equation *(2)*

Where r is the discount rate, C_t is the net cash flow and T is the design life of the system.
Payback period, which is the time taken to gain a financial return equal to the original investment, is determined using equation (3):
Payback period = investment required/net annual cash inflow .....(3)

RESULTS AND DISCUSSIONS

Technical Feasibility

Due to the maximum rainfall experienced in April, there was a large volume of rainwater stored (82.76) over the 12 months. There were deficits recorded in December, January, and July 2013 with values of -24.00, -22.70, and -15.90 respectively (See appendix). Water demand for September and October were comparably much lower due to the school holidays. Maximum storage of 395.07m^3 occurred in June 2014.

Social and economic feasibility

Social feasibility

Of the 50 respondents, 66% of the respondents agreed that they will be open to using rainwater fed toilet, 20% of the respondents were neutral while 14% disagreed to be open to using rainwater fed toilet (Table 2).

Table 2. Willingness to use rainwater for toilet flushing

	Frequency	%	Cumulative %
Agree	33	66.0	66.0
Neutral	10	20.0	86.0
Disagree	7	14.0	100.0

Use of treated rainwater for toilet flushing

Of the 50 respondents, 82% were comfortable using treated rainwater for toilet flushing, 16% were neutral while 2% were not comfortable using treated rainwater for toilet flushing. In comparison to the results shown in Table 2, Table 3 shows a higher percentage of respondents agreeing to use rainwater water basically because of treatment.

Table 6 Willingness to use treated rainwater for toilet flushing

	Frequency	%	Cumulative %
Agree	41	82.0	82.0
Neutral	8	16.0	98.0
Disagree	1	2.0	100.0

The issue of choice

Twelve percent of 49 respondents will only use rainwater fed toilets if normal water fed toilets are occupied, 28% were indifferent while 58% will not use rainwater fed toilets even when potable water fed toilets are occupied (Table 4).

Table 4. Respondents reaction to if they will only use rainwater fed toilets when normal water fed toilets are occupied

	Frequency	%	Cumulative %
Agree	6	12.0	12.2
Neutral	15	30.0	40.8
Disagree	29	58.0	100.0

Perception of health risks associated with rainwater

Rainwater is generally believed to be safe to use for non-ingested purposes. Out of the 50 respondents, 28% were concerned about using toilets that flush with rainwater, 20% were neutral and 52% were not concerned about using toilets that flush with rainwater (Table 5).

Table 5. Respondents concern about their health when using rain fed toilets

	Frequency	%	Cumulative %
Agree	14	28.0	28.0
Neutral	10	20.0	48.0
Disagree	26	52.0	100.0

Economic feasibility

The Economic feasibility was assessed using the cost benefit analysis. Table 14 presents Net Present Value (NPV) for the RWHS over a 10 year design period. The Economic cost was calculated based on capital and recurrent costs for the RWHS over a 10-year design with the assumption of 5% increase annually. While the economic benefit of the rainwater system was calculated based on an annual increase of 5% per annum. This assumption was based on survey and the rate of increase in price of water in Nigeria. The result over a ten-year period as shown in Table 6 indicated that the cost/ benefit ratio of 11 while the net present value of the resultant income stream over a ten-year period is ₦1.2m. From the result, it can be deduced that implementing rainwater harvesting project for toilet flushing is economically viable under a 10-year period with return of investment of 1 year based on the payback period.

Environmental feasibility and health

Physiochemical and microbiological rainwater quality results (before and after filtration) are presented in Table 7. The filtrate temperature reduces from 24^0C to 23^0C from the tank to filtration outlet. The filter achieved the following: turbidity reduced from 0.45 NTU to 0.12 NTU; total suspended solids reduced from 0.12mg/l to 0.06 mg/l; hardness reduced from 180 mg/l to100mg/l and total dissolved solids reduced from 23mg/l to 16mg/l.

PH of the water sample increased from 3.50 to 4.50, this is as result of decrease in the temperature from the tank and the filtration outlet. This is also based on *Le Châtelier's Principle*, which states that as the temperature increases in pure water, the pH reduces and so vice-versa. Also the conductivity reduces from 36.33 (us/cm) to 25.88 (us/cm). Total alkalinity values reduces from 492 ($MgCaCO_3$/l) in the tank to 376 ($MgCaCO_3$/l) after filtration. Nitrate and phosphate were not detected in water sample. The chloride value was within the range 248.15mg/l before and 174.41mg/l after treatment. The low BOD and COD were minimal with a percentage reduction of 16.84% and 16.61% respectively.

Coliforms and E.coli were not detected in the stored rainwater samples in both the filtered and the unfiltered samples. The total heterotrophic bacterial (THB) counts ranged from 14.40 (cfu/ml) $x10^3$) in the stored water and 12.35 (cfu/ml) $x10^3$) after filtration, showing a percentage reduction of 14.24% as a result of the filtration process. The microbiology analysis of rainwater suggests that it poses a low risk to public health.

Table 6 Cost-benefit analysis of the rainwater harvesting system

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Economic cost	140,520	500	500	500	500	15,500	500	500	500	500	160,020
Economic benefit	144,000	151,200	158,760	166,698	175,033	183,785	192,974	202,622	212,754	223,391	1,811,217
FCF	3,480	150,700	158,260	166,198	174,533	168,285	192,474	202,122	212,254	222,891	
Interest rate	5%										
Benefit-cost ratio	11										
Return on investment	1 year										
NPV	₦ 1,223,022.09										

Table 7: Water Quality Results

Parameter's	Before (in the plastic tank)	After (Filtration processes)	Percentage Removal
Temperature ^{o}C	24.00	23.00	4.17
Turbidity (NTU)	0.45	0.12	73.33
Total alkalinity ($mgCaCO_3$/l)	492.00	376.00	23.58
PH	3.50	4.50	-28.57
Conductivity(µs/cm)	36.33	25.88	28.76
Total Dissolved Solids (mg/l)	23.00	16.00	30.43
Total Suspended Solids (mg/l)	0.12	0.06	50.00
Chloride (mg/l)	248.15	174.41	29.72
Hardness (mg)	180.00	100.00	44.44
Nitrate (mg/l)	0.00	0.00	0.00
Phosphate (mg/l)	0.00	0.00	0.00
Biochemical Oxygen Demand (BOD) (mg/l)	24.46	20.34	16.84
Chemical Oxygen Demand (COD) (mg/l)	35.35	29.48	16.61
THB (cfu/ml) × 10^3	14.40	12.35	14.24
Coliform (MPN/100ml)	0.00	0.00	0.00
E.coli (MPN/100ml)	0.00	0.00	0.00

THB = Total Heterotrophic
cfu = Colony Forming Unit/ml
MPN = Most Probable Number
NG = No Growth

CONCLUSION

This study has demonstrated that the use of harvested rainwater is an effective intervention for perennial water shortages and that it can be used to solve the problem of unnecessary inconveniences of water and sanitation problems in any environment with scarce water resources. RWHS complements other water sources and utility systems, thus relieving pressure on limited water supplies and has offered several advantages over some other interventions such as greywater reuse such as a high degree of design flexibility, ease of installation, high levels of reliability and a supply of water at a quality consistently good enough for most non-potable applications. Rainwater collected from the building's roof that has undergone basic treatment processes (primarily coarse filtration) poses low risk to public health when used for purposes such as toilet flushing, laundry washing and garden irrigation. Therefore, advocacy for the adoption of a RWHS will lead to drastic reduction in water-shortage/water related diseases and improve standard of living of the people.

The perception survey carried out showed that over 60% of the respondents were willing to use rainwater for toilet flushing. Users' willingness and acceptability of treated rainwater for toilet flushing has clearly proven RWH to be a success, as respondents have clearly shown their desire for the project. As clearly stated in the survey by the respondents, their major problem is lack of water. The toilet facilities are also not clean enough and with their responses as shown above, it is obvious that they are willing to take part in this project. Also, due to favourable responses from the respondents about the positive impact it can bring to the environment, it is believed that this project would be a success whenever it may be embarked on as it would give the environment a new source of water. Respondents have indicated that they are comfortable using treated rainwater for toilet flushing. They have also shown their willingness to use treated rainwater originating from the rainwater harvesting system. From the results, it can be deduced that implementing rainwater harvesting project for toilet flushing is economically viable under a 10-year period, with the resultant income stream over a ten-year period as ₦1.2m and a payback period of 1 year. The analysis reported in this paper revealed that Akure has a considerable rainfall potential. It also suggests that embarking on the design and construction of more rainwater fed toilets will go a long way in improving the toilet situation in the university premises and it will provide a good return on investment.

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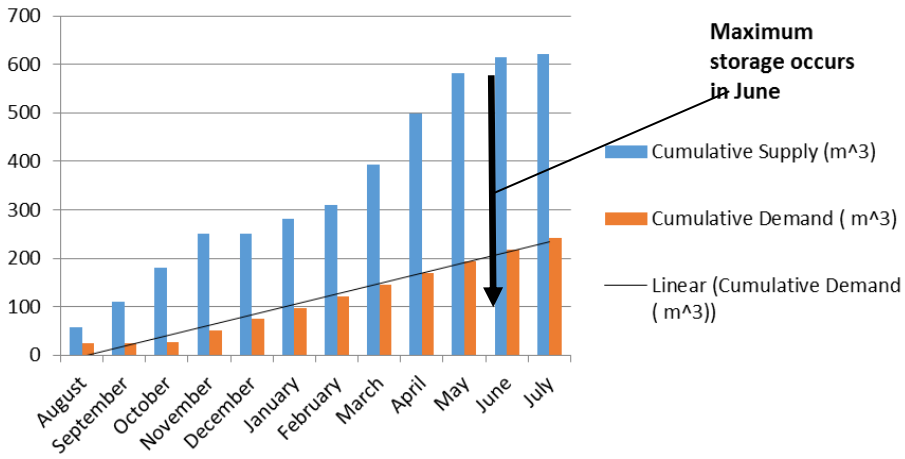
APPENDIX



Appendix 1A . Cumulative monthly roof runoff and cumulative water use. (Estimate of storage requirements)

A	B	C	D	E	F	G	H	I
Month	**Rain fall (mm)**	**Volume. Supplied (m^3)**	**Cumulative volume Supplied (m^3)**	**Volume demanded (m^3)**	**Cumulative Demanded (m^3)**	**Total amount stored (D-F) (m^3)**	**Deficit/Surplus (C-E) (m^3)**	**Storage Reliability (G-E) (m^3)**
August	206.22	57.97	57.97	24.00	24.00	33.97	33.97	9.979
September	189.71	53.33	111.31	1.12	25.12	86.19	52.21	85.06
October	248.11	69.76	181.07	1.12	26.25	154.82	68.63	153.70
November	247.62	69.62	250.69	24.00	50.25	200.44	45.62	176.44
December	0.00	0.00	250.69	24.00	74.25	176.44	-24.00	152.44
January	4.61	1.29	280.74	24.00	98.25	182.49	-22.70	158.49
February	137.71	30.04	310.78	24.00	122.25	188.53	6.04	164.53
March	291.52	81.96	392.75	24.00	146.25	246.50	57.96	222.50
April	379.71	106.76	499.51	24.00	170.25	329.26	82.76	305.26
May	290.22	81.59	581.11	24.00	194.25	386.86	57.59	362.86
June	116.81	32.84	613.95	24.00	218.25	395.70	8.84	371.70
July	28.82	8.09	622.05	24.00	242.25	379.80	-15.90	355.80

Appendix 1B: Calculation of cumulative supply, demand, storage requirement and storage reliability

Compressive Strength Characteristics of Laterized Palm Kernel Shell Concrete

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ABSTRACT

This study investigated the compressive strength characteristics of laterized palm kernel shell concrete with a view to establishing its suitability as an alternative Building material to the conventional ones. It examined the effect of varying water cement- ratios, palm kernel shell contents and laterite contents on the compressive strength of laterized palm kernel shell concrete. The percentage replacement of laterite as substitute in fine aggregates and percentage replacement of palm kernel shell as substitute in coarse aggregate were varied in the increment of (0%, 10%, 20% and 30%) respectively. The water-cement ratios (w/c) of (0.55 and 0.6), mix ratios of (1:1½:3 and 1:2:4) was used. A total of 576 cubes were cast and cured in water for (7, 21 and 28 days) respectively. The Laterized Palm Kernel Shell (LPKS) Concrete cubes of sizes 100 x 100 x 100mm were crushed using manual compression testing machine. The test results showed that the compressive strength of laterized Palm Kernel Shell Concrete decreases significantly with increase in water-cement ratio, increase in laterite content and increase in palm kernel shell content respectively. It was also discovered that during curing, the compressive strength of laterized Palm Kernel Shell Concrete increased from 7-28 days. This study concluded that laterized palm kernel shell concrete may perform better if up to30% laterite content and 30%PKS is use for mix ratio 1: 1½:3 at w/c ratio 0.55,up to 20% of laterite and 20% PKS for 0.6w/c. For mix 1:2:4 at both mix ratios and w/c ratios, up to 10% laterite and 20%PKS is adequate.

Keywords: Palm kernel Shell, Laterite, Concrete, Compressive strength

INTRODUCTION

The construction industry relies heavily on conventional materials such as cement, granite and sand for the production of concrete. The high and increasing cost of these materials has greatly hindered the development of shelter and other infrastructural facilities in the developing countries. As a result of shortage of building materials and with the advent of soil-cement as a material for the provision of cheap houses especially in the under-developed and developing countries of the world, a lot of investigations are now being made to determine the usefulness of cheap and locally available materials such as lateritic soils (Lasisi *et al.* 1990). Laterite is a soil formed by decaying rocks weathered by tropical heat and centuries of heavy rain. They are readily available in large quantities all over the tropical regions of the world, particularly in Nigeria. Lack of adequate information about its structural behavior in service coupled with lack of accepted standards regarding their performance characteristics when stabilized with some other materials may explain why the material has not been fully and confidently accepted for construction (Osunade, 2002).

The growing concern of resource depletion and global pollution has challenged many Researchers to seek and develop new materials relying on renewable resources. These include the use of by-products and waste materials in building construction (Teo *et al.* 2006). As stated by Olanipekun *et al.* (2006), one of the suggestions for cutting down conventional building material costs has been the sourcing, development and use of alternative, non-conventional local construction materials including the possibility of using some agricultural wastes and residues as constructional materials. Such wastes are palm kernel shell, coconut shell etcetera. One significant problem in the processing of palm oil is the large amount of

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waste produced and this is one of the main contributors to the nation's pollution problem. At the mills, when the fresh fruit bunches is processed and oil extraction takes place, solid residues and liquid wastes are generated. These by-products include empty fruit bunches, fibre, shell and effluent (Nuhu-koko, 1990).

Palm kernel shell is not a common material in the construction industry, but with the quest for sourcing and developing alternative, non-conventional local construction materials, limited research work has been carried out on the use of PKS as aggregate in light and dense concrete for structural and non-structural purposes. Palm kernel shells are used mostly as aggregates in concrete (Olanipekun *et al,* 2006; Alengaram *et al,* 2010; Olutoge, 2010) and asphalt concrete (Ndoke, 2006).

Attempts have equally been made by various researchers to reduce the cost of its constituents and hence total construction cost by investigating and ascertaining the usefulness of materials which could be classified as agricultural or industrial waste such as palm kernel shells, coconut shells, corn cob ash, fly ash, rice husk ash etc that have being continuously generated. The reuse of this waste product will help to save our environs from environmental pollution and severe ecological (green) problem. Due to this reality, an alternative source for the potential replacement of fine aggregates in concrete has gained good attention. As a result, reasonable studies have been conducted to find the suitability of laterite replacement for sand in conventional concrete and the use of Palm kernel shell to replace granite. Sand is a well-known building material and has occupied a very important place in construction work but it is more expensive than laterite because the former is more difficult to collect from rivers than the latter which can easily be dug from pits.

Concrete is the most widely use construction materials worldwide. This is due to its versatility, strength, durability, easy to make to any forms and shapes. These characteristics are the major factors that universally make concrete a material of choice in housing, development and other construction activities (Dadu, 2011).Concrete is constructional material that has been important in the past, is one useful today and is confidently forecast to be indispensable in the future. When compared with other material used in construction industry, concrete is one of the materials that consume high quantity of natural resources. The factors that influence the compressive strength of concrete are; Quality of materials, grading of the aggregates, water, water-cement ratio, cement content and age of the concrete (Mamman and Abdulsalam, 2011).

At least about 80% of the volume of ordinary concrete is occupied by aggregates. This shows that sourcing alternative aggregates will conserve our aggregates deposit from 1 to 80% concrete production. As aggregates are cheaper than cement it is more economical to use it as much as possible in concrete than cement. Neville (1997), stated that aggregates contribute to the volume stability and durability of concrete. In an attempt to achieve environmental sustainability, a lot of effort was made by different researchers toward substituting aggregates with other suitable materials. Hence the need for this study.

Laterized Palm Kernel Shell Concrete

Laterized concrete as described by Olusola *et al.,* (2005) is concrete in which laterite fines are used partially or wholly to replace the conventional sand". In this light, it can be said that laterized palm kernel shell (LPKS) concrete is concrete in which laterite fines and palm kernel shells are used partially or wholly to replace the conventional sand and granites respectively. Also studies by (Olusola *et al,* 2004 and Ayangade *et al,* 2004) have established the suitability of palm kernel shells as floor finish aggregates and also that the introduction of granite dust in the coarse aggregate up to 30% maximum gave a maximum compressive strength. Likewise, Obadje (2011) investigated into aspects of the durability of *Kernelrazzo*

in terms of its fire resistance, abrasion resistance and impact resistance and had established its suitability. Despite all these researches, the compressive strength characteristics of concrete when both sharp sand and granites are partially or fully replaced with laterites and palm kernel shells respectively is scarce in literature. Hence the need for this study.

Experimentation

Material Sampling

The basic components of the materials used were Palm Kernel Shell (PKS), Ordinary Portland Cement (OPC), Sand and Water. The PKS was obtained from Iwoye village along Iwo-Ibadan express road, Osun State. The Cement was Ordinary Portland Cement (OPC) whose properties are believed to conform to the requirements of BS EN197-1 (2000).The Sand and the granite used was obtained in Ede town, and the range of size of the sand used are those that passed through 5mm BS Sieve. Portable water that is free from organic matter of any kind was used for mixing.

Experimental procedure

Preparing the test sample

The various test specimens were prepared at the department of Building, Federal Polytechnic Ede, Osun State. This stage involves mixing the constituents of the LPKS using certain parameters such as mix ratios(1:1½:3,1:2:4), determined percentage of PKS Content(0%,10%,20% and 30%), and granite content, determined percentage of laterite content(0%,10%,20% and 30%), and sand. The whole mixture was thoroughly mixed before water was sprinkle. The required quantity of sharp sand, laterite, palm kernel shells,and granite was measured and spread on the concrete platform. The required quantity of cement per each mix ratio was first thoroughly mixed with laterite and sharp sand before mixing with the palm kernel shells in their right proportion. The required quantity of water was measured and poured into the mixture in stages for adequate mixing and to enhance effectiveness of the binding. The component was thoroughly and adequately mixed to prevent segregation and bleeding until uniform, homogenous and consistent mix was obtained.

Placing

The mixture immediately was poured into wooden moulds of 100x100x100mm size to avoid setting before placement. The mould used was oiled before filling with the mix. This was done to enhance easy de-moulding and smooth surface finishes. The mixture was placed in two layers in the mould and then tampered using a 20mm tampering rod. This was done to ensure adequate compaction to avoid honeycombing. After the top layer had been compacted, the surface of the LPKS concrete cube was finished and leveled with the top of the mould by means of a trowel. This was labeled for easy identification after some minutes. The LPKS concrete cubes was left in the moulds for 24 hours and kept in a place free from vibrations or exposure to direct sunlight or other sources of heat. The specimens was de-moulded after 24hours and cured. The mixing and sampling of the concrete was done in accordance with BS 1881: Part 125: 1986. However, maximum care was taken into consideration to ensure the stability of the moulds on the platform when filling and tampering. Clean sheet of polythene was laid under the moulds to avoid the outflow of the water from the mix.

Curing of test specimen

The concrete cubes were stripped the second day (after 24hours of casting) and were placed in curing tanks filled with water. The cubes were cured for 7, 21 and 28days.respectively.

Determination of the compressive strength

The compressive strength were done by crushing Concrete cubes of sizes 100mm x 100mm x 100mm on a 1000kN capacity ELE Compression machine. Soft boards of 10mm thickness were used as packing materials between the blocks and the platens of the machine. The cubes

were well centered under the compression machine before the load was applied. The test was done for 7, 21 and 28days

Tests results and discussion

Effect of w/c ratio on the compressive strength of laterized Palm kernel shell concrete

The figures below shows the variation of the compressive strength of the Laterized Palm Kernel Shell Concrete with water cement ratio of two mixes investigated. For the two mix ratios 1:1½ :3 and 1:2:4 and at all levels of Palm Kernel Shell and Laterite content, the compressive strength of Laterized Palm Kernel Shell decrease with an increase in water cement ratio.

Effect of mix ratio on the compressive strength of laterized palm kernel shell concrete

The figures below shows the variation of the compressive strength of the Laterized Palm Kernel Shell with two water cement ratios 0.55 and 0.60 at all levels of palm kernel shell and laterite content, the compressive strength of laterized palm kernel shell decrease with an increase in mix ratio.

Effect of percentage replacement level of palm kernel shell content on the compressive strength of laterized Palm kernel shell concrete

For water-cement ratios of 0.55 and 0.60 and at 0% to 30% Palm kernel shell level, the higher the water cement ratio the lower the compressive strength. However the compressive strength decreases with an increase in Palm kernel shell concrete

Effect of percentage replacement of laterite on the compressive strength of laterized palm kernel concrete

The compressive strength increase as the percentage of laterite decrease for both mix ratios, at both water/cement ratio 0.55 and 0.6. The richer the mix, the higher the compressive strength, the higher value of compressive strength was recorded at lower water cement ratio.

Discussion of the result

a. Mix ratio 1: 1½:3 and 0.55w/c ratio
   All the values satisfy the requirement
b. Mix ratio 1: 1½:3 and 0.6w/c ratio. The percentage written below is satisfactory for PKS content and laterite
   0% laterite – up to 30% PKS
   10%laterite – up to 30% PKS
   20%laterite – up to 20% PKS
   30%laterite – up to 10% PKS
c. Mix ratio 1:2:4 and 0.55w/c ratio
   0% laterite – up to 30% PKS
   10%laterite –up to 20% PKS
   20%laterite – up to 10% PKS
   30%laterite – The result is less than the requirement
d. Mix ratio 1:2:4 and 0.6w/c ratio
   0%laterite –up to 30% PKS
   10%laterite –up to 20% PKS
   20%laterite –Result less than the requirement
   30%laterite –Result less than the requirement

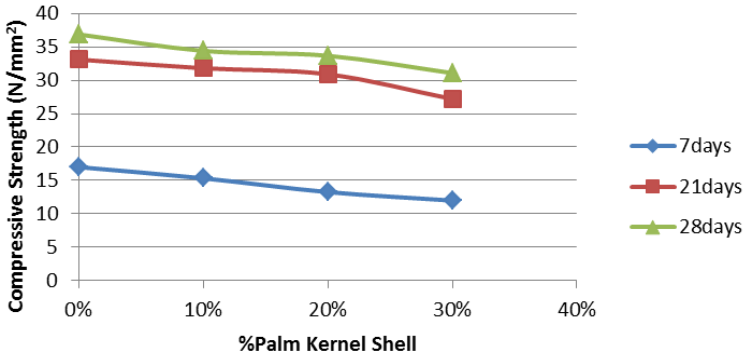

Figure 1: Compressive strength of Laterized Palm Kernel Shell concrete containing 0% laterite , 0.55 w/c ratio and mix ratio 1: 1½:3

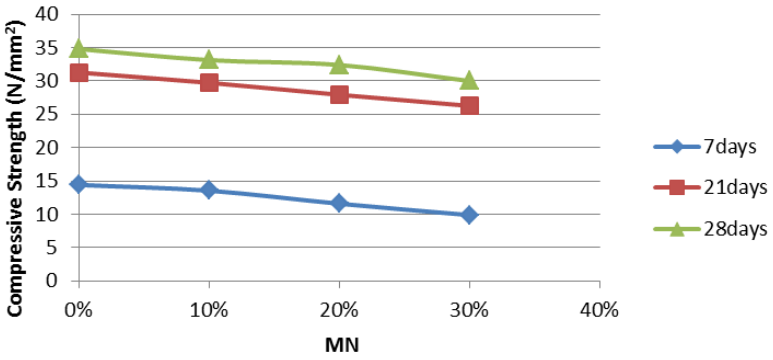

Figure 2: Compressive strength of Laterized Palm Kernel Shell concrete containing 10% laterite, 0.55 w/c ratio and mix ratio 1: 1½:3

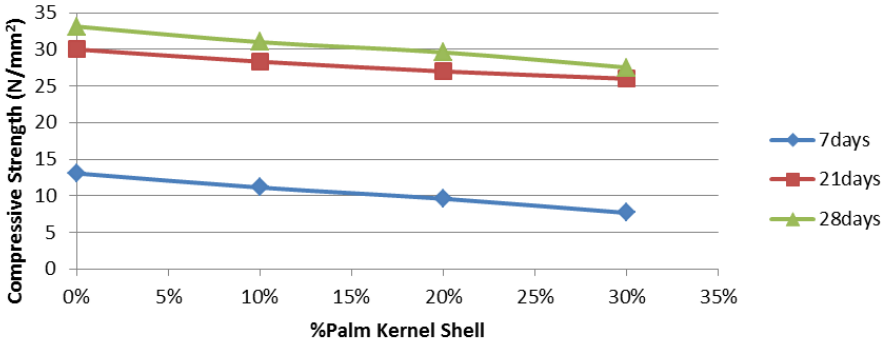

Figure 3: Compressive strength of Laterized Palm Kernel Shell concrete containing 20% laterite , 0.55 w/c ratio and mix ratio 1: 1½:3

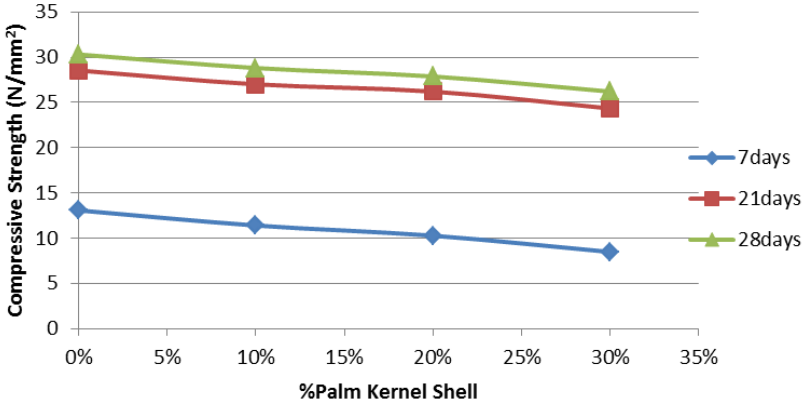

Figure 4: Compressive strength of Laterized Palm Kernel Shell concrete containing 30% laterite , 0.55 w/c ratio and mix ratio 1: 1½:3

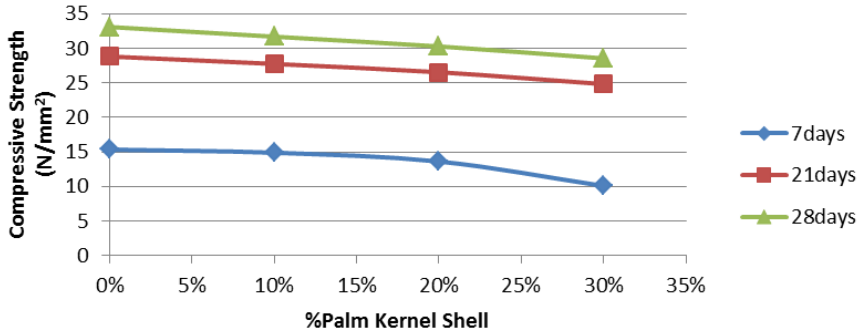

Figure 5: Compressive strength of Laterized Palm Kernel Shell concrete containing 0% laterite, 0.6 w/c ratio and mix ratio 1: 1½:3

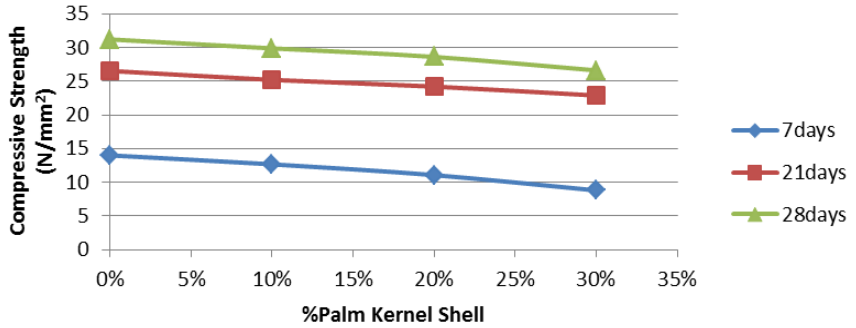

Figure 6: Compressive strength of Laterized Palm Kernel Shell concrete containing 10% laterite , 0.6w/c ratio and mix ratio 1: 1½:3

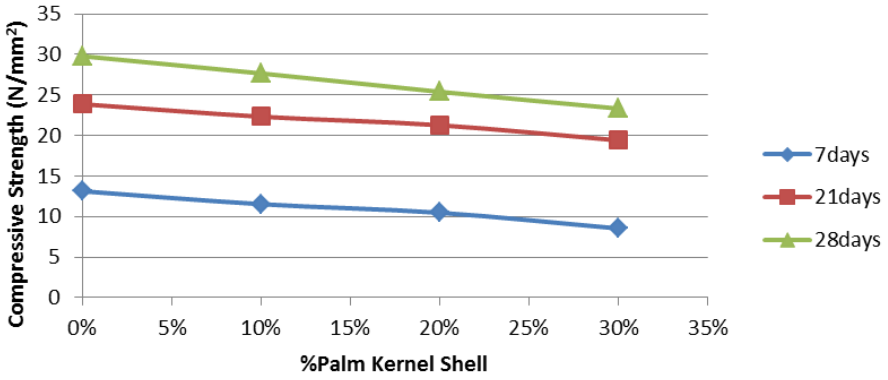

Figure 7: Compressive strength of Laterized Palm Kernel Shell concrete containing 20% laterite, 0.6 w/c ratio and mix ratio 1: 1½:3

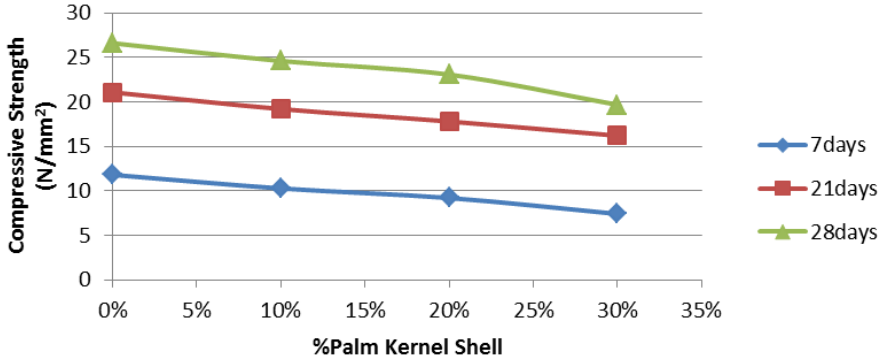

Figure 8: Compressive strength of Laterized Palm Kernel Shell concrete containing 30% laterite, 0.6 w/c ratio and mix ratio 1: 1½:3

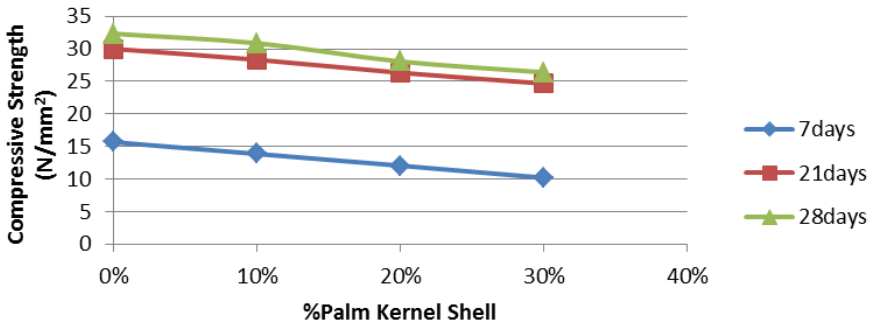

Figure 9: Compressive strength of Laterized Palm Kernel Shell concrete containing 0% laterite, 0.55 w/c ratio and mix ratio 1:2:4

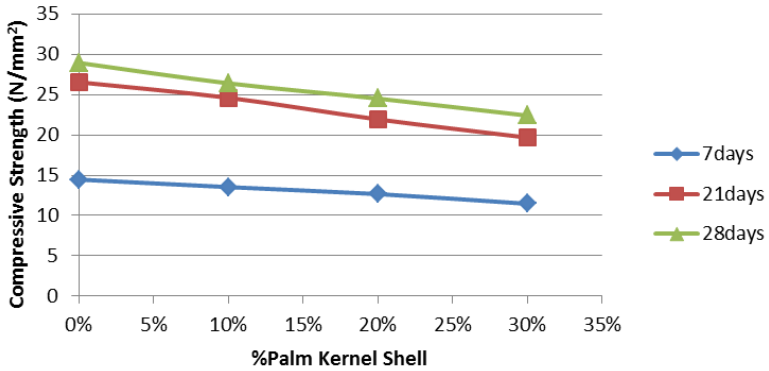

Figure 10: Compressive strength of Laterized Palm Kernel Shell concrete containing 10% laterite, 0.55 w/c ratio and mix ratio 1:2:4

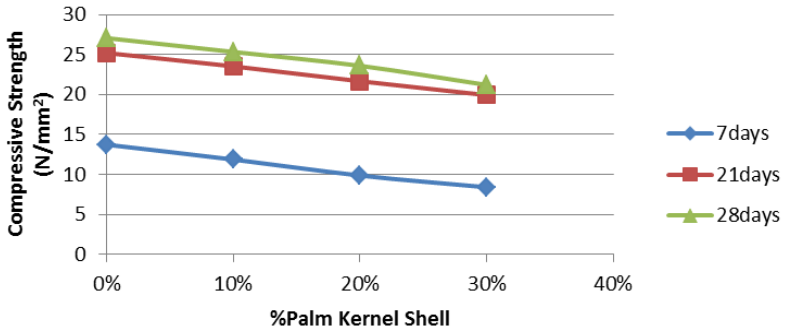

Figure 11: Compressive strength of Laterized Palm Kernel Shell concrete containing 20% laterite, 0.55 w/c ratio and mix ratio 1:2:4

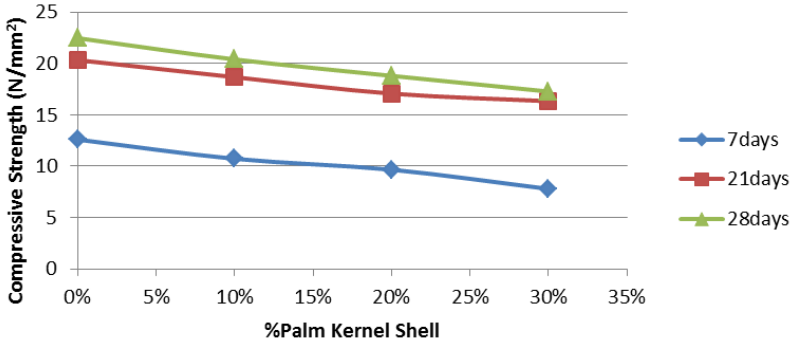

Figure 12: Compressive strength of Laterized Palm Kernel Shell concrete containing 30% laterite, 0.55 w/c ratio and mix ratio 1:2:4

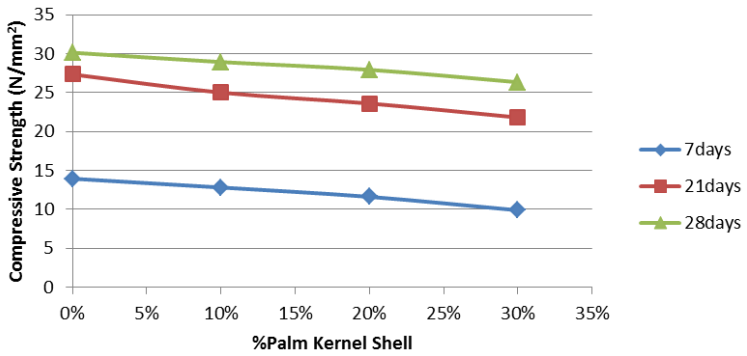

Figure 13: Compressive strength of Laterized Palm Kernel Shell concrete containing 0% laterite, 0.6 w/c ratio and mix ratio 1:2:4

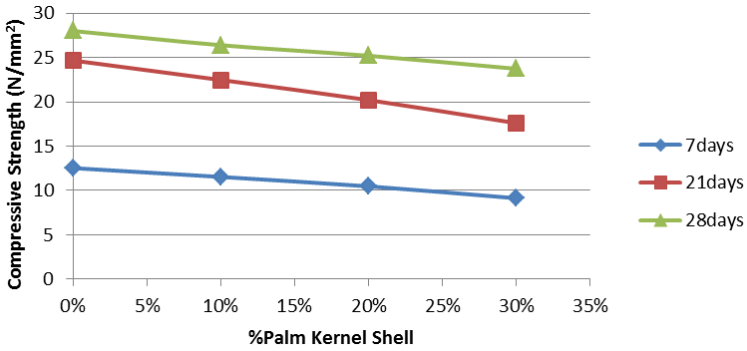

Figure 14: Compressive strength of Laterized Palm Kernel Shell concrete containing 10% laterite, 0.6 w/c ratio and mix ratio 1:2:4

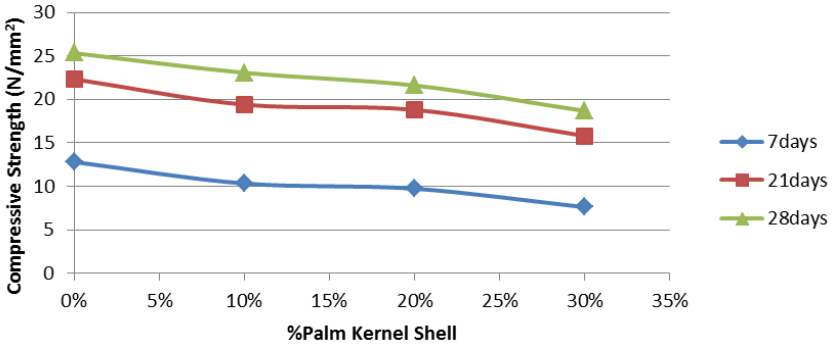

Figure 15: Compressive strength of Laterized Palm Kernel Shell concrete containing 20% laterite, 0.6 w/c ratio and mix ratio 1:2:4

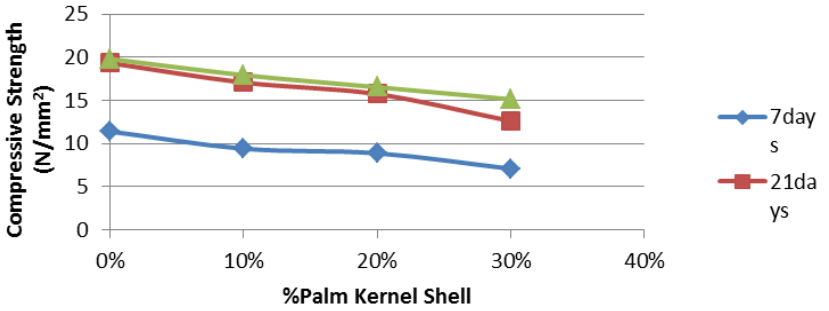

Figure 16: Compressive strength of Laterized Palm Kernel Shell concrete containing 30% laterite, 0.6 w/c ratio and mix ratio 1:2:4

CONCLUSION AND RECOMMENDATION

The following can be ascertained from the results of the study:

i. The compressive strength of mix rato 1: 1½s:3 is higher than for mix ratio 1:2:4

ii. The higher the cement ratio the lower the strength of the concrete. As the percentage of PKS content and percentage content of laterite increase the compressive strength decrease
iii. At 0%Laterite content for both the mix ratios and w/c ratio the strength of the concrete meet the required standard
iv. Up to 30% laterite content and 30%PKS for mix ratio 1: 1½:3 and 0.55w/c ratio c the concrete satisfy the minimum requirement of concrete
v. Up to 20% laterite content and 20% PKS for mix ratio 1: 1½:3 and 0.6w/c ratio satisfy the required strength of concrete
vi. Up to 10%laterite content and 20%PKS is satisfactory for mix ratio 1:2:4 and w/c ratios 0.55 and 0.6

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Housing Habitability in Informal Settlements of Akure, Nigeria

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ABSTRACT

The informal private sector is at the fore-front in provision of housing in Nigeria. The combination of high rate of population increase, acute shortage of housing, uncoordinated attempts by governments and private sector to provide housing has resulted in the spread of informal settlements in the fringes of many urban centres in Nigeria. Also, informal settlements are characterized by regular exposure to spatial, social, economic and environmental exclusion. The purpose of this study is to examine the impacts of the characteristics of informal housing on housing habitability in selected suburbs of Akure. The objectives of this study are to evaluate the impacts of informal housing characteristics on housing habitability, assess level of habitability of houses in the selected informal settlement and suggest means of relevant upgrading needed to improve habitability in the informal housing. The study adopts a cross-sectional study since it is based primarily on interviews, documents, physical observations and administration of Housing Habitability Standard Checks (HHSC) questionnaires within a limited time frame. Twenty (20) questionnaires each were administered on residents in each of the Six (6) selected communities amounting to One hundred and twenty (120) HHSCQs. This paper shed more light on the initiatives deployed by dwellers to adapt informal housing to their changing needs and circumstances. The paper argues that there is great need for improving the livelihood and habitability of informal housing by integrating informal housing into the broader urban fabric to overcome spatial, social and economic exclusion. Therefore, this paper suggests that enabling policies and planning are to be implemented, physical infrastructural, health, socio-economic and environmental improvement in view to improving livelihood and habitability of informal housing.

Keywords: Housing, Housing Habitability, Neighbourhood quality, Housing infrastructure, Informal Settlement, Neighbourhood wellbeing

INTRODUCTION

Housing is a basic human need in all societies and fundamental right of every individual regardless of age, sex, economic status, race or religion (Adebayo and Iweka, 2013). Housing can be regarded as habitable when physical safety is guaranteed as well as adequate space, protection from cold, damp, heat, rain, wind and other threat to health and structural hazards (UN-Habitat, 2015). Unlike developing countries, habitable housing is more accessible to all categories of people including the poor and the needy in advanced countries as a result of subsidies from the government. Although, various studies here shown that the problem of housing is universal, it is however more critical in less developed countries (Ogundahunsi and Adejuwon, 2014).

Informal settlement describes a wide range of low-income settlements in poor human living condition. Nebutola (2004) described informal housing as one that is characterized with inadequate access to safe water, inadequate access to sanitation and other infrastructure; poor structural quality, overcrowding and insecure tenure status. Housing is described as informal when it does not conform to the laws and regulatory frameworks set up in the environment in which it occurs (UN-Habitat, 2015). This condition not only exemplifies the variety of manifestations of poverty, inadequate infrastructure and poor housing quality but demonstrate type and level of housing the inhabitants can afford. Housing conditions play major role in individual health status, as a wide variety of housing features have been reported to influence the physical, social, economic and the mental well-being of occupants (Ihuah, 2015). This precarious situation is prevalent in many urban centres in Nigeria like Akure which has resulted into various categories of societal vices and crimes.

Adetunji, O. S. & Ayoola, H. A. (2016). Housing Habitability in Informal Settlements of Akure, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 285-295

However, the importance of informal settlements needs to be understood from the perspective of people living there. Mohit and Nazyddah (2009) reveals that informal settlements is an asset in the city because of the locational and competitive advantages that inhabitants derived in continued stay in informal settlements. Informal settlements thus serve a critical function as 'holding places' where people can access the urban environment at extremely low financial cost and piece together various livelihood strategies there (Misselhorn, 2008). Some might remain permanently and even ultimately gain access to formal housing, whilst others might reside temporarily for specific purposes which, once fulfilled, result in them moving elsewhere in the city or returning from whence they came. Other advantages derivable from continued stay in informal settlements are provision of access to the city at unrivalled low cost, limited public administration and low cost accommodation (Mohit and Nazyddah, 2009).

In view of this, the paper attempt to assess the level of habitability to inhabitants of selected informal settlements in Akure and discuss innovative mechanisms and strategies for improving habitability to compliment the actual financial income of low income people in selected informal settlements in Akure. Assumption of this study is that inhabitants of informal settlements will be able to realise full benefits thereby enjoying better housing and sanitary environment.

Informal Settlements

Informal settlements (also known as non-formal cities, squatter settlements, or shantytowns) appear in city centres and on their peripheries. They result both from traditional squatting and pirate urbanism. These communities differ dramatically in size, character, age, and level of political and social organization. Living in informal settlements often poses significant risks on health, education and well-being. Access to health and other services may be limited; overcrowding can contribute to stress, violence and increased problems of drugs and other social problems. As a result of the high cost of housing, lack of good financing schemes, the increasing population is forced to live in substandard housing and unhealthy conditions giving rise to informal settlements (Olotuah and Adesiji, 2005). Informal settlements in Nigeria are increasing and posing serious problems to their own personal life and health. Slums and squatters are experiencing a massive change in the housing quality as they retain in the settlements that are characterized by numerous problems such as overpopulation, inadequate basic amenities, non-conventional housing and so on (Fadare and Olawuni, 2008).

According to UN-Habitat (2005) listed the followings as the main features of substandard housing and environment: Overcrowding; "being defined as having more than two people per bedroom", flooding and inadequate drainage of storm water, poor access, for vehicle/inadequate roads, presence of litter and illegal piles of solid waste, inadequate disposal of residential waste water, inadequate open spaces for other land uses, lack of space for open air living between housings, unreliable electricity supply, sanitary problems, inadequate solid waste collection system, poor quality of drinking water, inadequate disposal of human excreta, acute environment, pollution and nuisance from solid waste, air and noise.

Statement of the Problem

The challenge of informal settlement is obviously a complex one and there are thus a wide range of issues and contributing factors, many of which overlap. However, misconceptions about informal settlements abound due to many policy makers having limited or no direct experience and understanding of the functionality of informal settlements. Misselhorn (2008) reveals that one factor leading to formation of informal settlements serves as critical holding place where people have initial access point to incoming immigrants and those moving from other parts of the city to experience urban environment. However, this study assesses

standards of housing habitation in selected informal housing in view to determine their level of habitability.

The Concept of Housing Habitability

Housing habitability is the outcome of the interaction between a territory and the uses made of it by its inhabitants, based on housing choices, conditioned by community characters, biophysical conditions of the context, rules and organisational system (Aigbavboa, 2013). Considering "man" who is the occupant of the house for instance, some of his socio-economic characteristics such as marital status, family size, income level and others need to be examined. In addition, the culture of the group to which the occupants belong should be given adequate attention.

In order to evaluate housing habitability, there are several research approaches that can be adopted, all based on "users reaction". Various models such as Onibokun 'Habitability' Model, Integrated Conceptual Model and Housing Adjustment Model were used to explain housing habitability focuses on the resident, socio-physical environment and satisfaction. These housing is more than shelter and looks at the interaction of four main subsystem; tenant (man), shelter/dwelling, environment and institutional management which interact actively to produce the level of satisfaction and the level of satisfaction in turn determines the level of housing needs in a given place (Ihuah 2015).

However , Ogundahunsi and Adejuwon (2014) reveals that what constitute habitability varies according to the ambient circumstance and as such the habitability of a housing at a particular point in time can only be defined meaningfully in the relative terms or sense rather than to the absolute sense.

Elements of Housing Habitability

The need to appreciate the relevance of a habitable housing therefore, requires an understanding of the concept of housing habitability. Informal housing is believed to be an element of urban decay described by lack of housing and services (Misselhorn, 2008). But, Adeleye, Azeez and Yusuff, (2014) stated that getting a definition of quality depends not only on the dwellers and their desires, but also on the product being considered. In essence, habitability is a product of subjective judgment which arises from the overall assessment of the housing as a produt itself. In assessing the habitability of housing, various studies have identified some criteria as relevant elements for habitability evaluation in residential development. Among such is The National Affordable Homes Agency (2008) who acknowledged structure and materials, access, space and security, interior air quality, water supply, sanitary facilities, thermal environment, illumination and electricity, food preparation and refuse disposal, sanitary condition and fire safety as elements of housing habitability.

Fig. 1 Elements of Housing habitability

METHODOLOGY

The study focuses on Akure, the capital city of Ondo State since 1976. The city lies within Latitude 7º15'N and 7º28'N North of the Equator and Longitudes 5º6'E and 5º21'E East of the Greenwich Meridian. The city is witnessing rapid rate of urbanization characterised by high influx of people into the city from towns and villages in the state. This resulted into attendant land use problem, inadequate housing and excessive stress on the available infrastructure in the city. The city also, witnessed immense and uncoordinated growth in size built-up areas, inadequate assess to basic services, substandard housing and unhealthy living condition.

Six (6) informal settlements were randomly selected as sampling size namely: Ipinsa, Owena, Irese, Iju, Itaogbolu and Igoba. The study adopts a cross-sectional study since it is based primarily on interviews, documents, physical observations and administration of Housing Habitability Standard Checks questionnaires (HHSCQ) conducted within a limited time frame. Twenty (20) questionnaires each were administered on residents in each of the Six (6) selected communities amounting to One hundred and twenty (120) HHSCQs. The questionnaires covers Structure and material, Access, Space and security, Interior air quality, Water supply, Sanitary facilities, Thermal environment, Illumination and electricity, Food preparation and refuse disposal, Sanitary condition and Fire safety as the ten (10) standards embedded in Habitability Standard Checklist (HSC)

FINDINGS AND DISCUSSION

Structure and Material

The condition of structure and materials of housing within the study area (see Table 1) is not conducive for safe habitation due to poor quality materials used in the construction of the houses and dilapidated state of the building components. Buildings constructed with traditional mud bricks has an average life span of 50 years (Adeleye, Azeez and Yusuff, 2014) but within the study, 63.5% of houses surveyed are aged above 50 years, 15.6% only have 10 years more to the average years of 50 while 20.9% of the surveyed housing were built within the last 10 years. Owoeye (2013) affirmed that housing habitability depreciates along with the age of the buildings. Therefore, very few of the houses surveyed can be regarded relatively habitable for man. Also, 20.2% rated the external condition of the walls suitable for habitation while 43.4% rated the interior wall condition also unsuitable for habitation. 82.4% of the sampled housing made use of Galvanized Zinc roofing material while 17.6% used Corrugated Fibre board materials. Table 1 shows the level of materials and technology used within the study area.

Access

Table 2 reveals that 90% of the surveyed houses have a type of vehicular access and 10% has no access for vehicles. This shows that the dwellers of houses without vehicular access are having difficulties in moving heavy loads in and out of their residences. Also, the dusty vehicular access available to 36.7% predominantly from Iju and Itaogbolu shows that air quality available for residents within the communities is poor. Majority of the houses surveyed do not have well defined pedestrian access and parking space, therefore many of the houses with either tarred or surface-dressed vehicular access are not equipped with parking space. 55.8% of the dwellers considered their building setbacks inadequate. This situation is consequential of poor habitability condition of the houses.

Table 1 Structure and materials for housing

Variable	Frequency	Percentage
Material used for construction		
a. Walls		
- Clay blocks	45	37.5
- Sand-crete blocks	75	62.5
Total	**120**	**100.0**
b. Roof		
- Corrugated galvanized Zinc	77	64.2
- Corrugated cement fibre	24	20.0
- Longspan Aluminium	19	15.8
Total	**120**	**100.0**
c. Ceiling		
- PVC	35	29.2
- POP	14	11.7
- Cemented Fibre board	48	40.0
- Timber slats	14	11.7
- Not available	9	7.5
Total	**120**	**100.0**
d. Door		
- Steel plate	46	38.3
- Timber	112	93.3
Total	**120**	**120**
e. Window		
- Louvre glass	40	33.3
- Timber	29	24.2
- Aluminium frame with glass panel	51	42.5
Total	**120**	**100.0**
f. Floor		
- Timber	38	31.7
- Concrete	82	68.3
Total	**120**	**100.0**
g. Floor Finishes		
- Cement screed	65	54.2
- Ceramic tiles	21	17.5
- Terrazzo	29	24.2
- Not available	5	4.2
Total	**120**	**100.0**
h. Wall finishes		
- Sand-crete plaster with paint	43	35.8
- Sand-crete plaster only	37	30.8
- Ceramic tiles	28	23.3
- Not available	12	10.0
Total	**120**	**100.0**
Structural condition		
a. Physically sound	12	10.0
b. Needs minor repair	68	56.7
c. Needs major repair	21	17.5
d. Old and dilapidated	19	15.8
Total	**120**	**100.0**
Age of buildings		
a. 50 years and above	22	18.3
b. 40 – 49 years	36	30.0
c. 30 – 39 years	13	10.8
d. 20 – 29 years	33	27.5
e. Below 20 years	16	13.3
Total	**120**	**100.0**

Space and Security

Table 3 suggests that 55.8% of the rooms within the study area is congested. The room space that was designed for between 2 – 3 users is occupied by 4 and more users. The situation poses greater threat to the security of life and property of the dwellers. The level of insecurity is aggravated by the absence of necessary building and site security measures. 81.8%, 72.5% and 30.8% respectively are not equipped with vehicular and pedestrian gate, perimeter fence

and burglary-proof frames while 17.5% neither has a security feature. These situations resulted into 72.5% indicating that they have experienced robbery within the last one year.

Table 2 Access to buildings

Variable	Frequency	Percentage
Vehicular access		
a. Tarred	43	35.8
b. Surface-dressed	21	17.5
c. Dusty	44	36.7
d. Not available	12	10.0
Total	**120**	**100.0**
Pedestrian access		
a. Well defined	37	30.8
b. Foot path	83	69.2
Total	**120**	**100.0**
Parking space		
a. Available	22	18.3
b. Not available	98	81.7
Total	**120**	**100.0**
Building setbacks		
a. Adequate	53	44.2
b. Not adequate	67	55.8
Total	**120**	**100.0**
Wheelchair accessibility		
a. Entrance ramp	15	12.5
b. Steps within the building	68	56.7
c. Not available	37	30.8
Total	**120**	**100.0**
Emergency vehicle		
a. Available	13	10.8
b. Not available	107	89.2
Total	**120**	**100.0**

Table 3 Space and security in housing

Variable	Frequency	Percentage
Room occupancy		
a. 1	17	14.2
b. 2	19	15.8
c. 3	17	14.2
d. 4	25	20.8
e. More than 4	42	35.0
Total	**120**	**100.0**
Building security		
a. Vehicular and pedestrian gate	23	19.2
b. Perimeter fence	33	27.5
c. Burglary-proof frames	83	69.2
d. None available	21	17.5
Robbery experience		
a. Available	87	72.5
b. Not available	33	27.5

Interior Air Quality

As shown in Table 4, over 72% respondents are dissatisfied with the quality of air available within their house. 84.2% reveals that their houses are not offering adequate protection against noise emanating from external sources such as automobiles and neighbours. As a result of this, external factors such as hazy weather, dusty road quality and inadequate green landscape are responsible for the poor air quality experienced by the dwellers.

Table 4 Interior air quality in housing

Variable	Frequency	Percentage
Air quality		
a. Very dissatisfied	51	42.5
b. Dissatisfied	36	30.0
c. Satisfied	20	16.7
d. Very satisfied	13	10.8
Total	**120**	**100.0**
Noise protection		
a. Available	19	15.8
b. Not available	101	84.2
Total	**120**	**100.0**

Water Supply

Water supply is regarded as a proxy indicator for weather the sources of water available for the dwellers of housing within the study area is safe. Within the study area, 43.4% and 12.5% rely on open well and water vendors respectively while 29.2% made use of water from borehole and public tap (see Table 5). World Health Organisation (2006) classified open well, stream and water vendors as unimproved sources of water. This connotes that majority of the dwellers of the study area are not having access to safe water for use within the houses. Also, the quality of water available for uses is poor with 73.3% reported that the water they use is cloudy and 68.3% uses water with foul smell. In view of this, 95% had to make use of water treatments such as boiling, water guard, alum, chlorine and water filter.

Table 5 Water supply in housing

Variable	Frequency	Percentage
Sources of water		
a. Open well	41	43.4
b. Borehole	9	7.5
c. Public tap	26	21.7
d. Nearby stream	18	15.0
e. Water vendors	15	12.5
Total	**120**	**100.0**
Water colour		
a. Cloudy	88	73.3
b. Colourless	32	26.7
Total	**120**	**100.0**
Water odour		
a. No smell	38	31.7
b. Foul smell	82	68.3
Total	**120**	**100.0**
Water scarcity		
a. January – April	47	39.2
b. May – August	33	27.5
c. September – December	28	23.3
d. Available round the year	12	10.0
Total	**120**	**100.0**
Water storage		
a. Buckets	32	26.7
b. Tanks	63	52.5
c. Not available	25	20.8
Total	**120**	**100.0**
Water treatment		
a. Boiling	35	29.2
b. Add water guard	39	32.5
c. Add Alum	42	35.0
d. Add Chlorine	18	15.0
e. Use water filter	35	29.2
f. Let it stand and settle	21	17.5
g. No treatment	6	5.0

Sanitary Facilities and Condition

20.0% (24) of respondents made use of flush/pour toilets in their homes, and another 29.2% (35) and 15.0% (18) made use of slab and non-slab pit latrines respectively. 18.3% (22) of respondents also, used bucket/hanging toilets while 17.5% (21) used bush or toilet facilities in near-by house. 61.7% (74) of respondents share toilet facilities with other people and 38.3% (46) made use of their toilets alone. Also, 25.8% (31) of respondents within the study area revealed that children stools are disposed in toilets/latrines, 14.2% (17) disposed children stools into drains. A sanitation facility is considered adequate if it hygienically separates human excreta from human contact. In view of this, the types of technology that are likely to meet this criterion are flush to pipe sewer system and pit latrine with slab (The National Affordable Homes Agency, 2008). Therefore, about half (59) of respondents make use of safe and hygienic toilets and children stools are disposed poorly. This connotes there is great likelihood of faecal contamination within the study area.

Table 6 Sanitary facilities and condition in housing

Variable	Frequency	Percentage
Type of toilet facility		
a. Flush to septic system	24	20.0
b. Pit latrine with slab	35	29.2
c. Pit latrine without slab	18	15.0
d. Bucket/Hanging toilet	22	18.3
e. Bush (Shot-put)	18	15.0
f. Nearby house	3	2.5
Total	**120**	**100.0**
Use of toilet facility		
a. Shared	74	61.7
b. Not shared	46	38.3
Total	**120**	**100.0**
Disposal of Children stools		
a. Child use toilet/latrine	31	25.8
b. Put/rinsed into toilet	22	18.3
c. Put/rinsed into drain/ditch	17	14.2
d. Thrown into garbage	26	21.7
e. Buried	17	14.2
f. Left in the open	7	5.8
Total	**120**	**100.0**

Food Preparation and Refuse Disposal

With respect to food preparation and refuse disposal, location of kitchen and availability of store were assessed across the study area. Table 8 revealed that 70.8% (85) of respondents has their kitchen located indoor while 29.2% (35) have kitchen located outside the building. Also, kitchen store is available for 39.2% (47) and not available for 60.8% (73). Concerning waste disposal, 19.2% (23) disposed their waste beside the road, 26.7% (32) gave waste to waste collectors while 22.5% (27) burn their waste. The result in Table 8 depicts that most of the indoor kitchens are not equipped with store. This will result into preparing food under in an environment not hygienic.

Thermal Environment, Illumination and Electricity

Table 7 revealed that 37.5% (45) of respondents feel cold, 8.3% (16) feel hot, 30.0% (36) and 24.1% (29) feel cool and warm. 55.8% (67) rely public power supply only, 37.5% (45) are using generator or solar power to augment for the shortage supply of public power while 6.7% (8) have no access to power supply. Public power is available for 34.2% (41) of respondents within 1 – 6 hours daily while 36.7% (44) have public supply of power for 19 to 24 hours. Also, 59.1% (71) of respondents revealed that the quality of the light is bad while

40.9% (49) have good quality light. In view of this, respondents were generally satisfied with the thermal environment due the 54.1% of respondents feel cool and warm. This connotes that the houses offers satisfying thermal environment to the dwellers. Table 7 revealed that minimum 18-hour power supply is regarded adequate for improved habitability Also, larger population of dwellers within the study area are experiencing inadequate power supply.

Table 8 Food Preparation and Refuse Disposal in housing

Variable	Frequency	Percentage
Kitchen location		
a. Indoor	85	70.8
b. Outdoor	35	29.2
Total	**120**	**100.0**
Kitchen store		
a. Available	47	39.2
b. Not available	73	60.8
Total	**120**	**100.0**
Waste disposal		
a. Dropped beside to road	23	19.2
b. Given to waste collectors	32	26.7
c. Thrown outside	38	31.7
d. Burning	27	22.5
Total	**120**	**100.0**

Table 7 Thermal Environment, Illumination and Electricity in housing

Variable	Frequency	Percentage
Thermal comfort		
a. Cold	45	37.5
b. Cool	24	20.0
c. Slightly cool	12	10.0
d. Warm	13	10.8
e. Slightly warm	16	13.3
f. Hot	10	8.3
Total	**120**	**100.0**
Source of power		
a. Public	67	55.8
b. Generator	43	35.8
c. Solar	2	1.7
d. No power	8	6.7
Total	**120**	**100.0**
Availability of public power		
a. 1 – 6 hours daily	41	34.2
b. 7 – 12 hours daily	44	36.7
c. 13 – 18 hours daily	21	17.5
d. 19 – 24 hours daily	14	11.7
Total	**120**	**100.0**
Quality of light		
a. Very bad	31	25.8
b. Bad	21	17.5
c. Neutral	19	15.8
d. Good	23	19.2
e. Very good	26	21.7
Total	**120**	**100.0**
Space illumination		
a. All	74	61.7
b. Few	37	30.8
c. None	9	7.5
Total	**120**	**100.0**

Fire Safety

The result of the study (see Table 9) showed that 62.5% (75) has no fire equipment install within their house while 37.5% (45) have fire extinguisher, hose reel or fire alarm install within the house. Also, 60.8% (73) of respondents have emergency exit while 69.2% (83) stored inflammable materials such as petrol within their house and 39.2% (47) have their houses located close to filling station. The implications of these are that one-third of the houses within the study area are not safe for habitation in emergency period and many of the houses are poorly located due to closeness to filling station. Also, many of the dwellers are engaged in the act of storing flammable materials within the house.

Table 9 Fire safety in housing

Variable	Frequency	Percentage
Fire safety equipment		
a. Fire extinguisher	21	17.5
b. Hose reel	18	15.0
c. Fire alarm	6	5.0
d. Not available	75	62.5
Total	**120**	**100.0**
Storage of inflammable materials		
a. Within the house	83	69.2
b. Outside the house	37	30.8
Total	**120**	**100.0**
Emergency exit		
a. Available	73	60.8
b. Not available	47	39.2
Total	**120**	**100.0**
Building location		
a. Near to filling station	47	39.2
b. Far to filling station	73	60.8
Total	**120**	**100.0**

CONCLUSION

Amidst other findings of the study is that there is relationship between level of housing habitability derivable and the satisfactions of the dwellers. The level of housing habitability in the selected informal settlements is not yet beyond remedy. A timely action will definitely forestalls further deterioration of habitability in these areas. A lot of intervention programmes should be put in place to improve the elements of habitability in these areas. Firstly, the governments at all levels should make well informed and targeted policies that are geared towards improving living condition within the areas. Such policies will involve building codes and Settlement development controls to help in planning pattern of developments of the informal settlements.

Also, upgrading of the informal settlements should be considered to improve living condition in the existing informal settlements. The upgrade should be done in the preferred approach informed by the dwellers and should minimize or eliminate relocation. Given that informal settlements afford people spatial access in respect of a range of key issues and given that most are better located relative to prospective relocations destinations, all efforts should be made to maximise densities in the upgrading process by whatever means possible (e.g. reduced level of internal services, more dense housing typologies). In most instances residents will prefer to remain in-situ, even with some compromises such as higher densities, than to be relocated to bigger houses with larger sites which have a distinct locational disadvantage.

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Importance of Incorporating Thermal Simulation in Designing Buildings to Mitigate and Adapt to Climate Change in Nigeria

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ABSTRACT

Climate change, a major challenge globally can have social, economic and environmental impact on the global and/or local climate. In buildings, the increase in external temperature will affect the performance of the building fabric and also energy demand for cooling in a tropical climate like Nigeria. The materials used in the construction of the building fabric will therefore have an impact on the internal environment thus influencing the need for cooling and energy demand. Using secondary data, it is highlighted that incorporating thermal simulation in the design stage of buildings can help mitigate the impact and also adapt buildings in Nigeria to predicted future climate change. It establishes that thermal simulation of a building at design stage through modelling predicts how the building will perform in future, thus allowing the designer to incorporate strategies that will aid the mitigation of and adaptation to climate change. As a result, it is recommended that designers in Nigeria should incorporate thermal simulation in designing to future-proof buildings.

Keywords: Adaptation, Building fabric, Climate change, Energy demand, Mitigation, Nigeria, Thermal simulation

INTRODUCTION

Climate change is causing a change in weather patterns, thus a change on the impact of a local climate of buildings in terms of how the building fabric which is a barrier between the indoor and outdoor environment will perform to help provide a comfortable indoor environment for its inhabitants (Biliyok, 2010). As a result, it is important that in designing buildings, the future impact of climate change and how the building will perform is explored in order to predict the thermal performance of the building fabric and also the energy demand for cooling and/or heating as the case may be. This will enable the designer to test and adopt measures which will aid in future-proofing the building against identified impacts of climate change.

A number of works have been carried out globally using thermal simulation by researchers to test the impact of climate change on buildings taking into consideration mainly the building fabric and energy demand of occupants. Unfortunately, little or nothing has been done on predicting the impact of climate change on the building fabric and energy demand of buildings in Nigeria using thermal simulation.

This study therefore aims to highlight the importance of thermal simulation in adapting buildings to climate change and also in mitigating the contribution of buildings in Nigeria to climate change using existing works which show the importance of thermal simulation in future-proofing buildings globally.

LITERATURE REVIEW

Climate Change in Nigeria

Climate change is a gradual process that is anticipated to become increasingly noticeable over the next 50 - 100 years. In recent years, climate change has become a very important

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issue globally as predicted future climate is anticipated to have an adverse effect on man and his environment (Biliyok, 2010). 'Climate change and weather are intertwined and it is the statistics of changes in weather over time that identifies climate change' (Solomon et al, 2007). The term climate change usually refers to changes that have occurred since the early 1900s as a result of natural and human factors (UK Climate Impact Program, 2008). Greenhouse gases, released into the atmosphere as a result of human activities, allow the Sun's rays to reach the Earth's surface but impede the heat they create from escaping back into space and absorb energy that is radiated from the Earth's surface. The Sun's rays which reaches Earth and the absorption of energy as a result of greenhouse gases causes the warming of the atmosphere, thereby increases temperatures globally – 'global warming' (UK Climate Impact Program, 2008). It has been argued that extreme events that currently have return frequencies of 1 in 100years could have return frequencies of 1 in 5 or 1 in 10 years by prevailing climate change conditions (Ezeabasili and Okonkwo, 2013). As the climate changes, the probabilities of certain types of weather events are affected.

In Nigeria, climate change will bring about extreme climate conditions such as high wind, heavy rainfall, heat and cold which can result in wide-ranging scenarios such as tropical storms, floods, landslides, droughts and sea-level rise (BNRCC, 2015). Extremes of heat tend to occur more often, although their frequency and intensity change as climate changes. Other anticipated consequences of climate change for Nigerian cities include fewer periods of extreme cold; increased frequency of air and water pollution, rising and changes in the timing, frequency and severity of urban flooding associated with it (Ezeabasili & Okonkwo, 2013).

Thermal simulation

'Modeling can help designers to ensure good internal conditions can be achieved under all foreseeable operating conditions' (CIBSE, 1998); through the prediction and analysis of the thermal performance of a building which affects the thermal comfort of building occupants. To better understand the thermal performance of a building, thermal simulation can be used (Biliyok, 2010). A number of thermal simulation computer based tools exist that may be used to predict the performance of buildings and to calculate energy use. These tools are created based on a mathematical model, 'constructed to represent each possible energy flow path and their interactions' (Clarke, 2001). Thermal simulation of a building through modeling provides an important tool for analysing not only the performance of the building envelope but also passive and active systems for heating and cooling used to attain occupant comfort (CIBSE, 1998). The external weather and climate where the building is located is important and should be considered in thermal modeling because it is responsible for the solar heat gain, incoming ventilation air temperature, and conductive and convective heat exchanges through the building envelope (Belcher et al, 2005).

The thermal performance of a building can be analysed as a steady state or as a dynamic state. The steady state assumes that the temperature outside is constant, the temperature inside is constant and hence the heat loss is constant. It, however, does not show how much energy the building is likely to consume during a year or how comfortable the occupants are likely to be as it does not incorporate the fluctuating outside temperature and activities within the building which affect heat loss/gain in its calculation. The dynamic state on the other hand takes into account the fluctuating outside temperature, the building thermal mass, and fluctuating heat loss/gain from the building including activities within the building. It also considers how much energy the building is likely to

consume during a year and how comfortable the occupants are likely to be. But to quantify these interactions the dynamic state requires weather data to carry out thermal simulation (Clarke, 2001). Weather data is an essential variable required in thermal building simulation that is unique and depending on the location of the building (Biliyok, 2010). Thus, in future-proofing buildings to the impact of climate change, it is recommended that dynamic state thermal simulation is used.

The use of thermal simulation in the design of buildings

It is evident that a changing climate and its implications will need to be reflected in future building design and refurbishment in form, material choice, thermal mass and building services; thus, at the planning stage building performance assessment can deliver valuable information on the viability of a design approach (Jentsch et al, 2008). Thermal simulation can be used to test designs where measures are put in place for thermal comfort to see if the measures are adequate for the predicted future climate change. This can be done by using weather data for the predicted climate change to run simulation.

There are a range of simulation programs available which use the dynamic state technique. (Crawley et al, 2005) described the capabilities of different simulation programs in their study which analyses what the different programs can do. This analysis can help building designers interested in answering specific questions select the appropriate simulation program. Dynamic state thermal simulation is identified as the appropriate simulation method that can be used to check thermal performance and energy demand of a building in present and future climates; based on the weather file used to run simulation.

In carrying out thermal simulation using the dynamic state technique, weather data including the fluctuating external temperature of the area where the particular building in question is located, the materials used in constructing the building fabric and activities within the building that affect heat loss/gain which in turn affect the energy consumption of the building over a period of a year are required. Results from such thermal simulation will therefore highlight how a particular building will perform in terms of the energy demand and the building fabric thermal performance for specific weather files. Thus where the weather files for present and future climatic condition is used, the behaviour of such a building at the time the building is designed and constructed and in future when the climate changes can be obtained. This can help the designer in choosing materials for the building fabric which are appropriate for present and future climate.

The thermal performance of a building depends on a large number of factors. Including:

i. Design variables (geometrical dimensions of building elements such as walls, roof and windows, orientation, shading devices)
ii. Material properties (such as density, specific heat, thermal conductivity, transmissivity)
iii. Weather data (such as solar radiation, ambient temperature, wind speed, humidity)
iv. A building's usage data (such as internal gains due to occupants, lighting and equipment, air exchanges).

Various factors which affect the heat balance of a building are presented in Fig. 2.1. The influence of these factors on the performance of a building can be studied using different techniques for estimating the thermal performance of buildings. Dynamic state thermal simulation technique takes into consideration these factors as against steady state. Dynamic thermal simulation can estimate the thermal performance and energy demand of different designs of a building for a given environmental condition (Clark, 2001).

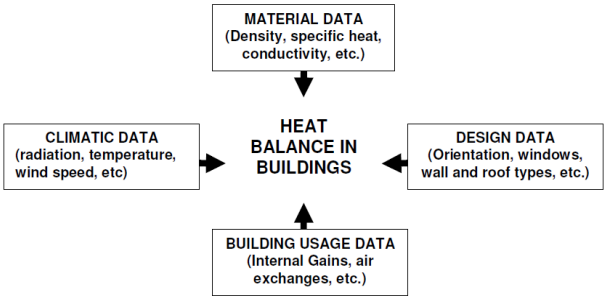

Figure 2.1 Thermal Simulation flow paths of a building (Source: mnre.gov.in/solar-energy/ch4.pdf)

Correct site orientation of buildings for thermal efficiency must pay attention to: solar radiation and resultant heat load; direction and force of the wind; the topography of the site. In a tropical climate like Nigeria, protection from the sun is always necessary as the intensity, duration and the angle of incidence of solar radiation to a particular surface are the main determinant necessary for comfort. Thus where suitable sun shading devices are provided; they minimise the heat load and consequently reduce air conditioning, provide cooler indoor environment, ensure greater thermal comfort of the occupants and increase productive efforts (Oni and Akingbohungbe, 2013). These design measures can be tested to identify one which is suitable for present and future climatic condition using thermal simulation.

FINDINGS AND DISCUSSIONS

The Impact of Climate Change on a Building Fabric

The external fabric of a building is the first line of defence against climate parameters which include; temperature, wind, humidity, solar radiation, precipitation and atmospheric conditions (Gaterell et al, 2005). As the change in climate has a direct effect on the weather conditions of an area, buildings that are provided to create shelter for people against the external weather will have to be able to withstand the change in weather patterns to perform their primary function.

The main effects of wind on a building are those of force, heat loss and rain penetration. The direction of the wind on a building affects both the structural design and the thermal design (McMullan, 2007), showing that changes in wind speed and/or direction as a result of climate change may affect the structural and thermal performance of buildings. Solar effects on a building have to do with the sun position in the sky and the angle made with the building surfaces; the quantity of radiant energy received upon the ground or other surfaces; and obstructions and reflections caused by clouds, landscape features and other buildings. For any position of the sun, the angle that the solar radiation makes with the wall or roof of a building can be predicted by geometry. This angle of incidence has a large effect as intensity is at a maximum when the radiation strikes a surface at right angle (McMullan, 2007). These can be analysed using thermal simulation.

The most important consequence of climate change on the built environment concerns the impact of higher temperatures on the thermal performance of buildings which does not only pose a risk of illness and mortality to building occupants but may increase the need for cooling (Gaterell et al, 2005). A major impact of this consequence will be a greater risk of overheating in free-running naturally ventilated buildings, especially those which are mostly free-running; making them particularly vulnerable to the impacts of extreme high temperatures (Hacker et al, 2008).

Indoor temperatures are closely related to external temperature as heat flows easily from the hot exterior to the interior through conduction, convection and radiation between the external environment and the building fabric (Biliyok, 2010). Thus when external temperatures are high, internal temperatures become high, this encourages the adoption of measures such as mechanical cooling to attain thermal comfort for occupants.

The Impact of Climate Change on the Energy Demand of a Building

Operational energy is the most energy consumed by buildings in use and includes energy used for heating, cooling, lighting, ventilation and other activities. Operational energy use is complex and depends on the location, design and construction of a building, the specification of heating and cooling systems and their controls, the efficiency of appliances and the life style of the occupants (Yohanis et al, 2008). Energy use is a consequence of the services provided to occupants to obtain an acceptable indoor environment for human activities in a building. Space conditioning (heating and cooling), lighting and ventilation are the three main energy related building services that affect energy use in buildings (Omer, 2008). In a climate like Nigeria, energy demand of buildings may include the aforementioned except heating, with cooling where used taking the bulk.

Higher external temperatures, one of the consequences of climate change in Nigeria, will increase the demand for electricity, which is the dominant source of energy for air conditioning. An increase in air conditioning in order to keep buildings at comfortable indoor temperatures when external temperatures are high will therefore be experienced as a result of climate change. This will in turn bring about an increase in CO_2 (a greenhouse gas) emissions due to the increase in energy demand for cooling.

Mitigating Climate Change Using Thermal Simulation in Designing Buildings

The rate at which climate change will occur in future depends on how much greenhouse gas emissions grow and how sensitive the climate system is to these emissions (The Hadley Centre, 2005). The atmospheric content of the climate system therefore contributes to the characterisation of the climate and changes that occur (Solomon et al, 2007). The role of greenhouse gases on global warming was further validated in 2007 by the Intergovernmental Panel on Climate Change (IPCC), the world's most authoritative body on climate change. The IPCC concluded that most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations (UK Climate Impact Program, 2008).

Therefore mitigating the human factor will have to involve the reduction of greenhouse gases such as carbon dioxide which has been identified as a major contributor to global warming as shown in Figure 2.3.

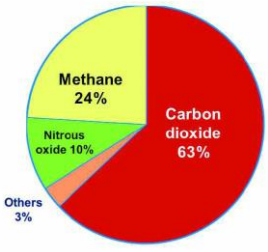

Figure 2.2 Percentage of Greenhouse gases that contribute to global warming (Source: Hadley Centre, 2005)

Mitigation means that measures must be taken to reduce rate and magnitude of climate change caused by human activities. According to IPCC, the mitigation options includes

reduction in burning of fossil fuels and reduction of greenhouse gases and soot from the energy sector; reduction in burning of deforestation ;increase in reforestation and afforestation; modification of agricultural practices to reduce emissions of greenhouse gases and build up soil carbon (Olaniyi et el, 2013).

Since mitigation includes reduction in burning fossil fuels and greenhouse gases emission from the energy sector and energy is used in the construction and operation of buildings, it is necessary to employ measures which encourage the reduction of energy from the building sector. This is important because it is estimated that at present, buildings contribute as much as one third of total global annual greenhouse gas emissions, primarily through the use of fossil fuel during their operational phase and consumes up to 40% of all energy. This includes energy used in the production and transportation of materials to building construction sites, as well as the energy used to operate buildings. Given the massive growth in new construction in economies in transition, and the inefficiencies of existing building stock worldwide, if nothing is done, greenhouse gas emissions from buildings will more than double in the next few years (Oni and Akingbohungbe, 2013). Buildings can contribute in mitigating climate change by the reduction of the energy and demand on resources associated with construction and operation of buildings. This can be achieved where thermally efficient building materials are used in construction to reduce or eliminate the need for mechanical cooling in a climate like Nigeria where external temperatures are expected to become higher as a result of climate change.

Thermal simulation can be used to check how efficient measures taken to address a good design for thermal comfort in the Nigerian climate which should take into consideration; the orientation of the building with due regard to solar incidence angle, direction and force of wind and the topography of the site; cross ventilation within the habitable rooms; solar control and appropriate shading techniques; use of appropriate properties of materials like heat storage and insulation; appropriate and correct use of vegetation and air humidification or evaporative cooling (Oni and Akingbohungbe, 2013). Using thermal simulation enables the designer to choose the best option for the present and also the future climate when changes occur. This will help in mitigating climate change as it will encourage the use of thermally efficient materials and reduce or eliminate the need for energy for cooling thereby reducing the burning of fossil fuels and the emission of greenhouse gases which contribute in bringing about climate change.

Adapting Buildings to Climate Change Using Thermal Simulation in Designing

Adaptation to climate change includes responses that may be used to reduce vulnerability of buildings (Solomon et al, 2007). The study of buildings and the understanding of the effects of weather patterns in existing climates can help buildings to cope with extreme conditions caused by climate change (Ezeabasili & Okonkwo, 2013). Thermal simulation is a tool which can be used to undertake such study. Adaptive strategies in building design involve incorporating flexibility into the design to allow for predicted climate change. It is important that in designing buildings research of localized risk of climate change is undertaken to prepare buildings for predicted hazards as identified by (BNRCC, 2015).

The considerations for a good design for thermal comfort in Nigeria as incorporated into a design need to be analysed under predicted future climate to assess if measures taken can provide sufficient protection against climate change impacts anticipated for the lifetime of the building to reduce the vulnerability of the building to such changes. The internal temperature in buildings will be higher leading to overheating as heat is transferred from the external to the internal environment; thus reducing heat gain from solar radiation is

therefore considered a priority in adapting buildings in Nigeria to climate change. Again, these can be analysed using thermal simulation to select the best possible option which can reduce or eliminate the vulnerability of the building and its occupant to the impact of high temperatures which can be detrimental to the health of the building occupants.

CONCLUSION

The treat of climate change on the environment is imminent. As a result, every possible avenue to reduce or curb this treat is important. The construction and operation of buildings have been identified as contributors to climate change; buildings are also at risk as a result of climate change. It is therefore paramount that measures are taken to help reduce and/or eliminate the contribution of buildings to climate change (mitigation) and also reduce and/or eliminate the impact of climate change on buildings (adaptation).

This work has identified how buildings contribute to climate change and also some of the impacts of climate change on buildings. It has highlighted that using thermal simulation in the early stage of the design of buildings; the designer can test how the building may perform in future as the climate changes using predicted future climate weather data. Results gotten by running simulations can inform a designer's choice of a design that consumes minimum energy at present and future climate. This also aids the designer's use of adequate design variables and building materials that will make it possible for the building fabric to adapt with the change in climate. The designer is also able to predict and reduce the future energy demand of the building; enabling the incorporation of measures which will reduce such energy loads, thus mitigating the contribution of the building to climate change. Thermal calculations also help to select appropriate retrofits for existing buildings from the viewpoint of energy conservation. Thus, by integrating the simulation of thermal performance of a building with its architectural design, one can achieve an energy efficient building that can adapt to climate change.

Further work need to be undertaken to identify and test the thermal simulation tools that can be used by designers in Nigeria.

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Integrating Life Cycle Assessment into Architectural Practice in Nigeria

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ABSTRACT

Over the years, professionals in the built environment have increased their concern about environmental protection in order to achieve a more sustainable built environment. In line with this, an architect is required to help achieve a sustainable environment through reasonable incorporation of sustainable principles into the design of buildings, evaluate and reduce their environmental impacts by understanding the life cycle performance of their proposed buildings. Life cycle assessment evaluates the environmental impacts of building components and materials. This study reviewed related published literatures to give an insight into life cycle assessment of buildings and its relevance to sustainable architecture with a view of incorporating it into architectural practice in Nigeria. This paper noted that adequate building performance assessment throughout the building process enhance health, safety, quality of life and sustainable environment. This paper finally highlights effective strategies which when adopted would improve the architects' decision making in achieving sustainable built environment.

Keywords: Architectural practice, built environment, life cycle assessment, sustainable architecture, sustainable building

Introduction

Architecture is concerned with the ways in which the built environment is planned, designed, used, furnished, landscaped and maintained (United Nations Educational, Scientific and Cultural Organization/International Union of Architects, 2011) . Architects are saddled with the responsibilities of preserving, improving and creating a high quality built environment (Chansomsak and Vale, 2009). According to Odebiyi, Subramania and Braimoh (2010), the building sector consumes more than one third of the world's energy and resources. This affects the built environment and is one of man's major contributions to the depletion of the natural resources and a major cause of environmental issues such as pollution, solid waste generation and global warming (Ashraf, 2011). The architects' responsibility, is not only the health and safety of end users of their products, but also extends to the effect of their creations on the environment; hence this informed the adoption of sustainable architecture that describes energy and environmentally conscious approach to the design of the built environment. A sustainable building is an outcome of a design that focuses on increasing the efficiency of resource use, energy, water, and materials-while reducing building impacts on human health and the environment during the life-cycle of building (Frej, 2005; Sirija, 2013).

Architects henceforth need to improve their knowledge about strategies for sustainable design. The knowledge of life cycle assessment (LCA) of buildings allows the architect to carefully consider building materials or components with the greatest environmental impacts, hence this improves the architect decisions as he thinks broadly about picking the right material or component, optimizing and selecting the most preferred one. Tsanova and Galabov (2013) identified Life Cycle Assessment (LCA) as one of the most functional assessment tools which considers the building along with its materials and components, from their extraction, manufacture and transport, to their use, reuse, recycling and disposal. It reinforces the architects' decisions and provides answers to numerous questions that arise during the design and construction of a green building (Bayer, Gamble, Gentry and Joshi,

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2010). Life Cycle Assessment (LCA) provides design guidance or feedback on how well a given design decision is working.

Furthermore, the importance of considering the life cycle impact of a building has been recognised as a way to increase profitability and engender sustainability (Finnegan, Ashall, Brady, Brennan, Dunne, Gammon, King, Turley, 2013). This study therefore looks into incorporating life cycle assessment technique/tool into Nigerian architectural practice to enhance delivery of building projects with good quality and minimal environmental impact for more sustainable environment.

LITERATURE REVIEW

Sustainability in Architecture

According to Ray-Jones (2000) sustainable architecture is a thoughtful and well-considered use of the energy systems to make a building more conducive for human use and comfort without generating pollutants or borrowing earth's resources meant for future generations. The use of environmentally conscious approaches and guidelines in building design and planning of the built environment has become expedient in order to achieve sustainability as the effect of climate change has become a serious problem facing humanity across the globe (Smith, 2010).

The architect plays a vital role in the quest of creating a climate resilient environment using design actions and guidelines. Kim (1998) and Haines(2010), noted that "careful selection of environmentally sustainable building materials is the easiest way for architects to begin incorporating sustainable design principles in building. Kim(1998), identified life-cycle design as one of the three principles of sustainable architecture which depict a process where the impact of building processes on the environment are analyzed, before during and after building. Moreover, architects must not only be concerned with the appearance of buildings but also be familiar with how they work, by increasing their understanding of the environmental performance of buildings, materials, systems and construction.

Life Cycle Assessment

LCA is a tool for measuring the environmental performance of products over their life cycle, from "cradle" (where the raw materials are extracted) to "grave" (where the product is finally disposed-off) and allows focusing effort to resolve them (Schenck, 2005). It is applied methodologically to build a quantitative inventory of environmental burdens or releases, evaluate their potential impacts, and consider alternatives to interpret the results or improve environmental performance (Fava, 2005). The use of LCA for buildings requires a set of guiding principles, which are based on each building design, performances of its components and on the environmental profile of the building components during production, service life and end of life (Campioli and Lavagna, 2007). Life Cycle Assessment (LCA) allows architects and other building professionals to understand energy use and other environmental impacts associated with all life cycle phases of the building. Khasreen, Banfill,and Menzies (2007), suggested that LCA should be part of the design process as a decision making support tool, to be used by the designers of the building in parallel with other aspects like cost, and functional requirements to achieve the optimum performance of the building.

As stated in ISO 14.040, LCA is composed of four different phases, which are:

i. **Goal and Scope definition:** This phase defines the preliminary concern of the LCA study in terms of its objectives, scope and depth of the assessment to be performed. The phase includes the definition and assessment of the products and materials, the determination of the functional unit and the depth of assessment. In addition the

phase deals with identifying the types of analysis, impact categories to be evaluated, the methodologies of impact assessment and data requirements.

ii. **Inventory Analysis:** This phase involves data collection and calculation that is quantifying of all materials, energy and emissions are considered as inputs and outputs from the studied system during its life cycle. In this step, the energy and raw materials used and the emissions to environment are quantified for each step in the process, then combined in the process flow chart and relates back to the functional unit. Thus, products and processes can be compared and evaluated using Life Cycle Inventory (LCI) results. The quality of life-cycle assessment is directly related to the quality of inventory data, its correctness and its concordance with the goal of the study.

iii. **Impact Assessment:** In this phase, inputs and outputs are related to actual (or assumed) impacts based on a series of environmental indicators, such as global warming potential, human toxicity, and resource depletion to makes the results of an LCA easier to communicate and comprehend. In other words, data from the inventory analysis is attributed to appropriate impact category defined in the goal and scope of the LCA .Categories are generally divided among three broad topics of resource use, human health, and ecological consequences.

iv. **Interpretation:** The purpose of this is to analyze results obtained at the inventory and/or impact assessment steps, and includes conclusions and recommendations on the findings of the preceding phases of the LCA or LCI study. LCA results are reported in the most informative way possible, and the need and opportunities to reduce the impact of the product(s) or service(s) on the environment are systematically evaluated. LCA can be an iterative process; therefore, the interpretation of the LCA can lead to changes in the proposed design, which then leads back to inventory analysis in the process.

Khasreen et al, (2007) identified two levels at which LCA can be applied to building: whole process of building, and building material and component combination (BMCC). In this case it is very important to recognize the component impact equivalent according to the functional unit of the building. The most important aspect of LCA is the energy consumed by a building, which are "Operational" and 'Embodied energy' (Tsanova and Galabov, 2013). Operational energy is the projected energy use within a building as it operates over a typical meteorological year while embodied energy comes from the materials manufacturing and construction phases of the building project. The most commonly studied impacts when LCAs were applied to whole building were global warming, acidification, eutrophication, and ozone depletion, which are present in most studies (Khasreen et al, 2007). The ATHENA® Impact Estimator, ATHENA® EcoCalculator, BEES®, EIO-LCA are the Four commonly used LCA tools in the U.S. EQUER, LCAid™ Eco-Quantun,LISA, Envest, LCAit, PEMS, TEAM™, Umberto, SIB LCA, Boustea, SimaPro , GaBi are used in other countries (Bayer, Gamble, Gentry and Joshi, 2010).

LCA and Architectural Practice

LCA is an attractive tool used in enhancing sustainability in architecture which supports evaluation of environmental performance, green labeling, compare the environmental implications of different materials or components, select environmentally preferable materials or components, and identifies cost-effective green materials and products. When carrying out a building design, it will assist the project team to establish environmental goals for the design and ensures that the goals are met through decisions made by the project team. Adoption of LCA in architectural practice of a firm could give the firm an edge over others and increase the market value of the firm (Bayer, Gamble, Gentry and Joshi, 2010). Although

the LCA method may reduce total resource use, it is cost and time intensive and also has problems regarding interpretation of results (Malmqvist et al., 2011). In addition, lack of data inventory and benchmarks established by government authorities because of little standardization within the building sector that can be used for comparisons are also limitations to the use of LCA. However, investment in LCA may be viewed as accumulative as it provides information that adds to the overall body of knowledge and reduces the need for additional testing. Nevertheless these studies are very important for advancing sustainable development.

Implementation Strategies for LCA in Architectural Practice

Integrative Design Approach

During the design process, stakeholders of the project combine their respective strengths and technical expertise to produce buildings with long life spans. In order to successfully undertake a LCA, it is essential to promote an integrative design process as it gives opportunity for stakeholders to discuss, brainstorm, test (via LCA tools), and refine their design ideas . Each of the stakeholder occupies distinct and essential roles. For example, the Architects have the opportunity to take ownership of material sustainability and, more importantly, high-level building design while Structural Engineers are responsible for producing structural systems that are optimized in terms of design and material. General contractors ensure that optimized designs are brought into fruition, while minimizing impacts and emissions from the construction process. In particular, the architect and structural engineer for the project should communicate closely to deliver sustainability on the system level.

Building Design phases

The potentials of optimizing a project is higher in early phases, therefore improvement of the building's sustainability performance must begin in the design stage (Rahim, Muzaffar, Mohd Yusoff, Zainon and Wang, 2014). Most of the building's material, energy, and environmental loadings are likely to be committed during the design phase, therefore the earlier LCA is brought into the building process, the greater its potential benefit to the project.

Design stage I - phase 1 (Commitment)

During this stage, it is essential to appoint other consultants with good knowledge of LCA as this will help to define the environmental goals of a project. Challenges, opportunities and project cost implications emanating from the brief and site analysis could serve as basis for conducting LCA. Conducting the LCA of the whole-building in this phase can also assist the project team with high-level decisions regarding the building footprint, structural systems, and assembly types. LCA encourages project teams to think about the intended lifespan of the building and the system durability necessary to support this. LCA can help the project team to quantify these relative impacts and, ultimately, choose the system that better aligns with the project goals.

Phase II (Concept Design)

This phase focus on the technical and functional characteristics of proposed project, estimated cost in relation to budget and considers inputs of other consultant and specialists. Hence it is essential to evaluate several systems alternatives to meet the defined environmental goal of the project. LCA can help project teams optimize structural systems to use less material by selecting the most environmental friendly option from among those available. LCA can also guide decision making regarding building assemblies, by considering both the type and quantity of material involved. LCA encourages project teams to refine their design in light of environmental impacts, bringing considerations of modular construction

and prefabrication into the discussion. Energy conservation measures can be assessed for their environmental burdens and an informed decision can be facilitated by the use of LCA.

Design Stage 2 Phase III (coordinated detailed design)

At this phase, the project team is ready to select specific products to be used on the project site, including lighting, heating, ventilation and air conditioning systems, and material finishes. LCA can help evaluate the life-long impacts of these components and compares the pros and cons of different products of a particular component selected. The design team can then consider the best product that meets the environmental goal of the project.

Table 1: Application of LCA in scope of Standard Architectural Services

Design stage I		Design stage II
Phase 1 (commitment)	Phase 2 (concept design)	Phase 3 (coordinated detailed design
i. Procedure to meet his clients requirement	**i. The technical and functional characteristics of proposed projects**	**i. Detailed site plan and location of all site structures**
ii. Constraints and challenges in meeting his requirements	**ii. The estimated cost in relation to budget**	**ii. Graphically define the construction of the building**
iii. The need for the appointment of other consultants	iii. The anticipate project programme	**iii. Spatially coordinated the design by other consultants and specialists**
iv. Selections of procurement method	iv. **The inputs of other consultant and specialists**.	**iv. Review the design with relevant authorities**
v. Challenges, opportunities and project cost implications emanating from the site analysis		v. Submit project for planning approvals

(Activities in "**bold**" indicate those where input from and LCA is clearly relevant.)

Source: NIA/ARCON conditions of engagement, charges and consultancy agreement for professional architecture and project manager services

The establishment of attractive remuneration will lead the path of integration of LCA in building design and promote its use by architects. The new conditions of engagement which is the approved document for remunerating the architect based on hourly rate should be enforced so that the architect will not only base their charges on the cost of the building but also assessing its life cycle impact on the environment.

RECOMMENDATIONS

Fundamental Research

Significant collaborative research is needed to establish detailed, comprehensive and robust data to support environmental impact and sustainability assessments of buildings. The building research and standards of the Nigerian Institute of Architects' should undertake fundamental research into typical buildings with various levels of environmental friendliness; however, it could provide useful indicators or benchmarks of the sensitivity of various technical strategies to the overall performance of the building. There is a need to produce accurate local datasets with the possibility to convert their results to an internationally comparable form. The research institutes should keep informing architects about current developments in sustainability. Policy or legislation that will encourage prospective clients to use sustainable design tools need to be enacted by encouraging standardization of building components in Nigeria in line with the global trend as canvassed by the International Standard Organization (ISO) to promote environmental impact reduction. The professional bodies should also examine incorporation of energy tools into the building code.

Education and Training

A designed frame work for incorporating LCA teaching into schools of architecture to further enhance Sustainability Education should be developed. This will avail architecture students the knowledge and skills required to apply sustainability concern into their everyday practice to enable them estimates the embodied and operational energy of buildings in various regional and size categories, based on data from both real and idealized structures.

Architects training through the Continuing Professional Development Program (CPDP) of the Nigeria Institute of Architects (NIA) could serve as a platform for discussions and collaboration for the exchange of ideas and information promotion of sustainable building practices.

Conclusion

The stake holders within the built environment are to ensure that quality buildings have low environmental impact on the environment with the aim of meeting the need of the present users and also be assets to be future generation. The institute and statutory body guiding the practice of architecture in Nigeria have embraced auspicious targets for combating climate change potentials of buildings via its architect colloquium and Archi-built programs clamouring for sustainable built environment. In view of this, keeping up with trends, technologies, challenges, and policies requires the acquisition of knowledge. This study has reviewed LCA and outlined strategies for it implementation into architectural practice in Nigeria. Despite the limitations to the use of LCA; cost, time intensive, lack of data and bench marks, it is a potential tool to make a strong contribution to the goal of sustainable development. The study identified integrative design approach and incorporation of LCA into scope of standard architectural practice in Nigeria as strategies for implementing LCA. The study further recommends that fundamental research should be undertaken by building research and standards of Nigerian Institute of Architects to provide useful indicators or benchmarks. Training of architects and integration LCA into curriculum of architectural schools are also important to incorporating LCA.

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Assessment of the Critical Success Factors for Healthcare Project Delivery in Ondo State, Nigeria

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ABSTRACT

The availability of healthcare facilities in a nation contributes to the wellbeing of the citizens and in turn translates to economic development of the nation. Therefore, it is imperative to ensure that healthcare projects are successfully completed according to plan and within the scope of design. To this end, an evaluation of the Critical Success Factors (CSFs) for delivering healthcare projects successfully, using Ondo State, Nigeria as the study area is investigated in this study. The construction industry professionals practicing in the study area that have been directly or indirectly involved in healthcare projects delivery were sampled with the use of questionnaire survey. The data obtained from the questionnaire survey were analyzed using mean score ranking, thereafter, the results were presented in tables. It is evident that project managers' leadership skills, site managers' management skills and collaboration/cooperation between project participants are the three most important CSFs that influence the successful delivery of healthcare projects in Ondo State. These findings provide an insight into healthcare project delivery CSFs that will serve as a guide to construction industry professionals currently engaged or will be involved in the future construction of healthcare facilities.

Keywords: Critical success factors, healthcare projects, construction industry professionals, Ondo State, Nigeria

INTRODUCTION

Project construction involves different parties as well as different inputs. In most project construction, all the project team members determine the three common project targets of quality, cost and time but there has not been a universal measure of project success (Chan et al., 2005). The dynamic nature of the construction environment which is characterized with some level of uncertainties (Walker, 2015) has led to numerous efforts into examining the factors that ensure the success of a construction project. However, managing healthcare projects requires special attention due to its peculiar nature (Chan et al., 2003). Studies on the management of healthcare projects have rarely been conducted in this part of the world, especially in Nigeria. Most of the previous studies were based on the situation in some developed nations. While Leonard (2004) looked into the Critical Success Factors (CSFs) relating to healthcare's adoption of new technology in general, Chan (2003) gave an assessment of the CSFs in delivering healthcare projects in Hong Kong.

Healthcare projects are specialized buildings equipped with up-to-date mechanical and electrical equipment in which medical care is been provided to the public (Chan et al., 2003). According to Lam et al. (1997a), the characteristics of a healthcare project include complexity of design, multiple end-users, many participants, requires state-of-the-art technology and tight time schedule and budgets. The outbreak of diseases in Nigeria (WHO Ebola Response Team, 2014), of which Ondo state is not exempted echoes the need for an efficient healthcare service that can only be delivered in a modern healthcare building. Since the economic development of a nation is hinged on improved health conditions of the citizens (Suhrcke et al., 2006), it is therefore, expedient to investigate the CSFs that will ensure

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successful completion of healthcare projects in Ondo state due to significant development in health system by the current administration.

LITERATURE REVIEW

Increased advancement in technology has created a dynamic construction environment, making construction projects much more complex and difficult. Similar scenario affects the delivery of healthcare projects (Chan, 2000). This is because hospitals provide different specialized but necessary facilities and services for people in a society (Chan and Chan, 1999). In providing an efficient and effective medical care and operation to the public, hospitals are highly serviced with up-to-date medical equipment, electrical and mechanical installation. Such projects require extraordinary considerations of special functions, medical techniques being employed and the social and economic conditions prevailing at the time (Lam et al., 1997a; Chan et al., 2003). Hence, it is imperative to study the challenges involved in construction projects delivery which may also affect healthcare projects as shown in Table 1.

Table 1: *Challenges involved in healthcare project*

Factors	Source
Lack of up-to-date technology	Chan et al. (2003)
Limited incorporation of new technique	Lam et al. (1997a)
Highly complicated building services	Chan et al. (2003); Chinowsky et al. (2009)
High risk of project delay	Kolhatkar and Dutta (2014)
Frequent changes were demanded by multi-head clients	Lam et al. (1997b)
Insufficient cooperation between various project participants	Wilkins and Smith (1996)
Tight time schedule	Chan et al. (2003)
High level of rework required for achieving the specification	Lam et al. (1997b)
Facing great pressure by general public and client	Chan et al. (2003)
Large number of claims involved	Gibb (1995)
Difficulty in dealing with large number of professionals	Chan et al. (2003)
Inadequate exchange of knowledge and skills between parties	Lam et al. (1997b)
Exposure to litigation	Chinowsky et al. (2009)
Productivity of workmen is comparatively low	Chan et al. (2004)

The concept and definition of project success remains ambiguous to many construction professionals, however, the study of project success and CSFs provides a course for understanding and thereby improving the effectiveness of construction projects (Babu, 2015). The need to identify CSFs is particularly acute in the provision of major healthcare projects due to their complexity, long design and construction periods, ongoing developments in healthcare planning and technology, and a need for a highly accountable approach to procurement by health authorities (Chan et al., 2003). A comprehensive literature review about CSFs for construction project delivery was conducted as presented in Table 2.

RESEARCH METHODOLOGY

The present study adopted the survey research approach to gain insight into the CSFs that influence the successful completion of healthcare projects in Nigeria. Easterbrook et al. (2008) posited that when data is collected from a study population in a study area, quantitative research approach is most appropriate in order to focus on the established factors from a larger spectrum. Hence, quantitative approach was adopted to elicit data from the targeted respondents in the study area.

The systematic literature review conducted revealed a total of 14 factors that pose as challenges to healthcare project delivery. At the same time, 20 CSFs that influence healthcare project delivery were retrieved from literature review. These factors were used to design a questionnaire that was administered on construction industry professionals that have been involved in healthcare project delivery in the study area. The questionnaire was divided into three sections. The first section contained questions that pertain to the professionals' demographic characteristics. In the other two sections, the challenging factors and CSFs were presented, respectively and the professionals were asked to rank the importance of each factor

based on a five point Likert-scale on a scale of 1-5, representing highly insignificant - high significant, respectively.

Table 2: *Critical success factors for construction project delivery*

Factors	Source
Leadership skill for project manager	Müller and Turner (2007); Fisher (2011)
Management skill of site managers	Pant and Baroudi (2008)
Collaboration of project participants	Larson (1997); Suprapto et al. (2015)
Supervision of workmen	Oloyede et al. (2010)
Nature of project	Turner (2006)
Planning effort	Hamilton and Gibson Jr (1996)
Location of Project	Cheng and Li (2004)
Technological advancement	Babu (2015); Chan et al. (2003)
Political condition	Abraham and Chinowsky (2003)
Suitability of equipment	Ng et al. (2009)
Tendering method	Tiong (1996)
Quality, health and safety program	Datta (2003)
Size of project	Babu (2015)
Site conditions	Akintoye et al. (2000)
Timely payment to sub-contractors	Ng and Tang (2010)
Procurement method	Chan et al. (2003); Oladirin et al. (2013)
Construction Method adopted	Chan and Chan (2004)
Complexity of project	Baccarini (1996)
Client's erratic changes	Kaliba et al. (2009)
Formal dispute resolution process	Fenn et al. (1997)

The respondent of this study are built environment professionals who include architects, engineers, quantity surveyors and builders practicing in the study area. They were contacted to establish their willingness to participate in the survey. Eventually, 60 professionals were sampled. At the end of the data collection exercise that lasted for 3 months, 55 questionnaires were retrieved and valid for statistical analysis. This represent a response rate of 92% which is satisfactory considering what is obtainable in construction industry studies (Oyedele, 2013).

In order to establish the Relative Importance (RI) of the various factors under consideration, the Mean Score (MS) of each factor was estimated. This approach is not uncommon in related studies (for instance, Chan et al., 2005; Gudienė et al., 2013). The MS was calculated using the formula presents in Equation (1).

$$\mathrm{MS} = \frac{5n_5 + \ 4n_4 + \ 3n_3 + \ 2n_2 + \ 1n_1}{N} \tag{1}$$

Where n is the score given by the respondent based on the five-point scale of 1 to 5 and N is the number of professionals that ranked a factor.

This study focuses on Akure, the state capital of Ondo state, Nigeria. The political influence the city gained in 1976 when it was made a state capital (Fadairo, 2013) can be attributed to the rapid urbanization being experienced in the city (Tofowomo, 2008), which has made it one of the fastest growing state capitals in Nigeria (Ogunleye and Kayode, 2013). The economic richness of the city in terms of the availability of numerous mineral resources which include crude oil, the development of Olokola Deep Sea Port and also the construction of OK Free Trade Zone (Ogunleye and Kayode, 2013) has made Akure to become an emerging metropolis in Nigeria. The recent developments in the health sector under the current administration in the state make it an area that is worth studying.

The characteristics of the respondents of this study in terms of their professional background (Figure 1) shows that most (45.50%) of the professionals are quantity surveyors and about 23.60% are architects. Engineers represent 21.80% of the respondent, while 9.1% of the professionals are builders. The respondents have acquired varying years of cognitive industry experience. However, about a total of 67.30% of the respondents possess industry experience

of above five years, although majority of this portion fall within 6-15 years of experience. This information implies that the professionals are well experienced and their length of experience is noteworthy for this study. This is substantiated with the impressive Cronbach's alpha value which is recorded in this study.

On the academic qualification (Figure 2), more than half (58.20%) of the professionals possess Bachelor of Science/Bachelor of Technology degrees, 20.00% of them have acquired a postgraduate degree in terms of Masters of Science or Masters of Technology degrees, probably in their fields or allied professions. However, a minuscule portion of them possess ordinary and Higher National Diploma degrees. In sum, about 78.20% of the respondents have at least a B.Sc./B.Tech. degree holder which makes it safe to suggest that the respondents are well educated and well informed about the latest developments in their chosen professions. Analyzing the number of projects they have handled in the course of their professionals career, majority (a total of 68.20%) of the respondents have had cognitive experience in between one and four projects. A proportion of 31.80% respondents have handled over four projects.

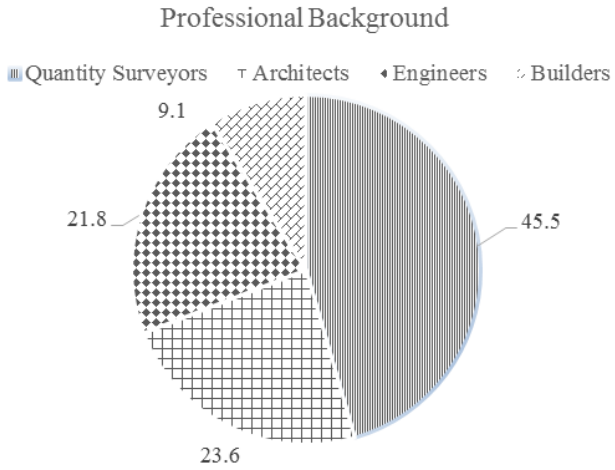

Figure 1: Professional background of the respondents

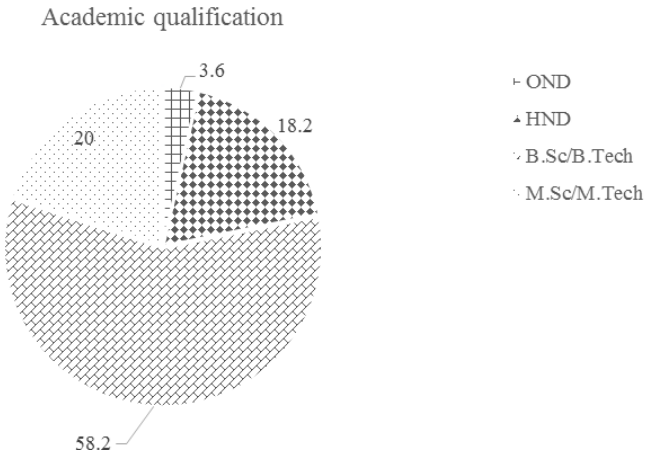

Figure 2: Academic qualification of the respondents

RESULTS AND DISCUSSION

In order to establish the internal consistency of the data collected, the Cronbach's alpha was estimated. This values ranges between 0 and 1. However, a Cronbach's values of 0.70 and above depicts a high internal consistent reliability (Hair et al., 2010). For this study, a

Cronbach's alpha value of 0.89 was recorded, this implies that a reliable internal consistency was achieved in this study. Thus meaningful inferences can be drawn from the analysis.

In order to establish the most significant factor(s), a threshold of 2.5 was adopted. This was informed by what is obtainable in literature, see for example Hsueh et al. (2009) and Le et al. (2014). To fully understand the CSFs that determine the successful completion of healthcare projects, insight into challenges that may affect such project is necessary. The information in Table 3 presents the ranking of the 14 factors that may pose as a challenge to healthcare projects as indicated by the respondent. All the 14 factors recorded a MS higher than the 2.5 threshold, which implies that they are all significant factors that can hinder the successful completion of healthcare projects. This is because the highest ranked factor (lack of cutting-edge technology) and the lowest ranked factor (low workmen productivity) recorded a MS of 4.04 and 2.98, respectively. However, in order of importance, lack of up-to-date technology, lack of adoption of new techniques, complicated building services, risk of project delay and frequent changes by clients are the five highly ranked factors with MS ranging between 3.49 and 4.04 that can militate against the successful completion of a healthcare project. The ranking of lack of up-to-date technology as the highest factors is consistent with literature, because Chan et al. (2003) argued that lack of up-to-date technology can impede the provision of efficient healthcare facility that will meet the needs of the people.

Table 3: *Ranking of the challenges involved in healthcare project*

Factors	Mean Score	Rank
Lack of up-to-date technology	4.04	1
Limited incorporation of new technique	3.80	2
Highly complicated building services	3.71	3
High risk of project delay	3.64	4
Frequent changes were demanded by multi-head clients	3.49	5
Insufficient cooperation between various project participants	3.45	6
Tight time schedule	3.42	7
High level of rework required for achieving the specification	3.42	7
Facing great pressure by general public and client	3.40	9
Large number of claims involved	3.35	10
Difficulty in dealing with large number of professionals	3.31	11
Inadequate exchange of knowledge and skills between parties	3.16	12
Exposure to litigation	3.09	13
Productivity of workmen is comparatively low	2.98	14

The RI in terms of the MS of the CSFs that determines the successful completion of healthcare projects in the study area are presented in Table 4. Considering the RI threshold of 2.5 established earlier, it is evident that all the 20 CSFs are significant determinants of healthcare projects delivery. They recorded a MS that range between 4.53 (Leadership skills for project manager) and 3.38 (design changes that occurs during construction). Some of the CSFs tied in ranking at the $4^{th}$and 8^{th} positions, which implies that same level of importance should be accorded to such CSFs during project construction. Be that as it may, the three most highly important CSFs are Leadership skill for project manager, Management skill of site managers and Collaboration of project participants, respectively.

A closer examination of these three CSFs shows that they are related project team personnel development and relationship. This suggests that in order to achieve a successful completion of a healthcare project, the project manager should ensure that experienced team members are recruited and they should possess a good teamwork spirit. This is in line with the position of Chan et al. (2003) that pointed out that the ability of a Project Manager to constitute a capable project team is essential for the successful completion of a healthcare project.

Table 4: *Ranking of the critical success factors for healthcare project delivery*

Factors	Mean Score	Rank
Leadership skill for project manager	4.53	1
Management skill of site managers	4.47	2
Collaboration of project participants	4.38	3
Supervision of workmen	4.36	4
Nature of project	4.36	4
Planning effort	4.36	4
Location of Project	4.29	5
Technological advancement	4.27	6
Political condition	4.25	7
Suitability of equipment	4.22	8
Tendering method	4.22	8
Quality, health and safety program	4.13	9
Size of project	4.09	10
Timely payment to sub-contractors	4.04	11
Procurement method	3.98	12
Construction Method adopted	3.96	13
Climate Condition	3.93	14
Complexity of project	3.85	15
Client's erratic changes	3.65	16
Formal dispute resolution process	3.53	17

CONCLUSION

Effort was made to assess the CSFs that determine the successful completion of healthcare projects in Ondo state, Nigeria. This was investigated in order to provide an insight into the CSFs of healthcare project, being that the health of the citizens usually have impact on the economy of a nation. Built environment professionals practicing in the study area and that have been involved in healthcare projects were sampled with the use of a questionnaire. A total of 20 CSFs were identified from the literature and they were included in the survey instrument used for the study. The professionals were asked to rank the CSFs in the order of their importance based on their opinion. Although all the CSFs were found to be significant, however, the top three highly significant CSFs can be categorized as human personnel and they are leadership skill for project manager, management skill of site managers and collaboration of project participants. This implies that when embarking on a healthcare project, the construction team should accord these factors utmost concentration as this will ensure successful delivery of such projects, within the stipulated time, estimated cost and with good quality.

This study may be limited in terms of its generalization to every part of Nigeria, being that it focused on Akure city. The inferences drawn from the data represents what is obtainable in the study area. However, due to the paucity of literature on this research topic both locally and internationally, this issue could be investigated in other cities in Nigeria and ultimately, researchers in other countries can replicate such study in order to present an international overview of the research topic.

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Assessing Compliance with Noise Control Guidelines in the National Building Code for Residential Estates in Ondo and Ekiti States, Nigeria

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ABSTRACT

The National Building Code (NBC), launched in 2007, is a document meant to control all matters concerning the design and specification of any building or structure within Nigeria and to proffer lasting solution to the hazardous trends in the Nigerian building industry. Environmental noise pollution is one of the problems affecting the quality of life of people and negatively impacting on the built environment which the national building code is meant to address. This paper seeks to assess the level of compliance to provisions of the national building code in terms of noise control measures in residential estates. Two residential estates were chosen for study in the state capitals of the Ondo and Ekiti states. Data were collected through structured questionnaires administered on the residents of the estates and actual measurements of the noise level within the estate and physical survey of the estates. The data were analyzed using percentile and compared with the recommendations in the national building code. It was revealed that most of the buildings in the estates did not comply with the provisions of the code. This paper recommended that the code be domesticated in all the states and publicised among the residents compliance.

Keywords: Building, Estates, Noise, Pollution, Residential

INTRDUCTION

The residential estates are supposed to be haven of rest, providing serenity and quietness for residents after a noisy day at work. Unfortunately, they have been bedevilled with noise pollution. The built environment has recently become noisy due to rapid urbanisation. While most countries are making conscious efforts at addressing the menace of noise pollution through legislation in from of building codes and effective guidelines, Nigeria seems not to be doing enough in this direction.

A building code is a systematic statement or a body of rules that govern and constrain the design, construction, alteration, and repair of buildings (Farlex, 2011). The codes are meant to proffer lasting solutions to the hazardous trends in the building industry. These problems might have resulted from planlessness of the built environment, use of non-professionals, use of substandard materials, insufficient referenced design standard for professional and lack of adequate regulations and sanctions against offenders (Toluhi, 2009). The resulting effects of these problems include frequent building collapse, fire outbreaks, environmental pollution and other disasters.

The national building code which was launched in 2007 is meant to address the problems and the challenges facing the building industry in Nigeria when fully put to operation. This paper seeks to find out the level of awareness of the people about this document and the level of compliance to some of its provisions, especially the aspect that has to do with acoustics and noise control.

THE STUDY AREA

Ado-Ekiti and Akure are the state capitals of Ekiti and Ondo states respectively. The two towns were the major towns from the old Ondo state before the creation of Ekiti state on October 1, 1996. The selected estates from Ekiti and Ondo were Irewole Housing Estate and Ijapo Housing Estate respectively. While Ijapo Housing Estate is bounded by Oke-Ijebu road and Fiwasaye roads, Irewole Housing Estate is located along Ilawe road. The two housing

Ganiyu, S. A. (2016). Assessing Compliance with Noise Control Guidelines in the National Building Code for Residential Estates in Ondo and Ekiti States, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 319-325

estates were purposely designed and built with prototype buildings. These estates were purposefully chosen based on their ages to allow for good comparison. While Ijapo is the oldest, being the first housing estate in old Ondo State; Irewole Housing Estate is relatively a new estate allowing for good comparison.

The buildings in Ijapo ranges between 3 and 5-bedrooms bungalow while those of Irewole are essentially 3-bedrooms detached bungalows. There are six hundred (600) buildings in Ijapo estate, Akure and four hundred and twenty (420) buildings in Irewole estate, Ado-Ekiti.

THE NATIONAL BUILDING CODE

Introduction

The National Building Code is a document evolved to proffer lasting solution to the hazardous trends in the Nigeria building industry. The code was evolved by the collective effort of all the seven professionals in the building industry. It was launched into operation on 25th January, 2007 (Toluhi, 2009; Oresegun, 2010). The Code, which is meant to control all matters concerning the design and specification, construction, alteration, repair and demolition of any building or structure anywhere within Nigeria as local building regulations and bye-laws, has only been adopted by few states like Ondo State (Toluhi, 2014). The section 6 of the Code is titled 'Environmental Requirements' and is meant to 'govern the means of light, ventilation and sound transmission control required in all buildings intended for human occupancy'.

Sound Transmission Control

The sub-section 6.2.11 is dedicated to sound transmission control in residential buildings whose scope apply 'to all common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between a dwelling unit and adjacent public areas such as halls, corridors, stairs or service areas in all buildings of Use Group H'. The section considered both the air-borne noise and structure borne noise.

Airborne Noise

The Code required that walls, partitions and floor/ceiling assemblies separating dwelling units from each other or from public or service areas shall have a sound transmission class (STC) of not less than 45 for airborne noise when tested in accordance with ASTM E90. This requirement shall not apply to dwelling unit entrance doors, but such doors shall be tight-fitting to the frame and sill.

Structure borne Noise

The Code required floor/ceiling assemblies between dwelling units and between a dwelling unit and a public or service area within the structure to have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM E492.

Acceptable Noise Level:

As preventive measure, the Code recommended the following daily maximum exposure to noise to avoid any hearing damage (National Building Code, 2007).

The Effect of Distance on Noise Level

The inverse square law of sound states that the intensity of sound in a free field is indirectly proportional to the square of the distance from the source. This infers a decrease in the intensity of sound the farther the observer is from the source. When sound spreads out from a point source in a free space the wave fronts are spherical and the sound pressure level will decrease 6 dB for each doubling of distance. However, When sound spreads out from a line source (such as a road with constant traffic or a pipe carrying fluid), the wave fronts are cylindrical and the sound pressure level will decrease 3 dB for each doubling of distance (Ogunsote, 2015).

Table 1: Recommended maximum daily exposure to noise.

Sound Pressure Level (dBA)	Maximum Exposure in any 24 Hours
85 or less	24 hours
87	16 hours
90	8 hours
93	4 hours
96	2 hours
99	1 hour
102	30 minutes
105	14 minutes
108	71/2 minutes
110	33/4 minutes

Source: National Building Code, (2007).

Acoustic Guidelines for Design of Residential Estates

The 1987 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) guide suggests an NR 25 to 30 (30 to 35 dBA) as appropriate for residential and apartment dwellings. The EPA aircraft noise study (Gierke, 1973) indicates that a night time level of 30 dBA in a bedroom would produce no arousal effects. Their recommendation of a maximum exterior L_{dn} of 60 dB(A) was based, in part, on a maximum interior level of 35 dB(A) at night with closed windows. The same reasoning, when applied to the Levels Document recommendations of L_{dn} 55 dB(A), would yield a maximum night time level of 30 dB(A) with windows closed. It is important to note that most residential structures provide about 20–25 dB of exterior to interior noise reduction with windows closed and about 10–15 dB with windows open. Table 2 shows the summary of noise levels identified by Environmental Protection Agency (EPA) as requisite to protect public health and welfare of residential areas.

Table 2: Summary of Noise Levels Identified as Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA Levels Document, 1974)

EFFECT	LEVEL	AREA
Hearing loss	$L_{eq(24)} < 70$ dBA	All areas
Outdoor activity interference and annoyance	$L_{dn} < 55$ dBA	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq(24)} < 55$ dBA	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{eq} < 45$ dBA	Indoor residential areas
	$L_{eq(24)} < 45$ dBA	Other indoor areas with human activities such as schools, etc.

Source: Marshall, 2006

Van Houten, according to Harris (1994), states that levels of plumbing related noise between 30 and 35 dB(A) in an adjacent unit can be "a source of concern and embarrassment." In multifamily residential developments, intrusive levels generated by activities in another unit are rarely a problem below 25 dB(A). At 30 dB(A) they are clearly noticeable and can be a source of annoyance, and above 35 dB(A) they frequently generate complaints.

People in their homes would have the lowest annoyance threshold. As a general guide, Szokolay (2008) recommended the following L_{10} (90th percentile) noise levels should not be exceeded inside any residential unit (Table 3).

Table 3: Emission limits of community noise in residences

	Day (dBA)	Night (dBA)
Country areas	40	30
Suburban areas	45	35
Inner city areas	50	35

Source: Szokolay (2008)

Sound Level Meters

The sound level meter (Figure 1) is the fundamental acoustical instrument used for measuring sound. The instrumentation must comply with the specifications given in IEC 61672-1, which has two performance categories, classes 1 and 2. Both classes have the same design goals and differ only in the tolerance limits: class 1 for precision sound level meters, and class 2 for ordinary sound level meters (Maekawa, Rindel and Lord, 2011).

Figure 1: Sound Level Meter. (Extech Sound Meters and Sound Calibrators, 2009)

RESEARCH METHODOLODY

The research adopted a survey method of the study areas using a structured questionnaire which was administered on one out of every five buildings in Ijapo and one out of every ten buildings in Irewole. Eighty one (81) questionnaires were administered in Ijapo while forty (40) questionnaires were administered in Irewole out the six hundred (600) and four hundred and twenty (420) buildings respectively. The reason for the difference in the percentages of the questionnaires administered was that the buildings in Ijapo were more heterogeneous than those of the Irewole housing estate. The buildings in Irewole Housing Estates were essentially 3-bedroom detached bungalows. These represent approximately 15% and 10% coverage respectively. In additions to the questionnaire, the prevalent noise levels of the estates were measured using sound level meter in front of the buildings.

The variables examined include:

a. Type of building
b. Setback from road
c. Type of barrier/demarcation
d. Level of noise exposure
e. Awareness level about the building code.

DATA COLLECTION, ANALYSIS AND DISCUSSION

The data were collected and analysed as follow:

Type of Building

The buildings were classified as rooming, detached, semi-detached, duplex and multi-storey buildings. The number of detached buildings in Irewole Estate is thirty-eight (38) representing eighty-five percent (85%) as against the forty-seven (47) detached buildings in Ijapo which represented fifty-eight percent (58%). There is no rooming apartment in Irewole Estate and the number of semi-detached buildings was small compare to Ijapo Estate. There are no duplex and multi-storey buildings in Irewole Estate while Ijapo Estate has fifteen (15) and six (6) respectively (Table 4). The rooming apartment and the semi-detached buildings can be a source of noise and great disturbance to neighbours causing discomfort.

Table 4: Type of Building

Type of building	Ijapo Estate		Irewole Estate		Total	
	Frequency	%	Frequency	%	Frequency	%
Rooming	2	2.5	0	0	2	1.7
Detached	47	58	38	95	85	70.2
Semi-detached	11	13.6	2	5	13	10.7
Duplex	15	18.5	0	0	15	12.4
Multi-storey	6	7.4	0	0	6	5.0
Total	81	100	40	100	121	100

Setback from Road

The distance of the buildings from the road were measured to determine whether they meet up with the minimum setback of 6m specified in the building regulations in Nigeria. It was discovered that over forty percent (40%) of the buildings in the two estates have a setback that is lesser than the half of the minimum requirement of 6m. It is noteworthy that none of the buildings in Irewole Estate has a distance that exceeded 6m (Table 5).

Table 5: Distance from Road

Distance from road	Ijapo Estate		Irewole Estate	
	Frequency	%	Frequency	%
Below 3m	35	43.2	16	42.1
Between 3 – 6m	34	42.0	22	57.9
Between 6 – 9m	7	8.6	0	0
Above 9m	5	6.2	0	0
Total	81	100	40	100

Type of barrier/Demarcation

The kind of barrier used to reduce the effects of the noise, thereby enhancing acoustic comfort on the residents was also determined. It was interesting to know that nearly all the buildings in Ijapo were fenced with block wall (90.1%) while about forty percent (40%) of the buildings in Irewole have no fence at all thereby exposing them to serious acoustic discomfort arising from the vehicular noise from the road (Table 6).

Table 6: Type of Barrier/Demarcation

Type of Barrier	Ijapo Estate		Irewole Estate	
	Frequency	%	frequency	%
Block fence	73	90.1	20	50.0
Trees	1	1.2	0	0.0
Shrub	4	5.0	4	10.0
No Barrier	3	3.7	16	40.0
Total	81	100	40	100

Level of Exposure to Noise

The actual measurement of noise level within the estate was measured using Sound Level Meter at strategic locations along the major streets of the estates. The meter used has accuracy of ±1.4 dB; frequency range of 31.5 Hz – 8 KHz; auto range (30 dB – 130 dB); time weighting for both fast (125s) and slow (1s); resolution of 0.1 dB; and display update of 2 times/second. It was discovered that the average noise level on the street of Ijapo Estate on a typical weekend ranges between 77.5 dB (A) and 95.0 dB (A) depending on vehicular traffic and type of noise breaker/barrier. The noise level at Irewole Estate, however, ranges between 70.3 dB (A) and 90.5 dB(A). This clearly shows that the residents of Ijapo Estate are exposed to more noise than the residents of Irewole Estate. While the National Building Code specify maximum daily exposure of 85 dB(A), it was observed that the residents of these estates are often exposed to noise above the daily limit exposures set in the Code.

Awareness Level about the National Building Code

Virtually all the respondents claimed ignorance of the knowledge of the national building code. All the few respondents but one (1) from each of the estates who claimed to have heard about it confessed that they have never seen a copy of it, not to talk of reading it (Table 7).

Table 7: Awareness level about the National Building Code

Type of Barrier	Ijapo Estate			Irewole Estate		
	Yes	No	Total	Yes	No	Total
I have heard about it	3	78	81	5	35	40
I have seen it	1	80	81	1	39	40
I have read it	0	81	81	0	40	40

DISCUSSION OF FINDINGS

The type of buildings may contribute to level of noise in a residential estate. People who live in rooming apartments and semi-detarched buildings are most likely to be subjected to higher level of noise due to the number of occupants and their degree of proximity. This probably account for the higher level of noise recorded in Ijapo housing estate. It has been established in the literature that there is a strong relationship between distance or setback from source of noise and the level of noise recieved from the source. This shows that the farther away a recipents is the lower the level of noise exposure. Only 14.8% of the residents of Ijapo estate have their buildings farther than 6m while none of the buildings in Irewole estate enjoys such a luxury thereby exposing them to high level of noise from vehicular road. Over 90% of the buildings in Ijapo estate are protected with barriers in form of block fence, trees of shrubs but only 60% of the buildings in Irewole estate are protected by any form of barriers leaving 40% of the buildings exposed to external and unprotected.

While the average noise level along the street of Ijapo estate ranges between 77.5 dB(A) and 95.0 dB(A) on a typical weekend, that of Irewole estate ranges between 70.3 dB(A) and 90.5 dB(A). The recommeded emission limits of community noise in residential areas are between 50 – 55 dB(A) for the protection of public health and welfare. Though the National Building Code allows for a maximum daily noise exposure of 85 dB(A), it was observed that the average noise levels in these estate are often above this limit. It was observed that the reason for the high level of environmental noise pollution in Ijapo estate was as a result of large volume of vehicular traffic within the estate coupled with the fact that commercial taxis are also allowed into the estate, a situation which is not obtainable in Irewole estate in Ado-Ekiti. This situation is likely to expose the residents of Ijapo to higher noise level despite their barriers

RECOMMENDTIONS

Arising from the above, the following recommendations are hereby made:

i. Conscious efforts must be made to create awareness on the negative effects of noise pollution with a view to safeguard the health of the people.
ii. Efforts should be made to minimise the exposure of residents of the residential estates to high level of noise. This can be achieved by encouraging the erection of noise breakers/barriers in form of fence and/or shrubs.
iii. The minimum setback of 6m should be enforced by relevant government agency to reduce the level of exposure to noise.

CONCLUSION

It is apparent that the residents of these estates are often exposed to noise level above the limit specified in the national building code which was promulgated to proffer solution to the hazardous trends in the Nigeria building industry including environmental noise pollution.

However, the code, which was signed into law since 2007, has remained grossly under-utilised due to poor awareness. The level of compliance to the provisions of guidelines on noise control in residential environment in the code which has remained largely unknown to the people cannot but be low, even in government owned housing estates. The paper has therefore recommended aggressive awareness drive to sensitise people on the negative effects of noise pollution and call on the professionals in the building industry to insist on the provisions of the building code with a view to minimising the level of exposure of occupants of the residential environment to high level of noise pollution.

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Trends in Sustainable Design in Architecture

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ABSTRACT

The concept of Sustainable design also called environmental design, environmentally sustainable design, environmentally conscious design, etc. is the philosophy of designing physical objects, the built environment, and services to comply with the principles of social, economic, and ecological sustainability. This research embraced quantitative data collection method by looking at sustainable architectural designs around the world with an aim to highlight practices which promote sustainable design that is about creating a better quality of life now, for future generations in architecture and construction industry in Nigeria. The main objectives of sustainable design are to reduce, or completely avoid depletion of critical resources like energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create built environments that are liveable, comfortable, safe, and productive. Principles and methods of sustainable design are discussed in this write-up. The paper recommends working with nature as the most efficient way to sustainable development through architecture in Nigeria.

Keywords: Sustainable Design, Sustainable materials, Sustainable Construction, Architecture and Sustainable Development

INTRODUCTION

We all want to improve the quality of life in Nigeria and this guidance highlights the important contribution which can be made to improve the design of new developments. It is important to create developments that are more cost effective to run, more secure, and that minimise their environmental impact and provide healthy living conditions, while respecting the area's rich heritage and distinctiveness.

This paper is intended to sensitize architects and contractors when undertaking new developments. Careful consideration of design and specification at an early stage can provide significant savings compared with an ad-hoc approach and proposers of development will benefit at the planning stage if they understand the principles of sustainable design prior commencing the design work.

The intention of sustainable design is to "eliminate negative environmental impact completely through skillful, sensitive design". According to McLennan (2004), the Philosophy of Sustainable Design Manifestations of sustainable design requires no non-renewable resources, impact the environment minimally, and connect people with the natural environment.

Beyond the "elimination of negative environmental impact", sustainable design must create projects that are meaningful innovations that can shift behaviour. A dynamic balance between economy and society, intended to generate long-term relationships between user and object/service and finally to be respectful and mindful of the environmental and social differences. The negative impacts of poor sustainable designs lead to poor construction industrial activities on the environment include destruction of natural habitats, demand for

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materials which leads to mining activities and consequently land destruction, air emissions/pollutants, health and safety harm, among others.

Design Process

The exact point in time when design professions' embrace of green principles changed from a desirable commodity to a fully integrated design expectation is probably lost in history. The difference between both designer and client expectations now versus the 1990s is striking. Green design transcends mere descriptions of the techniques that may be employed in shaping a more sustainable existence on Earth. It must also incorporate the principles, processes, and cycles of nature in a way that leads to a deeper understanding of what makes a design successful. Ideally, a book in the first decade of the third millennium that addresses green design should form the foundation for exploration and discovery of new and innovative ways to minimize ecological footprints. Now, and from now on, designers must strive for an end product that mutually benefits the client, the public, and the environment.

It is only through creating a better understanding of the natural world that new strategies can emerge to replace the entrenched design mind-sets that have relied on traditional schemes steeped in the exploitation of nature. Designs of much of the past four centuries have assumed an almost inexhaustible supply of resources. Almost everything we do in some way affects the health of the planet, from showering and brushing our teeth in the morning to well after we are finally tucked in at the end of the day, and the small clock on our nightstand continues to demand energy from the grid. One of the great misconceptions of scientists and non-scientists alike is that environmental consciousness is not dictated by sound science. To the contrary, everything that we do to the environment can be completely explained scientifically. The good news is that by applying the laws of science, we can shape our environment and provide the products demanded by society both predictably and sustainably. That is, strategic use of the principles of physical science informs our designs and engineering decisions.

Since the industrial revolution of the nineteenth century, architects and engineers have been key players (culprits?) in the war against nature. Single-minded exploitation and subjugation of nature was the norm during much of the twentieth century and persists as a mainstay of design. Technology has hastened the process. Notably, "man-made weather" (i.e., air conditioning) is now a universal expectation of building design in the West, following the invention of an

"Apparatus for treating air" patented by Willis Carrier in 1906. It is also entrenched in the desire for conformation of the International Style of Architecture, which spanned much of the twentieth century. Many of us follow the remnants of this style, still seeking one universal building, regardless of climate and place.

Actually, green thinking is not new at all. In fact, our new way of thinking resembles an understanding of and respect for nature found in antiquity, as evidenced by the designs of cliff-dwelling native peoples. Re-establishing the link between built form and the environment will require a more complete understanding of the science that underpins successful sustainable design strategies, and incorporating this knowledge as architects and engineers engaged in shaping our world along with the construction community charged with realizing a new vision.

The *law of unintended consequences* is ever ready to raise its ugly head in design. There are numerous examples of building design solutions touted as sustainable that fail to recognize and respond to the specifics of local climate. A building project that has applied sustainable principles with the mind-set that these principles are "universal" solutions will produce less

than optimal results, if not total failure. For example, a wind system is renewable but is not necessarily efficient. Incorporating wind turbines without first understanding local climate and the physics of wind-generated energy could lead to poor design solutions by placing turbines in an area that does not generate sufficient wind speeds throughout the year. The idea of a more "holistic" approach is required to arrive at complete, sustainable design strategies. The notion of life cycle in the design and construction community has too often been confined to a cost–benefit economic model of demonstrating the return on investment that can be expected over the life of a building.

STATEMENT OF THE PROBLEM

The specific problem of creating sustainable design in sustainable human habitats is visible in both rural and urban centres of developing countries. Olotuah (2009) averred that incremental design and construction has pervaded most urban centres in Nigeria. Many of such buildings are inhabited with the barest facilities in place. Although sustainability is fast assuming a global trend, the position of architecture in actualizing the sustainable design goals in developing countries is not encouraging. The concept of the necessity to protect the environment through architecture is not well understood by many intending developers or house-owners. Quacks, who claim to be architects most times, use corrupt means of getting architectural works done. Consequently, the environment is left unsafe and unsustainable for habitation. Furthermore, poverty seems to have clouded reasonable thoughts of what a habitable and sustainable house should be, and consequently, people find shanty and uncompleted dwellings habitable. It is obvious that the role of architecture in its theory, education and practice, in sustainable development cannot be over-emphasized.

Sustainable Design

Peakstoprairie (2005) describe a sustainable design as "the systematic consideration of a project's life cycle impact on environmental and energy resources". One of the key features is the need to minimise material and resource consumption and some strategies for achieving this, and consequently sustainable construction, include:

i. Ensuring land is safe for development
ii. Ensuring access to and protection of the natural environment
iii. Reducing negative impact on the local environment
iv. Conserving natural resources and reducing carbon emissions
v. Conserving economic and social well-being

The Push for Sustainable Design

There are now many factors encouraging designers and developers to adopt more sustainable design practices:

i. Growing awareness from shareholders, investors and the public has led to increased public reporting on social and environmental issues, with some developers now producing annual environmental, social or sustainability reports
ii. Socially responsible investment has placed pressure on government to integrate social and environmental considerations into their working practices, and to adopt environmental management systems, creating greater pressure from clients for buildings with reduced running costs and more attractive and healthy working environments for their staff
iii. Planning authorities around the world are setting increasingly high standards for sustainability, adopting a strong sustainability strategy for all developments will save time and money when sustainability is required on individual developments.
iv. The UK Government in conjunction with BRE released the Code for Sustainable Homes rating scheme in April 2007, it is expected that this will become a mandatory

requirement in a few years and Code Level 3 is already stipulated by the Housing Corporation and English Partnerships for developments built on their land

Sustainable Architecture

Sustainable architecture is the design of sustainable buildings. Sustainable architecture attempts to reduce the collective environmental impacts during the production of building components, during the construction process, as well as during the lifecycle of the building (heating, electricity use, carpet cleaning etc.) This design practice emphasizes efficiency of heating and cooling systems; alternative energy sources such as solar hot water, appropriate building siting, reused or recycled building materials; on-site power generation - solar technology, ground source heat pumps, wind power; rainwater harvesting for gardening, washing and aquifer recharge; and on-site waste management such as green roofs that filter and control storm water runoff. This requires close cooperation of the design team, the architects, the engineers, and the client at all project stages, from site selection, scheme formation, material selection and procurement, to project implementation. Ji and Plainiotis (2006)

Sustainable architects design with sustainable living in mind. Holm (2006) Sustainable vs green design is the challenge that designs not only reflect healthy processes and uses but are powered by renewable energies and site specific resources. A test for sustainable design is — can the design function for its intended use without fossil fuel — unplugged. This challenge suggests architects and planners design solutions that can function without pollution rather than just reducing pollution. As technology progresses in architecture and design theories and as examples are built and tested, architects will soon be able to create not only passive, null-emission buildings, but rather be able to integrate the entire power system into the building design.

An essential element of Sustainable Building Design is indoor environmental quality including air quality, illumination, thermal conditions, and acoustics. The integrated design of the indoor environment is essential and must be part of the integrated design of the entire structure.

Principles of Sustainable Design

While the practical application varies among disciplines, some common principles are as follows:

i. Low-impact materials: choose non-toxic, sustainably produced or recycled materials which require little energy to process
ii. Energy efficiency: use manufacturing processes and produce products which require less energy
iii. Emotionally durable design: reducing consumption and waste of resources by increasing the durability of relationships between people and products, through design
iv. Design for reuse and recycling: "Products, processes, and systems should be designed for performance in a commercial 'afterlife'. Anastas & Zimmerman (2003).
v. Design impact measures for total carbon footprint and life-cycle assessment for any resource used are increasingly required and available. Vallero & Brasier (2008), Sustainable Design.
vi. Sustainable design standards and project design guides are also increasingly available and are vigorously being developed by a wide array of private organizations and individuals. There is also a large body of new methods emerging from the rapid development of what has become known as 'sustainability science' promoted by a wide variety of educational and governmental institutions.

vii. Biomimicry: "redesigning industrial systems on biological lines ... enabling the constant reuse of materials in continuous closed cycles… Hawken, Lovins, & Hunter Lovins (1999). Natural Capitalism
viii. Renewability: materials should come from nearby (local or bioregional), sustainably managed renewable sources that can be composted when their usefulness has been exhausted.
ix. Robust eco-design: robust design principles are applied to the design of a pollution sources. Ben-Gal et al., (2007)

Sustainable planning

Urban planners that are interested in achieving sustainable development or sustainable cities use various design principles and techniques when designing cities and their infrastructure. These include Smart Growth theory, Transit-oriented development, sustainable urban infrastructure and New Urbanism. Smart Growth is an urban planning and transportation theory that concentrates growth in infill sites within the existing infrastructure of a city or town to avoid urban sprawl; and advocates compact, transit-oriented development, walkable, bicycle-friendly land use, including mixed-use development with a range of housing choices.

Sustainable landscape and garden design

Sustainable landscape architecture is a category of sustainable design and energy-efficient landscaping concerned with the planning and design of outdoor space. Plants and materials may be bought from local growers to reduce energy used in transportation. Design techniques include planting trees to shade buildings from the sun or protect them from wind, using local materials, and on-site composting and chipping not only to reduce green waste hauling but to increase organic matter and therefore carbon in the soil.

Samples of Sustainable Designs

The term sustainable is thrown about quite a bit these days, but there's more to it than adding some solar panels to the roof of an inefficient building and calling it a day. True sustainability is made up of many facets, from building materials to the use of renewable energy sources to design that strives for efficiency and harmony with the surrounding environment. Below are few selections of sustainable buildings with element of sustainable design criteria.

Waste

The Waste House is a sustainable construction project installed at the UK's University of Brighton. As its name suggests, the prototype home is built *almost* exclusively from discarded waste. Around 90 percent of the materials that went into making the Waste House derive from household and construction waste, including 20,000 toothbrushes, 4,000 DVD cases, 2,000 floppy discs, and 2,000 used carpet tiles, used to clad the home's facade. While nobody actually lives in it at present, the building is a remarkable achievement and proves the organizer's mantra that "there is no such thing as waste, just stuff in the wrong place."

S House

Vietnam's Vo Trong Nghia Architects has been tinkering away at the issue of providing practical, sustainable, and most importantly, cheap, homes. The result is the S House, a US$4,000 dwelling part-built using local, easily-obtained materials, including Palm leaf thatching and bamboo.

Fall House

San Francisco's Fougeron Architecture recently designed and built a particularly beautiful luxury house that's guaranteed to make the neighbours see green. Located on California's Big Sur coastline, the Fall House sports a copper facade that will weather and patina over time, as it comes into contact with the sea air. The copper is also designed to offer a degree of fire-

protection. In addition to its enviable looks and views, the two-story Fall House features energy-efficient windows and its open design naturally encourages stack ventilation, automatically opening windows help reduce the need for air-conditioning. A grey water recycling system is also installed.

ZEB Pilot House

The ZEB Pilot House, by international architecture outfit Snøhetta is a remarkable experimental home that makes an even more remarkable claim: thanks to incredible efficiency and ample solar panels, it's said to generate almost three times the amount of electricity it requires.

Pop-Up House

Whatever kind of home you live in, the chances are it took longer to build than the Pop-Up House, by French architecture firm Multipod, which was erected by a team of builders in just four days with no more tools than a screwdriver. The firm likens the construction process to building with Lego.

Tight house

Said to be the first certified Passive House in New York City, Tighthouse represents an impressive energy-efficient renovation of an existing row house that's over a hundred years old. Architectural design firm Fabrica718 added a new rear facade, an additional story, a roof terrace, and an art studio to the house. Sustainable technology installed includes two solar thermal panels for hot water needs, and solar PV panels, which reduce grid-based electricity requirements. As the home is almost air-tight, a highly-efficient heat recovery ventilation system (HRV) is always running to provide plenty of fresh air.

Blooming Bamboo

Like Vo Trong Nghia Architects, Vietnamese firm H&P Architects has also produced a prototype home that will eventually be mass-sold to Vietnamese people on a low income. However, this particular home is also flood-proof. The Blooming Bamboo house is placed on stilts and designed to withstand floods of up to 1.5 m (5 ft) in depth, though H&P Architects hopes to increase this to 3 m (10 ft).

Illawarra Flame

Students from Australia's University of Wollongong took a typical Australian "fibro house," and retrofitted it with enough sustainable technology to make the notoriously energy-hungry style of home into a net-zero houses. The Illawarra Flame house project involved a lengthy renovation process, including transforming a bedroom into a living space, and the installation of prefabricated pods which contain amenities including laundry room and bathroom.

Z6 House

The Z6 House in California is all about innovative and convenient sustainable design. In fact, the name itself is based on the philosophy of achieving zero levels across key areas: waste, energy, carbon emissions, water and ignorance. Essentially, the Z6 house is a combination of every sustainable method of construction, and the result is not only a zero waste home, but a stylish looking one too. The building makes heavy use of solar power and this is responsible for around 70% of its energy use. Through other luxuries such as solar powered water heaters and heated floorboards, the Z6 house makes the best of natural resources.

Z6 House
Source: www.aiatopten.org

The Change Initiative

Located in Dubai, TCI is officially the most sustainable commercial building in the world to date. The building itself is a shop that provides sustainable solutions, so we certainly know that it practices what it preaches. While most of the materials used to create TCI is recyclable (including the water they use), the roof is equipped with solar panels and heat-reflective paint which provides 40% of the building's energy, and the outer structure has three times the insulation of your average building. The building's logo is a clever play on the 'on switch,' reinforcing the circuitous nature of sustainable living.

The Change Initiative
Source: www.bigprojectme.com

Pixel

Pixel was the most sustainable commercial building in the world before TCI knocked it from the top spot, so it's certainly worthy of note. Built in Australia, it was the first building to ever be granted a perfect Green Star score and set precedence for sustainable architecture in the country. Pixel itself is a small office building that makes use of several innovations for sustainability, including a sun shade system that lets natural light into the office whilst reducing glare and heat. The building even generates its own electricity through the use of wind turbines. It's also fair to say that the design is pretty striking; certainly one to be remembered.

The Change Initiative
Source: www.greenbiz.com

The Experience of Building Research Establishment (BRE) Innovation Park, Watford, United Kingdom

Created in 2005, The Building Research Establishment (BRE) Innovation Park has some of the world's most sustainable buildings, landscape designs and many innovative low carbon products, materials and technology. It is an independent research-based consultancy, testing, certification and training organisation, offering expertise in every aspect of the built environment.

Recommendation

The adoption of urban design principles can contribute significantly to a safer environment. Development schemes could incorporate measures in their design, layout, siting and landscaping to minimise the risk of crime and maximise security. Blank walls and parts of buildings such as loading bays, which cannot contribute to passive surveillance, should not face onto public space but should be placed at the backs of blocks. The adoption of the 'perimeter block' layout can support these measures, comprising frontages where the public realm is readily overlooked from adjacent properties and the rear gardens are private

Secure areas which are difficult for third parties to access. The following issues should be considered when designing a safe development:

i. Opportunities to incorporate passive surveillance of streets, spaces, parking and servicing areas
ii. Strong demarcation between public and private space
iii. Public areas are well lit and landscaping does not obscure views into and out of the space
iv. Developments are constructed of vandal resistant materials, and that maintenance arrangements are in place
v. Installation of sprinkler systems and hard wire smoke alarms where feasible
vi. All Designs to be developed must have satisfied the principles of sustainable designs before been approved for development by the various approval bodies in the country
vii. More discussion on sustainable design, sustainable living, sustainable materials, sustainable construction etc. should be carried out in architecture schools, NIA/ARCON organised events; this will create more awareness on sustainable living in the built environment within country.
viii. Nigerian architectural education should be a conscious process which entails effort towards development of skills, knowledge, attitudes and information for the improvement of our architecture within our cultural realm.

CONCLUSION

For any progress to be made in entrenching sustainable Design through design and constructing buildings that are sustainable, we in turn are allowing the building's inhabitants to lead more sustainable lives. Building occupiers will experience lower fuel and water bills, healthier living conditions and draw comfort from the fact that they are helping to protect the environment. While responsible development can ensure that resources are protected and carbon emissions reduced over the lifetime of the building, occupiers can deliver further environmental benefits by choosing to live sustainable lifestyles. However, without the provision of appropriate facilities or information, these options can be restricted or even withdrawn altogether. We need buildings that can breathe naturally, not sick buildings. Let us now design with nature, an architecture deeply rooted in our culture and traditions. That is the architecture of our time.

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GSM and us: Evolution, Trend, Challenges and Solutions

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ABSTRACT

Communication is the process of sharing ideas, information and messages with others in a particular time and place. It includes writing, talking, as well s non-verbal communications (facial expression, body language or gestures), visual communications telephone calls, email, cable television or satellite broadcasts). In order to provide advanced and efficient way of communication, the GSM technology has emerged from a cell-based mobile system at Bell Laboratories in the early 1970s. It is a circuit-switched system that divides each 200 KHz channel into eight 25 KHz time-slot. This digital technology has evolved over the year. The impact is that the globe has been miniaturized into a mere village as never before. There are however its inherent challenges. These, notwithstanding, with time and much effort, more discoveries will be integrated into the GSM technology for much more communications. This research was designed to examine the origin, developments, benefits and challenges of the GSM with aim of improving the technology. The secondary sources of data collection were used in obtaining relevant data and information where a study of wireless communications including analog and digital system was carried out and special attention was given to GSM as a digital communication system which is the topic under review.

Keywords: GSM technology, cell-based, circuit-switched, digital technology and miniaturized

HISTORY OF GSM

Before the advent of the GSM networks, there were public mobile radio networks or cellular networks. Cellular mobile communications systems use a large number of low-power wireless transmitters to create cells which is the basic geographic service area of a wireless communications system. Variable power levels allow cells to be sized according to the region. They normally used analog technologies in which signals propagate through the medium as continuously varying electromagnetic waves. These technologies however vary from country to country and from manufacturer to manufacturer.

According to Adam (2011), the idea of the first cellular network was brainstormed in 1947. It was intended to be used for military purposes as a way of supplying troops with more advanced forms of communications. From 1947 till about 1979 several different forms of broadcasting technology emerged. The United States began to develop the AMPS (Advanced Mobile Phone Service) network, while European countries were developing their own forms of communication. However, when Europeans quickly realized the disadvantages of each country operating on their mobile network such as incompatibility of cell phone use from country to country within Europe, they came together to resolve the issue. Global System for Mobile Communications, originally "Groupe Spécial Mobile", is a standard developed by the European Telecommunications Standard Institute (ETSI) to describe protocols for second-generation (2G) digital cellular networks used by mobile phones. In 1982, work began to develop a European standard for digital telephony when the European Conference of Postal and Telecommunications Administrations (CEPT) created the Groupe Spécial Mobile committee and later provided a permanent technical support group based in Paris. Five years later in 1987, fifteen representatives from thirteen European countries signed a memorandum of understanding in Copenhagen, Denmark, to develop and deploy a common cellular

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telephone system across Europe and EU rules were passed to make GSM a mandatory standard eventually resulted in a unified open, standard-based network which was larger than that in the U.S.A.

In February 1987, Europe produced the very first agreed GSM technical specification. Ministers from the four big EU countries cemented their political support for GSM with the Bonn Declaration on Global Information Networks in May, 1987 and the GSM memorandum of understanding drew mobile operators from across Europe to pledge to invest in new GSM networks to an ambiguous common date. It got GSM up and running fast. France and Germany had earlier in 1984 signed a joint development agreement while Italy and UK joined them in 1986. The initial release of GSM was called GSM Phase I, and it is commonly referred to as the first generation. This release made provision for the basic voice, SMS and circuit switched Date (CSD) services. CSD allow a maximum data rate of 9.6kbs and was capable of fax transmission as well. Supplementary services at that point were very basic consisting of call forward and called barring capabilities. The second generation (GSM Phase 2) was released in 1995 and provided enhanced supplementary services, amongst which were Calling Line Identity (CLI), call waiting and multiparty services. Data services however remained limited to 9.6kbs. GSM Phase 2+ was an enhancement to GSM Phase 2 and was released two years later in 1997. Realizing the need for enhanced data service, Phase 2+ addressed this requirement by making provision for High Speed Circuit Switched Data (HSCSD) and General Packet Radio Services (GPRS). HSCSD and GPRS allowed maximum data rates of 48kbs and 177kbs respectively.

The world's first GSM call was made by the former Finnish Prime Minister, Harri Holkeri to Kaarina Suonio, and the Mayor of Tampere on July 1st, 1991 on a network built by Telenokia and Siemens and operated by Radiolinja. In 1992, the first short messaging service (s.m.s) or text message was sent and Vodafone UK and Telecom Finland signed the first international roaming agreement. In the same 1991, work began to expand the GSM standard from the initial 900MHz reserved spectrum band for GSM to the 1800MHz frequency band. Consequently, the first 1800MHz network became operational in the UK by 1993. In that same year, Telecom Australia was the first network operator to deploy a GSM network. As a result of this, the first practical hand-held GSM mobile phone became available. In 1995, facsimile (fax), data and s.m.s messaging services were launched commercially. Also, the first 1900MHz GSM network became operational in the US. This made the GSM subscribers worldwide to exceed 10 million. In the same year, the GSM Association was formed. In 1996, pre-paid GSM Subscriber Identification Module (s.i.m) cards were launched. In 1998, the global or worldwide GSM subscribers surpassed 100 million.

THE MILLENIUM ADVANCEMENTS

By 2000, the first commercial General Packet Radio Services (GPRS) were launched. Also, the first GPRS-compatible handsets became available for commercial purposes. However, in 2001, the first Universal Mobile Telecoms System (UMTS) Wideband Code Division Multiple Access (WCDMA) network was launched which is a 3G technology that is not part of GSM. Similarly, the global subscribers surpassed 500 million. In 2002, the first multimedia messaging service (m.m.s) was introduced and the first GSM network in the 800MHz frequency band became operational. In 2003, Enhanced Data rates for GSM Evolution (EDGE) services first became operational in a network. By 2004, the global GSM subscribers exceeded 1 billion. Also, by 2005, GSM networks provided more than 75% of the global cellular network market with 1.5 billion subscribers. In the same year, the first High-Speed Digital Packet Access (HSDPA)-capable network also became operational. In 2007, the first High-Speed Uplink Packet Access (HSUPA) network was launched. It will be noted

that High-Speed Packet Access (HSPA) and its up and downlinks versions are 3G technologies, not part of GSM. In 2008, worldwide GSM subscribers exceeded 3 billion. In 2010, the GSM Association estimated that technologies defined in the GSM standard serve about 80% of the global market, encompassing more than 5 billion people across more than 212 countries and territories, thus making GSM the most universal of the many standards for cellular networks.

It will be noted that GSM is a 2G standard that employs Time-Division Multiple- Access (TDMA) spectrum-sharing, issued by the European Telecommunications Standard Institute (ETSI). Also, the GSM standard does not include the 3G Universal Mobile Telecommunications Service (UMTS) Code Division Multiple Access (CDMA)-based technology or the 4G Long Term Evolution (LTE)-based technology issued by the 3rd Generation Partnership Project (3GPP). Following the ETSI's adoption of GSM standard in 1991, the GSM is now used in about 210 countries and has included both the CDMA and TDMA/FDMA radio spectra. Thus the GSM allows eight concurrent calls on same radio frequency. It operates on four special frequencies worldwide. However, some countries like Macau planned to phase out its 2G GSM networks by June, 2015, making it the first region to decommission a GSM network. Singapore intends to phase out 2G services by 2017.

The Structure of a GSM Network

The GSM is a cellular network. This means that the cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network; namely: macro, micro, pico, femto and umbrella cells. The coverage area of each cells varies according to the implementation environ.

i. Macro cells: These can be regarded as the cells where the base station antenna is installed on a mast or a building above average rooftop level.
ii. Micro cells: These are cells whose antenna height is under average rooftop level. They are usually used in urban areas.
iii. Pico cells: These are small cells whose coverage diameter is a few dozen meters. They are usually used indoors.
iv. Femto cells: These are cells designed for use in residential or small business environments. They connect to the service provider's network via a broadband Internet connection.
v. Umbrella cells: These are used to cover shadowed areas or regions of smaller cells. They fill in gaps in coverage between those cells.

Cell horizontal radius varies depending on antenna height, antenna gain and propagation conditions from a couple of hundred meters to several tens of kilometers. The longest distance the GSM specification supports practically is 35 KM or about 22 miles. There are also several implementations of the concept of an extended cell where the cell radius could be doubled or even more depending on the antenna system, the terrain type and the timing advance.

GSM also supports indoor coverage and may be achieved by the use of an indoor pico cell base station or an indoor repeater. These are usually deployed when significant call capacity is needed indoors such as in shopping centers or airports. However, this is not a prerequisite since indoor coverage is also provided by in-building penetration of the radio signals from any nearby cell.

GSM Architecture

A GSM network comprises of many functional units. The network can be broadly divided into:

i. The Mobile Station (MS)
ii. The Base Station Subsystem (BSS)

iii. The Network Switching Subsystem (NSS)
iv. The Operation Support Subsystem (OSS)

Given below is a simple pictorial view of the GSM architecture:

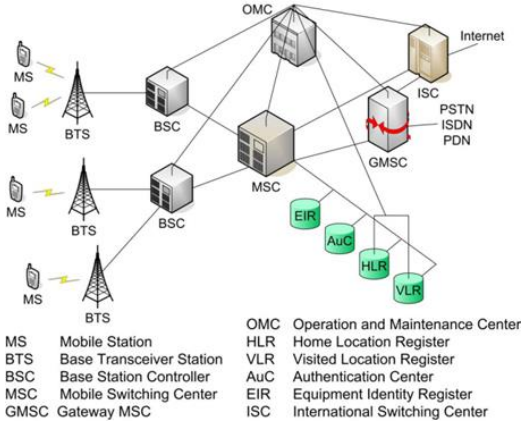

Figure 1: GSM Architecture

The additional components of the GSM architecture comprise of databases and messaging systems' functions:

i. Home Location Register (HLR)
ii. Visitor Location Register (VLR)
iii. Equipment Identity Register (EIR)
iv. Authentication Center (AuC)
v. SMS Serving Center (SMS SC)
vi. Gateway MSC (GMSC)
vii. Chargeback Center (CBC)
viii. Transcoder and Adaptation Unit (TRAU)

The following diagram shows the GSM network along with the added elements:

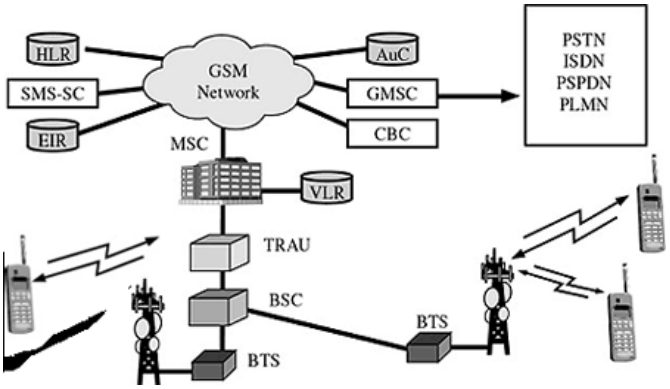

Figure 2: The GSM network along with the added elements

The MS and the BSS communicate across the Um interface. It is also known as the *air interface* or the *radio link*. The BSS communicates with the Network Service Switching (NSS) center across the *A* interface.

GSM User Services

GSM offers much more than just voice telephony. It offers three basic types of services:

i. Telephony services or teleservices
ii. Data services or bearer services
iii. Supplementary services

Teleservices

The abilities of a Bearer Service are used by a Teleservice to transport data. These

services are further transited in the following ways:

Voice calls
The most basic teleservice supported by GSM is telephony. This includes full-rate speech at 13 kbps and emergency calls, where the nearest emergency-service provider is notified by dialing three digits.

Videotext and Facsimile
Another group of teleservices includes Videotext access, Teletex transmission, Facsimile alternate speech and Facsimile Group 3, Automatic facsimile Group 3, etc.

Short text messages
Short Messaging Service (SMS) service is a text messaging service that allows sending and receiving text messages on your GSM mobile phone. In addition to simple text messages, other text data including news, sports, financial, language, and location-based data can also be transmitted.

Bearer services
Data services or Bearer Services are used through a GSM phone. to receive and send data is the essential building block leading to widespread mobile Internet access and mobile data transfer. GSM currently has a data transfer rate of 9.6k. New developments that will push up data transfer rates for GSM users are HSCSD (high speed circuit switched data) and GPRS (general packet radio service) are now available.

Supplementary services
Supplementary services are additional services that are provided in addition to teleservices and bearer services. These services include caller identification, call forwarding, call waiting, multi- party conversations, and barring of outgoing (international) calls, among others. A brief description of supplementary services is given here:

i. **Conferencing:** It allows a mobile subscriber to establish a multiparty conversation, i.e., a simultaneous conversation between three or more subscribers to setup a conference call. This service is only applicable to normal telephony.
ii. **Call Waiting:** This service notifies a mobile subscriber of an incoming call during a conversation. The subscriber can answer, reject, or ignore the incoming call.
iii. **Call Hold:** This service allows a subscriber to put an incoming call on hold and resume after awhile. The call hold service is applicable to normal telephony.
iv. **Call Forwarding:** Call Forwarding is used to divert calls from the original recipient to another number. It is normally set up by the subscriber himself. It can be used by the subscriber to divert calls from the Mobile Station when the subscriber is not available, and so to ensure that calls are not lost.
v. **Call Barring:** Call barring is useful to restrict certain types of outgoing calls such as ISD or stop incoming calls from undesired numbers. Call barring is a flexible service that enables the subscriber to conditionally bar calls.
vi. **Number Identification:** There are following supplementary services related to number identification:
vii. **Calling Line Identification Presentation:** This service displays the telephone number of the calling party on your screen.
viii. **Calling Line Identification Restriction:** A person not wishing their number to be presented to others subscribes to this service.
ix. **Connected Line Identification Presentation:** This service is provided to give the calling party the telephone number of the person to whom they are

connected. This service is useful in situations such as forwarding where the number connected is not the number dialed.

x. **Connected Line Identification Restriction:** There are times when the person called does not wish to have their numbers presented and so they would subscribe to this person. Normally, this overrides the presentation service.

xi. **Malicious Call Identification:** The malicious call identification service was provided to combat the spread of obscene or annoying calls. The victim should subscribe to this service and then they could cause known malicious calls to be identified in the GSM network, using a simple command.

xii. **Advice of Charge (AoC):** This service was designed to give the subscriber an indication of the cost of the services as they are used. Furthermore, those service providers who wish to offer rental services to subscribers without their own SIM can also utilize this service in a slightly different form. AoC for data calls is provided on the basis of time measurements.

xiii. **Closed User Groups (CUGs):** This service is meant for groups of subscribers who wish to call only each other and no one else.

xiv. **Unstructured Supplementary Services Data (USSD):** This service allows operator-defined individual services.

Benefits of GSM

i. It provides easier and efficient communication: Since this service is in most countries, it is quite easy to communicate anywhere in the world through roaming capabilities.

ii. Emergency Response: 112 is now a universal number among GSM networks. Other things being equal, no matter where a user is, he can call for help using this code.

iii. Universal Data Transfer: it allows for reliable and efficient data transfer. With the developments of many apps, sounds, pictures and graphics can be sent and shared.

iv. Better Sound: As a digital carrier, a GSM cell phone makes for clearer connections, as it can filter background noise, attenuations and distortions. This makes communications despite the distance.

v. Technological Growth: The universality of GSM has enhanced the growth of communications technology. This has lead to a reliable cell phone service and improved quality in both connection stability and ease.

vi. Greater Job provider: Being the highest employer of labour, the GDP is enhanced. The GSM also stands out with its range of services from health, education, research, economic, social and other human endeavours.

Some Challenges and Solutions to Gsm Security Issues

Recently, the mobile industry has experienced an extreme increment in number of its users. The GSM network with the greatest worldwide number of users succumbs to several security vulnerabilities. Although some of its security problems are addressed in its upper generations, there are still many operators using 2G systems. The GSM has experienced gradual improvements that leaded to several versions such as GSM1800, HSCSD (High Speed Circuit Switched Data), EDGE (Enhanced Data rates for GSM Evolution), and GPRS (General Packet Radio Service). The GSM improvements are continued to 3G systems such as UMTS. It is believed that the GSM has many inherent security flaws and some of its security flaws are addressed in the upper generations such as UMTS. However, many operators especially in the developing countries are still using the traditional GSM network that succumbs to several security flaws. This paper provides a brief and complete review of

the GSM security flaws, and some applicable solutions to improve the security of currently available GSM systems.

Security Architecture of the GSM

The security architecture of GSM was originally intended to provide security services such as anonymity, authentication, and confidentiality of user data and signaling information. The security goals of GSM are as follows:

i. Authentication of mobile users for the network
ii. Confidentiality of user data and signaling information
iii. Anonymity of subscriber's identity
iv. Using SIM (Subscriber Identity Module) as a security module

The Mobile Station (MS) consists of the Mobile Equipment (ME), and the SIM card. The SIM is a cryptographic smart card with the GSM specific applications loaded onto it. As a smart card, it has some inherent security functions specified to smart cards. Its operating system and chip hardware have several security attributes. SIM includes all the necessary information to access the subscriber's account. IMSI and Ki are stored on every SIM. IMSI is the International Mobile Subscriber Identity with at most 15 digits uniquely devoted to every mobile subscriber in the world. Ki (Individual subscriber authentication Key) is a random 128-bits number that is the root cryptographic key used for generating session keys, and authenticating the mobile users to the network. Ki is strictly protected and is stored on the subscriber's SIM, and AuC.

The SIM is itself protected by an optional Personal Identification Number (PIN). Each user is requested to enter the PIN unless this feature is deactivated by the user. After a number of invalid attempts that is usually 3 times, the SIM locks out the PIN, and the PUK (PIN UnlocK) is then requested. If the PUK is also incorrectly entered for a number of times that is usually 10 times, the SIM refuses local accesses to its privileged information and authentication functions, and makes itself useless. Authentication and confidentiality of user data are in deposit of the secrecy of IMSI and Ki. With disclosure of such numbers, anyone can impersonate a legitimate user. A3 and A8 algorithms are also implemented on every SIM. This means that each operator can determine and change such algorithms independent of other operators and hardware manufacturers.

Therefore, the authentication will work when a user is roaming on other countries or operators since the local network will query the HLR of the home network for the results and does not need to know the A3/A8 algorithm of the home network. A3 is mainly used for authenticating users to the network while A8 is used for generating the session key of encryption Kc. The network sends a random challenge to the user so that SIM produces Kc and SRES. After user authentication, the network can order the phone to start the encryption by using the generated session key Kc. The cryptographic algorithms are implemented on the hardware of mobile phones. The network can choose from up to 7 different encryption algorithms (or the mode of no ciphering) but it should choose an algorithm that is implemented on the phones. A class mark message has been earlier specified the phone's capabilities to the network.

Three algorithms are generally available: A5/1, A5/2, and A5/3. A5/1 and A5/2 are two stream ciphers originally defined by the GSM standards. A5/1 is stronger but it is subject to export control and can be used by those countries that are members of CEPT. A5/2 is deliberately weakened to be deployed by the other countries. The use of such algorithms is controlled by the GSM Memorandum of Understanding (MoU). A5/3 is a block cipher based

on the Kasumi algorithm that is defined by the 3GPP at 2002 and can be supported on dual-mode phones that are capable of working on both 2G and 3G systems.

The GSM authentication, session key generation, and encryption processes are depicted in Figure 3 below:

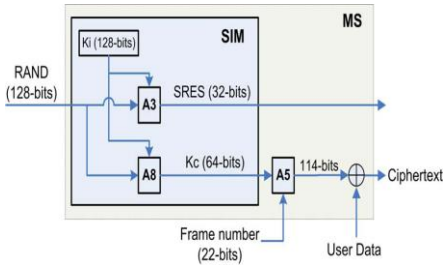

Figure 3: GSM authentication, session key generation and ciphering

The anonymity in the GSM is provided by replacing the use of IMSI with a 32-bit Temporarily Mobile Subscriber Identity (TMSI). TMSI is typically handled by the VLR and is valid in a particular Location Area (LA) and will be updated at least in every location update procedure. It is also stored on the subscriber's SIM and prevents an eavesdropper to track a particular subscriber.

Challenges to the GSM Security

The openness of wireless communications makes the communicating parties more vulnerable to the security threats. Although GSM tried to harden the interception by using several techniques such as frequency hopping, the real-time interception of the exchanged information is completely practical. Currently, there are commercial equipment capable of simultaneously intercepting several collocated subscribers. While GSM was intended to be a secure wireless system and considered the user authentication and over-the-air encryption, it is completely vulnerable to several attacks, each of them aiming a part of network. Hereunder, the most important security flaws of the GSM are briefly listed. Several practical scenarios can also be deployed to misuse such vulnerabilities that are neglected for the case of brevity.

i. *Unilateral authentication and vulnerability to the man-in-the-middle attack:* This is the network that authenticates users. The user does not authenticate network so the attacker can use a false BTS with the same mobile network code as the subscriber's legitimate network to impersonate himself and perform a man-in-the-middle attack. The attacker can then perform several scenarios to modify or fabricate the exchanged data. At the designing phase of the GSM protocols, this kind of attack seemed impractical due to costly required equipment. Currently, this kind of attack is completely applicable due to the decreased costs.

ii. *Flaws in implementation of A3/A8 algorithms:* Although the GSM architecture allows operator to choose any algorithm for A3 and A8, many operators used COMP128 (or COMP128-1) that was secretly developed by the GSM association. The structure of COMP128 was finally discovered by reverse engineering and some revealed documentations, and many security flaws were subsequently discovered. In addition to the fact that COMP128 makes revealing Ki possible especially when specific challenges are introduced, it deliberately sets ten rightmost bits of Kc equal to zero that makes the deployed cryptographic algorithms 1024 times weaker and more vulnerable, due to the decreased key space. Some GSM network operators tried another new algorithm for the A3/A8, called COMP128-2. COMP128-2 was also secretly designed and inherited the problem of decreased key space. Despite of such important problem, no other problems are reported so far. However, we can prospect

for new discovered vulnerabilities in the future as it is secretly designed. An improved version of COMP128-2, called COM128-3, is also proposed that generates 64 bits of session key and resolves the problem of decreased key space.

iii. *SIM card cloning:* Another important challenge is to derive the root key Ki from the subscriber's SIM. In April 1998, the Smartcard Developer Association (SDA) and the ISAAC research group could find an important vulnerability in the COMP128 algorithm that helped them to extract Ki in eight hours by sending many challenges to the SIM. Subsequently, some other schemes were proposed that were based on the chosen challenges and were capable of extracting Ki in fewer times. Ultimately, a side-channel attack, called partitioning attack, was proposed by the IBM researchers that makes attacker capable of extracting Ki if he could access the subscriber's SIM just for one minute [9]. The attacker can then clone the SIM and use it for his fraudulent purposes. The COMP128 algorithm needs large lookup tables that would leak some important information via the side channels when it is implemented on a small SIM.

iv. *Over-the-air cracking:* It is feasible to misuse the vulnerability of COMP128 for extracting the Ki of the target user without any physical access to the SIM. This can be accomplished by sending several challenges over the air to the SIM and analyzing the responses. However, this approach may take several hours. The attacker can also extract IMSI using an approach that will be explained later. After finding Ki and IMSI of the target subscriber, the attacker can clone the SIM and make and receive calls and other services such as SMS in the name of the victim subscriber. However, the attacker will encounter with a slight problem. The GSM network allows only one SIM to access to the network at any given time so if the attacker and the victim subscriber try to access from different locations, the network will realize existence of duplicated cards and disables the affected account.

v. *Flaws in cryptographic algorithms:* Both A5/1 and A5/2 algorithms were developed in secret. The output of A5/1 is the XOR of three LFSRs. An efficient attack to A5/1 that can be used for a real-time cryptanalysis on a PC includes two kinds of attacks. The former that requires the first two minutes of eavesdropped encrypted conversation is capable of extracting the ciphering key in about one second, while the latter just needs two seconds of encrypted conversation to extract the ciphering key in several minutes. A5/2 is the deliberately weakened variant of A5/1. An efficient attack to A5/2 requires less than one second of encrypted conversation to extract the ciphering key in less than one second on a PC.

vi. *Short range of protection:* The encryption is only accomplished over the airway path between MS and BTS. There is not any protection over other parts of network and the information is clearly sent over the fixed parts. This is a major exposure for the GSM, especially when the communication between BTS and BSC is performed over the wireless links that have potential vulnerabilities for interception. In some countries, the encryption facility of the air interface is not activated at all. There are also security problems on the GSM backbone. The deployed Signaling System no.7 (SS7) has also several security vulnerabilities. The messages in the current SS7 system is so that they can be modifies or even fabricated into the global SS7 system in an uncontrolled manner. SS7 incorporates very limited authentication procedures since it was originally designed for the closed telecommunication communities. The interconnection with Internet can also have its potential vulnerabilities. Additional vulnerabilities will be arisen when SS7 systems are interconnected using the Internet. Remote management of the GSM backbone elements that can be conducted by connecting them to the IP networks can also introduce additional vulnerabilities. If the

HLR and AuC are physically separated, it can be a new point of vulnerability since the authentication triplets may be obtained from AuC by masquerading as another system entity, e.g. a HLR. Unauthorized accesses to HLR, AuC, and MSC will also cause several problems.

vii. *Lack of user visibility:* The ciphering is controlled by the BTS. The user is not alerted when the ciphering mode is deactivated. A false BTS can also deactivate the ciphering mode and force MS to send data in an unencrypted manner.

viii. *Leaking the user anonymity:* Whenever a subscriber enters a location area for the first time or when the mapping table between the subscriber's TMSI and IMSI is lost, the network requests the subscriber to clearly declare the IMSI. This can be misused to fail the user's anonymity and can be accomplished by sending an IDENTITY REQUEST command from a false BTS to the MS of the target user to find the corresponding IMSI.

ix. *Vulnerability to the DoS attack:* A single attacker is capable of disabling an entire GSM cell via a Denial of Service (DoS) attack. The attacker can send the CHANNEL REQUEST message to the BSC for several times but he/she does not complete the protocol and requests another signaling channel. Since the number of signaling channels is limited, this leads to a DoS attack. It is feasible since the call setup protocol performs the resource allocations without adequate authentication. This attack is economical since it does not have any charge for the attacker. It can also be used for many practical situations such as terrorist attacks.

x. *Absence of integrity protection:* Although the GSM security architecture considers authentication and confidentiality, there is no provision for any integrity protection of information [2]. Therefore, the recipient cannot verify that a certain message was not tampered with.

xi. *Vulnerability to replay attacks:* The attacker can misuse the previously exchanged messages between the subscriber and network in order to perform the replay attacks.

xii. *Increased redundancy due to the coding preference:* The Forward Error Correcting (FEC) is performed prior to the ciphering so there is a redundancy that increases the security vulnerabilities of deployed cryptographic algorithms.

Security of Transport Channels

The GSM network has some transport channels: *Short Message Service* (SMS), *Unstructured Supplementary*

Service Data (USSD), *Wireless Application Protocol* (WAP), and the voice channel. There are also some newer services such as *Enhanced Messaging Service* (EMS) and *Multimedia Messaging Service* (MMS) that have been added in the GSM upgrades. The security flaws described in the previous section are commonly applicable to all the services and transport channels since they aim all the exchanged data and signaling information. However, in addition to such common flaws, some of GSM transport channels have some extra problems and vulnerabilities. The SMS messaging has some extra security vulnerabilities due to its store-and-forward attribute, and the problem of fake SMS that can be conducted via the Internet. When a user is roaming, the SMS content passes through different networks and perhaps the Internet that exposes it to various vulnerabilities and attacks. Another concern is arisen when an adversary gets access to the phone and reads the previous unprotected messages. The USSD that is a session-oriented technology is also vulnerable to attacks since the messages are not encrypted and secured on the GSM backbone. The WAP allows ME to connect to the Internet. The WAP Gateway that resides between MS and Web server in the WAP architecture and acts as an interpreter between the Internet protocols (HTTP, SSL/TLS, and UDP/TCP/IP) and the corresponding WAP protocols (WSP/WTP, WTLS, and WDP),

introduces an additional security flaw in some implementations that is referred to as the WAP gap. Other concerns are arisen from security problems of the Internet as a huge uncontrolled network that is in contradiction with assumptions of the GSM security architecture in which the core network is assumed as a secure and controlled environment. The web servers may also download and execute malicious applets at the client (ME) so the safety of applets and other downloaded programs is another concern.

Solutions to the GSM Security Flaws

The GSM specifications have been revolutionized since its inception. In 2002, several efforts were done to design new cryptographic algorithms for GSM, ECSD, GPRS, and EGPRS that can be implemented on dual-mode phones. Ultimately, A5/3 for GSM and ECSD/EDGE, GEA3 for GPRS, and f8 for UMTS were proposed, all of them having a similar structure.

The security mechanisms of the GPRS are similar to that of the GSM. However, instead of using A5 algorithm, GPRS uses the GPRS Encryption Algorithm (GEA) that currently has three versions: GEA1, GEA2 and GEA3. In the GPRS, the end terminal of encryption is moved towards a deeper point in the network, i.e. the SGSN. Although the encryption is performed at the physical layer of the GSM, it is accomplished at the Logical Link Control (LLL) layer of the GPRS. The UMTS, in addition to its new offered applications, has scrutinized the GSM security problems and has resolved most of them. The main reason of GSM security problems was due to the fact that its security was provided by obscurity so the UMTS algorithms were openly designed. Consequently, its algorithms are not encountered with serious problems. Although some theoretical attacks are proposed, they are not practically feasible with the current technology. However, there are also some other problems related to the deployed protocols.

Regardless of security improvements in the upper generation networks, it is necessary to provide solutions to improve the security of the currently available 2G systems. Hereunder, some practical solutions are proposed for this purpose. They are:

i. *Using secure algorithms for A3/A8 implementations:* This can thwart the dangerous SIM card cloning attack. This solution is profitable since the network operators can perform such improvement themselves and without any need to the software and hardware manufacturers or the GSM consortium. However, this solution requires providing and distributing new SIM cards and modifying the software of the HLR. Currently, both COMP128-2 and COMP128-3 algorithms thwart the SIM card cloning and over-the-air cracking of Ki. Since COMP128-3 enhances the effective key length of the session key to further 10 bits, it allows the deployed cryptographic algorithm to have its nominal security. Although it is soon to judge on the real security of COMP128-2 and COMP128-3, they have apparent advantages over the traditional COMP128-1 that its SIM cloning apparatus are available at very low prices.
ii. *Using secure ciphering algorithms:* Operators can use newer and more secure algorithms such as A5/3 provided that such improvements are allowed by the GSM consortium. The deployed cryptographic algorithms should be implemented on both BTS and mobile phones. Any change to the cryptographic algorithms requires agreement and cooperation of software and hardware manufacturers since they should perform the appropriate changes to their products. Since the cryptographic algorithms should be implemented on the cellular phones, the agreement of mobile phone manufacturers is also required. However, a lonely upgrading of the deployed cryptographic algorithms cannot be so useful. Even though the ciphering algorithms are replaced with the strongest ones, the attacker can simply impersonate the real

network and force MS to deactivate the ciphering mode so it is also necessary to modify the authentication protocols.

iii. *Securing the backbone traffic:* Encrypting the backbone traffic between the network components can prevent the attacker to eavesdrop or modify the transmitted data. Although this solution may be implemented without the blessings of GSM consortium, the co-operation of hardware manufacturers is still required.

iv. *End-to-end Security:* The best, easiest, and most profitable solution is to deploy the end-to-end security or security at the application layer. Most of GSM security vulnerabilities (except SIM cloning and DoS attacks) do not aim at ordinary people. Their targets are usually restricted to special groups. So it is reasonable and economical that such groups make their communications secure by the end-to-end security. Since the encryption and security establishment is performed at the end-entities, any change to the GSM hardware will not be required. In this way, even if the conversation is eavesdropped by the police or legal organizations, they cannot decrypt the transmitted data without having the true ciphering key, provided that a secure enough cryptographic algorithm is deployed. Therefore, in order to avoid illegal activities, it should be transparent to both GSM operator and service provider. It may also be necessary to find solutions for a legal interception or a key screw scheme. The end-to-end security establishment has a complete flexibility to the deployed algorithms so the appropriate upgrades can be easily accomplished when necessary. However, it may be a subject to export control. Generally, the end-to-end security can be provided in the cellular systems by following one or some of the following approaches:

    a. Exploiting the processing capabilities of mobile phone using the programming languages such as J2ME (Java 2 Mobile Edition): Supported by the most recent cellular phones and Personal Digital Assistants (PDA) with the improved processing capabilities.
    b. Exploiting the processing capabilities of the SIM using the SIM Application Toolkit (SAT): Not supported by all SIM cards; especial SIM cards are required; the processing resources are still limited; and operations may be so time-consuming.
    c. Exploiting the processing capabilities of an additional smart card, e.g. JavaCard: Not supported by the usual phones; requires costly dual slot cellular phones.
    d. Exploiting the processing capabilities of a portable PC (laptop) connected to the ME: suitable for security mechanisms with huge processing and memory requirements, e.g. real-time end-to-end secure voice communications over the GSM voice channel.
    e. Exploiting the processing capabilities of a crypto processor that is embedded in the ME: It should be accomplished by the mobile manufacturer; cannot be changed or manipulated by the user; and may be a subject to export control. The first four approaches have an inherent advantage due to their capability of being simply manipulated by the end-entities. However, choosing the most profitable approach regards to some parameters such as required memory and processing resources of the corresponding application. For example, if the voice is to be end-to-end encrypted over the data channel, it can even be implemented by a software application that is installed on an advanced cellular phone. On the other hand, for encryption over the voice channel that is hard to be tracked and so attractive for the terrorist and illegal activities, the fourth approach may be

suitable. The end-to-end security can be established by both symmetric and asymmetric encryption. The asymmetric encryption is usually too slow to be used for the real-time applications and may be used for the key establishment of a symmetric encryption algorithm. The public keys are usually jointed with the certificates. The private keys and the certificates can be securely stored on either SIM card, an additional smart card (for the dual slot phones), or a secure hardware on the phone. There are also some proposals for the Wireless Public Key Infrastructure (WPKI).

CONCLUSIONS

The GSM has become a tool for economic, political and social interactions among people of all profession, classes and status. This research effort was aimed at tracing the origin, developments, challenges and the solutions to the greatest communications technology the GSM has become. There is no gainsaying that this super tech is as large as the services and benefits it provides. Its technology has challenges in infrastructure, installation, commissioning, management and optimization. Since there is no end to research to research, this work was able to focus on the security of the network which aims at providing efficient, seamless, secure and effective services. Further areas of research can be on the hardware infrastructure. If the solutions are critically and judiciously implemented, it will enhance better quality service delivery from the operators and better value for money spent by the subscribers.

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Evaluation of Different Plastering Materials for Mud Buildings

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ABSTRACT

This study evaluates two different plastering materials for mud buildings. Mud stabilized with straw was used to cast two types of bricks of 450 mm by 225mm by 225 mm dimension using steel and wooden moulds. Six (6) samples of bricks were tested for strength, using the hydraulic compression machine. Bricks were used to construct eight (8) walls and finished with mortar and plaster rendering materials. The first four walls have mud mortar with plaster varied with mud and sandcrete for wood and steel moulded bricks respectively. The last four have sandcrete mortars, with variation in the brick type and plaster. The walls were observed for strength, crack and peel. Cracks on the walls were measured by the use of thread while the wall strengths test was done by the use of rebound hammer method. The results showed that walls constructed with steel moulded bricks, bounded with mud mortar and plastered with sandcrete gives the highest strength and the least amounts of cracks. Walls constructed with wooden moulded blocks using mud mortar and plaster tends to give the least amount of peel. Result shows that the older the bricks, the greater the failure load and hence the greater the compressive strength. Mud stabilized with grass and used engine oil gave the highest compressive strength of 1.123 N/mm2. The amount and type of stabilizers also affects the strength of bricks. This can be seen as in the bricks made of paste stabilized with grass alone and that stabilized with grass and used engine oil. Also the more compacted the mould is, the more the weight of the brick. This might be the reason while the steel moulded bricks were higher than those of wooden bricks at all ages.

Keywords: Cracks, Mortar, Mud bricks, Strength, Wall

INTRODUCTION

Mud as alternative building material

The meteoric and continuous rise in the cost of building materials possesses strong challenges to the construction industry (Abagale and Twumasi, 2013). This challenge led many researchers into finding alternative cheap materials of construction. This challenge was further emphasized in the Nigerian New National Housing Policy, where it was stated that the nation should gradually and systematically develop appropriate capabilities to reduce construction cost and achieve self sufficiency in the production of basic building materials and components from local resources at affordable cost (Olusola, et. al., 2006). Low cost shelter can maintain good health of vulnerable lives in many places (Vatandoost et. al., 2009). Locally building materials commonly used are organic materials such as timbers, stalks, wood, bamboo, grasses, rubber and bitumen and inorganic materials such as concrete, sandcrete, iron, steel, earth (mud), rock, stone and lime (Alabadan, 2006, Alabadan, et. al., 2012 and Fawale, et.al., 2016). One of the available alternative materials is the mud. It is primarily the most readily available materials around. Mud is used in its pure state and mixed with straw to make it more resistance to water effect because of its structural limitation. It has high thermal capacity. Mud is cheaper and readily available, resistant to fire, easy to work, using simple tools and skills and a good noise absorbent.

Challenges of using mud as a building materials

Mud is characterized by failure through cracking, under scouring and shrinkage, poor in durability and hence required frequent routine maintenance on the walls. Mud is generally available in all locations but varies in its quality and strength from one location to another hence the need for stabilization to increase its resistance to weather conditions. Stabilizers

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include grasses, fibres, bitumen, ashes, termite hills, vegetable oil, lime, Portland cement, electrolyte solution of sodium silicate salts and soil compaction (UNCHS, 1986 and Ahmed, 1987).

Mud buildings are generally more relevant to the modern building than it sometimes looks. They are easy and less costly to build and their waste can re-integrate with the soil. Their weakness to wind and water can be improved, and an appropriate finishing to these buildings will improve appearance, durability and comfort. There is the need to improve the strength, quality of the mud and the life expectancy of the mud buildings and thereby reduce the cost of maintenance carried out every year to keep the structure stable and in good condition (Abagale and Twumasi, 2013).

The most common finishes are plastering for inside surface of a wall and rendering for outside surface of a wall. Both applications serve identical purposes to provide resistance to moisture penetration, increase the fire resistance, sound and thermal insulation properties of the wall, give a more pleasant appearance and protect the structural wall from rain and sand storms (Banda, 1981; Ragsdale and Raynham 1972).

Problems associated with plastering and rendering of mud buildings include cracks, crazing or hair cracks, shelling and bond Failure. A plaster based on Parkia biglobosa husk extract is cheaper and has been used by the Kasena-Nankana people of Northern Ghana (Abagale and Twumasi, 2013). The objectives of this study are to evaluate different plastering materials on mud walls and to suggest ways on how to reduce these effects of failure on mud building wall.

METHODOLOGY

Mixing and casting of mud bricks

Clay soil was obtained from Federal Polytechnic Kaura-Namoda, Zamfara State, Nigeria. The mud paste was made by mixing the clay with water and treaded upon. Straw was added as stabilizers to the mud paste at different moisture contents. Mixing was done manually three different times. A little amount of straw spread on the surface of the mixture is remixed and left for a period of one to three week in which the mixture is remixed at interval of three to five days.

Wooden and steel moulds of 450 mm x 225 mm x 225 mm dimension were made and used for the casting of the bricks. The cast from the wooden mould batch had more moisture than that of the steel mould batch so that the consistency was good enough for the paste to come off easily from the wooden mould. To avoid sticking of mud to the wooden mould, a rag soaked with water was rubbed over the internal surface of the mould. In the case of steel mould, spent motor car engine oil was used to provide lubrication at the internal sides of the mould. The oil is also another form of stabilizer because it is derived from bituminous compounds.

To ensure workability the moisture content at each batch mixed was determined by weighing and oven drying. The consistency was also determined. After the first batch has been cast, the second mix was made while allowing the cast bricks to be strong enough to be moved, so that the second casting can be done. Each mixture was divided into two batches for the casting with the two moulds.

Consistency test

The apparatus consist of a cone shaped metal known as the cone penetrometer, in which a reading needle is attached to it. This is held by a clamp called the holder , the whole set is attached to a cubical container which houses the mud paste, by the aid of a long straight metal

which has the graduated scale on it. Mud paste was poured in the cubical container until full. The cone is released until its tip touches the surface of the paste. The position of the tip of the cone was noted on the graduated rule. It is then released fully to note the position on the graduated rule. The differences between the initial and final value is taken as the paste consistency (pc). The procedure is repeated for every batch of mud mix.

Moisture content determination

Mud paste samples were prepared in three containers and weighed in three replicates. Oven dried at a temperature of about 105^{o}C. The dried mud samples were removed and weighed to note the moisture loss. The moisture content is expressed as a percentage, as follows:

$$\% \text{ Moisture Content} = \frac{W_w - W_d}{W_d} \times 100 \qquad (1)$$

Where:

W_w = weight of wet soil

W_d = weight of dry soil

The procedure was repeated for each batch of mud paste and for mortars and plaster.

Brick testing

Two samples of bricks from each batch of the bricks and for each type of mould were used for compression strength test using the hydraulic compression test machine available in the Department of Civil Engineering, Federal Polytechnic Kaura-Namoda, Zamfara State, Nigeria. Each brick was first weighed and placed on a board of the size of the brick and another placed on top of the brick. It was then mounted on the machine and tested. The deflection of the indicator was observed. Lines of cracks appear on the brick surfaces which widens until a point of failure was reached when there was no more deflection. The failure load of each brick was noted and recorded.

Experiment design for different wall-plaster combination (2^3 Factorial)

The experiment was carried out in a way that the mortars and plaster were varied for each case. For the first row of walls, the first four walls have mud mortar with plaster varied with mud and sandcrete for wood and steel moulded bricks respectively. The last four has sandcrete mortars, with variation in the brick type and plaster. The arrangement of the walls and numbering according to the way they were constructed is shown in the Table 1 below:

Wall construction

Walls were constructed using the bricks from steel and wooden moulds. The walls were coated with two types of rendering materials. The walls were observed for changes due to environmental or weather conditions to note the extent of degradation and also tearing which could be on both sides of the walls.

Eight walls were constructed using the two types of brick and varying the plaster and mortar as shown in the 2^3 factorial experiments. For effective evaluation of the effect of these mortars and plaster, a replicate for each was also constructed with the same variation. The surface area was first cleaned, and the walls were constructed facing the direction of rainfall. Straight line was drawn using a tape, so that walls could be constructed along the line. The soil was excavated to about half the height of bricks. Mortar was laid as blinding and bricks arranged with the aid of spirit ray of bricks before the second course was laid. Each wall was made of 4 bricks for a course and 4 courses altogether. A total of sixteen walls using 256 bricks were constructed in two rows. Mud and sandcrete mortars were used for joining of bricks.

Table 1. Wall arrangement and numbering

Wall no	Code	Description of wall		
1	$A_{11}B_{11}C_{11}$	Wooden moulded bricks	+ mud mortar	+ mud plaster
2	$A_{22}B_{11}C_{11}$	Steel moulded bricks	+ mud mortar	+ mud plaster
3	$A_{11}B_{11}C_{22}$	Wooden moulded bricks	+ mud mortar	+ sandcrete plaster
4	$A_{22}B_{11}C_{22}$	Steel moulded bricks	+ mud mortar	+ sandcrete plaster
5	$A_{11}B_{22}C_{11}$	Wooden moulded bricks	+ sandcrete mortar	+ mud plaster
6	$A_{22}B_{22}C_{11}$	Steel moulded bricks	+ sandcrete mortar	+ mud plaster
7	$A_{11}B_{22}C_{22}$	Wooden moulded bricks	+ sandcrete mortar	+ sandcrete plaster
8	$A_{22}B_{22}C_{22}$	Steel moulded bricks	+ sandcrete mortar	+ sandcrete plaster
9	$A_{22}B_{22}C_{22}$	Steel moulded bricks	+ sandcrete mortar	+ sandcrete plaster
10	$A_{11}B_{22}C_{22}$	Wooden moulded bricks	+ sandcrete mortar	+ sandcrete plaster
11	$A_{22}B_{22}C_{11}$	Steel moulded bricks	+ sandcrete mortar	+ mud plaster
12	$A_{11}B_{22}C_{11}$	Wooden moulded bricks	+ sandcrete mortar	+ mud plaster
13	$A_{22}B_{11}C_{22}$	Steel moulded bricks	+ mud mortar	+ sandcrete plaster
14	$A_{22}B_{11}C_{22}$	Steel moulded bricks	+ mud mortar	+ sandcrete plaster
15	$A_{22}B_{11}C_{11}$	Steel moulded bricks	+ mud mortar	+ mud plaster
16	$A_{11}B_{11}C_{11}$	Wooden moulded bricks	+ mud mortar	+ mud plaster

Where: A_{11} = *Wooden moulded bricks* A_{22} = *Steel moulded bricks;*
B_{11} = *Mud mortar;* B_{22} = *Sandcrete mortar;*
C_{11} = *Mud plaster;* C_{22} = *Sandcrete plaster*

The wall no. 9 to 16 stand for the replicates of the wall no. 1 to 8

Plaster and mortar thickness

Two types of mortar and plaster were used: mud and sandcrete respectively. The thickness of the sandcrete plaster ranges between 10 to 13 mm while the mortar thickness for jointing ranges between 20 to 50 mm respectively, the initial mud plaster thicknesses were recorded as the walls were being washed off by rain. This was done to know the reduction in thickness of plaster as shown in Table 6.

Walls strengths test (use of rebound hammer Rh)

Rebound hammer is an instrument used in testing the strength of a building or wall. In case of this study, it is the index used in determining the strength variation between walls. Another index is the use of a mallet hammer. The rebound hammer is used to know the extent the walls can resist loosening their plaster due to rain and other environmental conditions. It also helps to determine the effect of cementing properties of plaster and the general strength of the walls. Each wall was divided into twelve grids. Readings were taken at specific points in each grid. The rebound hammer was pressed to project a rod-like structure from the inside of the hammer. It was pressed at the point whose reading was to be taken, until the entire length of rod has gone back into the hammer. This was accompanied by a sound; a button was pressed to hold the rod-like structure from projecting outside, so that the value can be read on a graduated scale attached to the hammer. Readings were taken at interval of one to two weeks for two months.

Measurement of cracks

Measurement of cracks was by the use of thread, whose tip is knotted to serve as a reference point and a 2m long tape. For each grid, the number of cracks was measured by placing the thread on the wall following the contours of the cracks to be measured. The length obtained is placed on the tape to read the value. The sum of individual crack in each grid, gives the total length for that particular grid. The procedure was repeated five times at intervals of one to two weeks. For each case, new cracks were noted and their lengths measured, while old ones were measured some of which increase in length and some remained the same.

Measurement of peel area

Mud plastered walls were observed for peels. The peels were mostly irregular in shape. A paper was placed on the peel to trace the shape of the peels. The figures obtained are sectioned to respective squares, rectangles and triangles of known dimension. The dimension were used to get the areas and hence, the total area of the peel.

RESULTS AND DISCUSSIONS

Moisture contents for mud, plaster, and mortars

Moisture contents of samples of mud paste used for casting of bricks and for the two types of brick cast, and moisture contents of plaster and mortars used for rendering and joining of bricks are given in Tables 2 below.

Table 2 Moisture Content of Mud Pastes

Brick type	Moisture Content (%)			Average Moisture Content (%)
	1	2	3	
Wooden molded bricks	28.13	27.47	28.49	28.04
Steel molded bricks	24.18	24.76	25.76	24.90
Mortar (Mud)	29.50	-	31.29	30.40
Mortar (Sandcrete)	30.10	-	30.70	30.40
Plasters	30.86	30.14	29.64	30.21

Table 2 shows that the moisture content of mortar is greater than that of plasters. Mortars are used for joining bricks which are dry, the moisture in mortars aid in effective joining, if moisture is less in mortars, bricks may not be fully joined. Moisture content of bricks cast with wooden mould was found to be 28.04 % while that of steel mould was about 24.90 %. The moisture content of the mortar for brick laying was found to be 30.40 %, while that of plaster for rendering was about 30.21 %.

Mud consistencies

The consistency of mud paste batches for the different casting periods and for the two types of bricks are presented in Table 3 below.

Table 3: Values of Consistometer test

S/N	Brick type	Description	Mud consistency (mm)		
			Straw Stabilizer		
			Initial value	Final value	difference
1.	A_{11}	Wooden moulded bricks	170 130	178	8
2.	B_{11}	Steel moulded bricks	140	133	3
3.	A_{22}	Wooden moulded bricks	110	142	2
4.	B_{22}	Steel moulded bricks	150	115	5
5.	A_{33}	Wooden moulded bricks	110	153	3
6.	B_{33}	Steel moulded bricks		114	4

The result in Table 3 shows that the consistency of mud paste decreases with a corresponding decrease in the moisture content. This can be observed in the consistency of the steel mould paste which appears to be less than that of the wooden mould paste, because the moisture level in the wooden mould paste is higher than that of the steel mould paste.

Compressive strength of cured bricks

The failure loads and compressive strength of bricks cast with wooden and steel mould for samples of bricks selected at different casting are given in Table 4 below. The result in Table 4 shows that the older the bricks, the greater the failure load and hence the greater the compressive strength. The amount and type of stabilizers also affects the strength of bricks. This can be seen as in the bricks made of paste stabilized with grass alone and that stabilized with grass and used engine oil. Also the more compacted the mould is, the more the weight of

the brick. This might be the reason while the steel moulded bricks were higher than those of wooden bricks at all ages.

Table 4 Failure Loads of Cured Bricks

Age (Days)	Brick Type	Weight of Block (kg)	Failure load, P (kN)	Area of Block, A (mm^2)	Stress= P/A (N/mm^2)
239	Wooden Moulded	37.45	105.0	100.833	1.041
239	Steel Moulded	39.21	115.0	102.383	1.123
198	Wooden Moulded	36.55	81.5	102.383	0.796
198	Steel Moulded	37.31	94.0	100.100	0.960
166	Wooden Moulded	36.20	40.0	100.100	0.399
166	Steel Moulded	37.41	91.0	100.133	0.909

Wall dimensions

Dimensions of walls for the mud and sandcrete plastered walls before the commencement of the test and grid dimensions for the sandcrete plastered walls are given as shown below in Table 5.

Table 5 Grid and Wall Dimensions for Mud and Sandcrete plastered Walls

Mud plastered wall dimension before commencement of test						**Sandcrete plastered wall dimension before commencement of test**					
Wall No	Width b(cm)	Height h(cm)	Length l(cm)	b + h (cm)	Grid length	Wall No	Width b(cm)	Height h(cm)	Length l(cm)	b + h (cm)	Grid length
1	23	88	192	111	49.50	3	25	84	198	109	36.33
2	23	89	200	112	50.00	4	22	89	200	110	37.45
5	23	89	190	112	41.20	7	23	90	190	113	37.66
6	23	89	194	112	46.33	8	23	89	193	112	37.33
11	24	89	191	113	48.33	9	23	90	191	113	38.33
12	23	90	190	113	48.00	10	23	92	192	115	38.43
15	23	93	190	116	48.00	13	23	92	194	115	38.33
16	23	93	194	116	48.00	14	23	92	194	115	48.33

The results in Table 5 show that the change in the dimension of bricks results in the variation of the walls dimensions. The mud plastered wall had higher grid length. This is as a result of mud paste not properly compacted during casting, inconsistency of the mixed constituents, the level of moisture content of mud paste and drying effect of casted bricks.

Plaster and mortar thickness of walls

The values of plaster and mortar thickness of both mud and sandcrete and for the sandcrete plastered walls is given in the Table 6 below:

Table 6 Plaster and mortar wall thickness

Mud			Sandcrete		
Wall No	Plasters thickness (mm)	Mortars Thickness (mm)	Wall No	Plasters thickness (mm)	Mortar thickness (mm)
1	10	15	3	20	20
2	20	20	4	20	30
5	30	20	7	20	20
6	20	25	8	30	25
11	20	30	9	20	30
12	20	25	10	20	15
15	20	30	13	10	20
16	10	25	14	20	25

The result shows that, there is a variation between the walls and thickness of plasters and mortars. This is as a result of the method of application of plasters and mortars, which is done by hand. It can be observed that the thicknesses varies between 10 mm and 30 mm for mud and sandcrete plastered walls and between 15 – 30 mm for mortars of both walls.

Rebound hammer test

Results of walls strength test using Rebound hammer at interval of two weeks in N/mm^2 are given in Table 7 below:

Table 7 Values of rebound hammer readings.

Total Rebound Hammer Readings (N/mm^2)							
Wall 1	Wall 2	Wall 3	Wall 4	Wall 5	Wall 6	Wall 7	Wall 8
0.92	0.86	0.68	0.58	0.74	0.60	0.55	0.38
0.89	0.99	0.85	0.43	0.61	0.72	0.73	0.67
0.61	0.64	0.71	0.19	0.50	0.50	0.46	0.60
0.74	0.81	0.53	0.38	0.40	0.63	0.79	0.11
0.97	1.04	0.49	0.64	0.35	0.43	0.72	0.21

The results shows that at specific points on each grid, the rebound hammers readings are not the same as a result of the inconsistency in the mixing of plaster because mixing is done by hand. The application of plaster is another reason for variations in readings taken. At some points plaster thicknesses is greater than other points. Looking at individual walls and their replicates the walls combinations of brick, mortar and plaster types greatly influences the strength of such walls. The type of stabilizers used also affects the walls strength. Walls constructed with mud stabilized with straw and used engine oil (bituminous compounds) tends to be stronger and durable than those constructed with mud stabilized with only straw. The walls constructed with steel moulded bricks, bounded with mud mortar and plastered with sandcrete gave the highest strength.

Cracks

The result of the total length of cracks which occurred in each wall recorded at interval of two weeks is given in Table 4.7 below.

Table 8 Total crack length for each wall

Total crack length (mm)							
Wall 1	Wall 2	Wall 3	Wall 4	Wall 5	Wall 6	Wall 7	Wall 8
-	-	-	-	-	-	-	-
1915	4745	3365	4680	8815	7875	4870	5355
5450	7890	5170	6695	5935	8395	5515	7075
6590	13155	6720	11205	10600	10255	15645	8340
7685	15170	7930	11405	11555	23860	19670	11085

The results in Table 8 shows that the amount and rate of cracks is due to the level of exposure of walls to ambient conditions and the most exposed walls to such conditions were wall 6 and 7. The type of brick, mortar and plaster used, affects the amount and rate of cracking. The consistency in the constituents of brick and mortar also affects the binding property of plaster on walls, hence the amount and rate of cracking. The highest amount of cracks was recorded in walls constructed with wooden moulded bricks, bounded with sandcrete mortar and plastered with sandcrete.

Peel area and reduction in mud plasters

The result of the peel area and reduction in mud plasters in each wall recorded at interval of two weeks are given in Table 9 below.

Table 9a Peel area and reduction in mud plasters

Peel Areas (mm^2)							
Wall 1	Wall 2	Wall 5	Wall 6	Wall 11	Wall 12	Wall 15	Wall 16
-	-	-	53590	-	77716	140530	89410
-	-	263069	209450	212250	173670	275680	238460
-	-	341060	365310	254790	508590	493970	275310

It was found that walls constructed with wooden moulded bricks binded with sandcrete mortar and plastered with mud have the highest amount of peel. Results shows that peels occur as a result of plaster not properly bound to the wall. This is due to the constant wetting and drying of walls which causes the swelling and shrinking of walls. When the plaster is not properly bound to the wall, it tends to peel off the wall. The tendency for mud plasters to stick to the wall depends on the consistency in the constituents of bricks, mortar and plasters used.

Table 9b Reduction in mud plasters thickness

Reduction in mud plasters thickness (cm)							
Wall 1	Wall 2	Wall 3	Wall 4	Wall 5	Wall 6	Wall 7	Wall 8
24	16	14	15	30	26	16	28
19	11	10	12	10	13	14	25
10	8	5	10	5	4	5	8

On the other hand, reduction in plaster thickness is as a result of constant washing of the surface of walls plastered with mud. The main weakness of mud lies on its low resistance to water as stated in the review of this study. The tendency of mud plasters to be washed depends on the stabilization, because stabilizers increase the resistance of mud plasters to weather conditions.

CONCLUSIONS

Mud paste with higher moisture contents results in high level of shrinkage upon drying of bricks. The age and type of bricks influences the failure load and the compressive strength of bricks from steel mould has higher value. Bricks compacted by hand tends not to be fully compacted, which results in reduction in block dimension and the compressive strength of bricks.

Walls constructed with steel moulded blocks, binded with mud mortar and plastered with sandcrete gives the highest strength. Walls constructed with steel moulded blocks, binded with mud plaster and plastered with sandcrete gives the least amounts of cracks. It was found that walls constructed with wooden moulded blocks, binded with wooden moulded blocks, binded with sandcrete mortar and plastered with mud has the highest amount of peel.

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The Building Profession and the Challenges of Achieving Sustainable Buildings in Nigeria

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ABSTRACT

The incessant building collapse happening across the country is a matter of concern to authorities, developers, users and professionals alike. Some buildings no longer reach their life expectancies. Some even collapse in the process of construction. In this sense, sustainable buildings seem to be at large in Nigeria. When a building collapses before the expiration of its lifespan or before being put into use, sustainability is even far from being attained. The effort of concerned stakeholders especially the professionals to formulate and see to the implementation of a standard National Building Code for all building projects in the country has not reached a conclusive point. The National Building code was approved by the Federal government in 2006, but it is yet to be put into practice. The lack of continuity, consistencies and commitment in policy implementation is identified as a major problem militating against the use of the building code. This paper adopts literature review to examine the incidents of building collapse and sustainability issues in the nation's environment, the contributing factors and proffered solutions to curb the undesirable situation. It evaluates applied theories of policy analysis to address the policy implementation problem of the building code, education, professional training and other relevant policy issues in the industry, encourages professionals in the industry to solve the problem in collaboration with the government using policy implementation networking.

Keywords: Building collapse, Sustainable building, builder, Building Code

INTRODUCTION

The quest by the construction industry professionals and other stakeholders to move towards sustainable buildings and green buildings is beclouded by the ugly incidences of building collapse across the country. Buildings are scarcely fulfilling their life span, while some even collapse in the process of construction. The attitude towards maintaining and upgrading the existing structures is not encouraging. It is also noticeable that some of the new structures that are springing up within the environment are of less value in terms of sustainability features and aesthetics. This state of things in towns and cities is rather worrisome and does not pose a good image of the industry. How can one talk about sustainable built environment or the Green Building when buildings die at 'infant' or as 'foetus' in the process of delivery before reaching matured age. The blame for this, cut across all participants, ranging from the professionals to the authorities and building owners and users. There has been an effort on the side of the professionals to instil in the government, the need for adoption of building code for standardization of building construction and practice in Nigeria. After much effort the National building code was approved but its implementation has not been enforced. The lackadaisical attitude towards policy implementation needs a critical redress. The paper in the following paragraphs highlights the trend of building collapse in the country, the likely causes and some measures needed to address the ugly situation.

UPDATES FROM THE INDUSTRY – THE PERFORMANCE

Sustainability Crises and Building Collapse

The news coming from the industry is not a palatable one. The industry is said to be 'underperforming and uncoordinated' with lack of discipline and operates in a seemingly 'lawless situation' which partially account for the incessant building collapse in the country.

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Report has it that from 1994 to 2011, the reported cases of building collapse stand at about 114 with attendant 404 deaths, 136 various degrees of injuries and property losses worth billions of Naira (Jambol, 2012). The study conducted by Ebehikhalu and Dawam (2014) shows a recorded number of building collapse between 1974 and 2012 as 139 with 798 lives lost. It shows further that 54.17% of the reported cases of collapsed buildings are residential buildings (15.83% under construction), 10% for commercial buildings, 8.33% for educational buildings, 5% for religious buildings, 2.5% for hotels, 1.67% for courts, and 0.83% for hospitals. These figures do not take account of unreported cases and still not updated till date. It could be seen around the environment what seems like unplanned cities, abuse of the built environment, incessant building collapse, fire outbreak and the like which are majorly attributable to the lack of referenced design standards for professionals, use of quacks, lack of supervision, poor workmanship, use of substandard/untested materials, and the lack of maintenance culture, conversion of building use from its original purpose, excessive loading, faulty design, lack of compliance with building regulations and approved plans (Obiegbu, 2008; Mbamali and Okotie, 2012; Ebehikhalu and Dawam, 2014). These results indicate that sustainability of the built environment is undermined. In the situation that this generation is still struggling to cater for itself, it will not be out of place to admit that the present generation is already compromising the rights and expectations of the future generation to enjoy the environment. If the authorities and industry professionals are still struggling to address issues related to meeting the objectives of what can be termed first degree sustainability (safe structures), one wonders the state of their preparedness in achieving the second degree sustainability- the green building.

Theoretically the terms ‘Sustainability’ and ‘Sustainable Construction’ can be used interchangeably. Sustainable Construction is the set of processes by which industry delivers built assets that enhance quality of life, offer customer satisfaction, provide the potential to cater for user changes in the future, provide and support desirable natural and social environment, and maximise the efficient use of resources (Highway Agency, 2003). A building may fulfil its intended purpose and ‘die at old age’ or die an untimely death by way of collapse referred to as ‘total failure’, or it may be partial failure where the observed performance is less than the designed performance. In both cases sustainability is undermined. This is mostly attributed to human errors by way of design, build and the use (Jambol, 2012). Sustainable construction spans the entire project life cycle- design, procurement, construction, commissioning and use. It involves the use of environmentally friendly materials, energy efficiencies and waste management (Izam and Ameh 2012). Sustainability features need to be incorporated at different stages of the life – cycle of the construction facilities due to its network of interaction with people and environment, but unfortunately, and sad to note also, that infrastructure sustainability till date has proved elusive to the Nigeria public infrastructure and buildings (Abiodun, 2013). Having summarised the industry performance in terms of sustainability, it is imperative to proceed to examine the major causes so that suggestions can be proffered for appropriate remedial actions.

Update from the Industry – Causal Factors

Government Side

The picture painted by the industry commentators about government’s posture towards developing the industry is a bleak one. Since government has a larger share of the industry, its impact on the industry development and performance is great either by action or inaction. The construction industry is said to account for about 17% of GDP out of which building subsector is estimated to account for 12% per annum and 70% of the demand of the building industry is by the public sector. Abandoned projects are commonplace due to lack of fund,

political change where successive government fails to honour their predecessor's obligations, leadership problem, corruption and inconsistent policies. The posture of the past government towards housing and urban development and the lukewarm attitude towards encouraging the intervention of the Green Building Council of Nigeria (GBCN) to ensure sustainable development of the environment does not show any positive drive to set the industry on the path of achieving sustainable environment (Akindoyeni, 2012). Nigeria's development efforts over the years have been characterized by lack of continuity, consistencies and commitment (3Cs) to agreed policies, programmes and projects (Izam, 2012). The lack of referenced standard code for design and construction, occasioned by the non-passage of the building code into law to make it effective show government's characteristic lack of '3Cs' which undermines the industry's growth (Obiegbu, 2008; Akinsola and Fatokun, 2012; Izam, 2012). Although the National Building Code has been approved by the Federal Executive Council since 2006, it is yet to be given a legal backing and so it is yet to be accepted across board.

Other factor is the state of our tertiary education to respond in terms of improved curriculum to cope with emerging demand of the industry. This area too on the side of government is lacklustre.

Professional Side

One major setback in the industry practice is duty overlap and rivalry. Instead of the industry professionals to work collectively towards the development and growth of the industry, some prefer to take undue advantage over others by practising profession of others where they have not received requisite trainings. This has been argued extensively in the author's research work (Abiodun, 2012), particularly how the sister profession (the engineers) have taken over the profession of quantity surveying in civil and infrastructure works, known or unbeknownst to the authorities. Building profession suffers similar fate in the hands of other professions in the industry. In this regard, Akindoyeni (2012) lamented on the seemingly unending state of unhealthy rivalry in the industry. Due to the absence of enforcement of regulation and monitoring of the industry practice by the authorities, the industry 'limped along' where some 'greed –induced' rivalry has placed other profession in a position of advantage over others. In an ideal situation, members of the design team, on a building project, should be the architect, structure engineer, a builder, electrical engineer, mechanical engineer, quantity surveyor. If the functional coordination of spaces and the environment, structural stability, buidability potentials, green potentials and sustainability, health and safety potentials as well as cost limit assurances are faulty, it means the whole members of the team have not been given adequate chance to participate and contribute their respective skills. He puts it rather humorously this way "It is not only the lawyer or shoemaker who design and build that is unqualified" but when one professional in the industry performs functions of another professional, he is unqualified and as such a quack. This means that quacks are not just unskilled street guys. This situation is majorly caused by the lack of any legal instrument currently in operation that forces professionals to observe boundary limit of their respective practice without interfering in other's area of competence.

Other problem from the professional side is the lack of adequate coordination of the design and construction among the project team to resolve sustainability issues during the project lifecycle. In most cases no feedback mechanism are performed by the project team in respect of performance of the completed projects (See also Jambol, 2012).

Capacity building and continuous professional development individually and by the professional bodies to meet the emerging realities of the industry have not been addressed adequately. This is in the area of the use of new methodologies, environmental friendly materials, energy efficiencies, waste management and global best practices that gear towards

maintaining sustainable environment.

Having summarized the major problems, suggestions on the possible remedial courses of action are proffered in the following paragraphs.

Suggested Solutions – Government Side

Policy Formulation and Regulation

The converging views from the foregoing review in respect of causal factors to the sustainability challenge in the industry are that government is deficient in the area of policy formulation and implementation. Then, what is policy and how is it formulated and implemented? In discussing the theories of policy analysis, it is imperative to first highlight the precursor to policy process and agenda setting. Public policy is "a course of action of government or inaction in response to the public problems." It involves dealing with public problems to 'address conditions considered not acceptable which requires intervention'. It formally deals with policy goals and means of achieving them, including setting regulations for agencies that implement government programmes (Kraft and Furlong 2010). Public policies are one of the main means through which order is set in the societies and changes are introduced which modifies individual and collective behaviour' (Parag 2006). Policy process is conceived through three separate streams: Problem stream; Policy stream; and political stream. Firstly, there must be policy problems to be solved. These problems usually emanates from the feedback from the performance of an existing policy. There must be awareness of problems seeking government intervention which were possibly not seen as such in the previous regime. Secondly, there must be available policy solution to resolve the lingering problems. Thirdly, the political environment must be conducive to accommodate the intending policy change (Parsons 1995).

Applying this theory to the situation at hand, a need arises for the use of Building Code to standardise building planning, design and construction, with the objectives of addressing the dysfunction of the built environment such as building collapse, quackery, use of substandard products and so on (problem stream). Building code has been formulated already as a concrete policy solution to the problem (policy stream). Accepting and implementing the code within the industry to make it effective to solve the problem is still lingering (political stream). The stage of political stream is the most problematic in the Nigeria's system. It is rarely got done!

The National building code has been formulated, but passing it into law to regulate building practice is still begging for attention. Building Code is a collection of technical and legal requirements that guides the design, construction and maintenance of buildings. "It is the minimum acceptable standard used to regulate design and construction and maintenance of buildings for the purpose of protecting the health, safety, and general welfare of the building users" (Obiegbu, 2008). The code is to make the building safe, reduce deaths, injuries and property damage, preserves the environment, contribute to durability of buildings to maintain quality of life. Until 2006 when the building code was approved by the Federal Executive Council (FEC), Nigeria's building industry has operated without uniform regulation and guidelines for design, construction and maintenance of buildings leading to disorganization and deplorable state of affairs in the industry (Mbamali and Okotie, 2012). The building code needs to be implemented to serve its purpose and also integrate it into the various States' Physical Planning laws (see also Jambol 2012). As at 2012 only Lagos State has passed and implemented physical planning law that incorporates National building code. Ogun State is also implementing physical planning law but without using the national building code. Others are at various stages of the process, while some are yet to start the process at all (Akinsola and Fatokun, 2012). It is worrisome that the federal government is not taking a proactive

measure towards the implementation of the building code. This attitude can be termed a pure state of accountability insensitivity.

In addition to the code, there should be regulations that will demarcate practice limit and boundaries and provides minimum standards of practice of professionals in order to correct the anomalies in the system and to improve service delivery, thereby reducing incidence of building failure and ensuring sustainability of the environment. This could be achieved through the establishment of Construction Industry Development Board which will encourage genuine transformation of the construction industry in Nigeria (See Akindoyeni, 2012; Izam 2012).

Governance System and Sustainable Policy implementation

The lack of continuity consistencies and commitment in policy implementation identified by commentator's centres around deficient governance system (leadership problem). The lack of continuous and consistent policy implementation is rife in Nigeria. The failure of incumbent governments to honour the obligations of the past regime negates the notion of 'inheritance' in policy analysis. The policies of the past governments have impact on whatever the present policy decision will be. The inheritance from previous governments has great impact on the present government. In fact since problems are inherited from the past, a newly installed government needs to 'look back before it can look forward' (Rose, 1990). The commitment of past government must be accepted by the incoming government as legacy that is carried forward by institutional commitment grounded in laws. If government abides by this rule, projects of previous administration will not be abandoned to award new ones, probably for selfish or political interest.

The process of implementing a new policy whether in public or private domain involves effective change management strategies. Accepting new rules and culture of working in a system is always a process and not by happenstance. This is because it is not always easy to change the culture of an organization because change is always a source of 'shock' to the organization in the first instance (Burnes, 2009). However changes to the organization culture can be done by following an organized procedure. For example, using Cummings and Worley's six steps to culture change: Formulate a clear strategic vision; Display top-management commitment; Model culture change at the highest level; Modify the organization to support organization changes; Select and socialize newcomers and terminate deviants; and Develop ethical and legal sensitivity. Change management could also be done through Lewin's three-phase model of change. The first step is to 'Unfreeze' the status quo and establishing the need for change (policy formulation). The second step is to Change to a new state by using the available resources (policy implementation). The third step is to 'Refreeze' the change to make it sustainable by integrating the change into organizational/institutional processes (consistent and continuous monitoring for policy sustainability). Unless refreezing or what is called internalization is done, it is expected that the change will be 'short-lived' (Robins and Judge, 2008). Short-lived changes are ubiquitous in the nation's governance system.

Most organizational/institutional changes are accompanied by resistance from individuals or groups. People repel change because of the fear of losing something of value, but in any transition 'old things have to be done with and new things must begin to take place' (Bridges, 2003). Four most common reasons why people resist change are: fear of loss of something of value; lack of understanding of the change and its implications; a belief that the change is not appropriate or not needed in the organization; and a 'low tolerance for change' (Kotter and Schlesinger, 1979). The fear of ability to develop new skill and behaviour that will be required in the changed organization is another reason for resistance to change (Kotter and

Schlesinger, 1979). The builder needs to learn new skills to adapt the global best practices in the industry especially in the area of sustainable development.

The system of government must recognize these policy and change management theoretical framework and sincerely put system in place to make it work. Professionals on their own part must be willing to adapt to change by altering behavioural pattern to fit into the changed system and structure so that policy implementation can be sustained.

Education

Government need to take a closer look at the academic system by providing funds for research and development including staff remuneration to build capacity for indigenous professionals (Dlakwa, 1998). If the tertiary institutions will continue to maintain relevance in the market place, then they need to update their curriculum to serve the outside world. Marketization of higher education is characterized by a closer partnership with outside client. There is now a movement away from the 'traditional pedagogy and conventional curricular' to the one that is responsive to the employers' demand (El-Rufai, 2006). The clear inadequacies in the university curriculum covering the area of sustainable construction and also in the area of related professional training need to be reviewed (Izam and Ameh 2012). Moving to the professional side, what are the expectations, particularly from builders?

Suggested Solutions – Professional Side

The Role of a Builder

"A Builder (or Professional Builder) is an academically trained specialist and statutorily registered professional responsible for Building Production Management, Construction and Maintenance of Buildings for the use and protection of mankind and his assets" (http://www.niobuilding.org/builderrole.html; Adeniye 2008) . The core practice of a builder is building production management and it encompasses services relating to buildability and maintainability (Obiegbu, 2008). Two distinct areas of practice identified by NIOB for builders are Building Construction Companies and Consultancy Firms of Professional Builders. Nigerian Institute of Building (NIOB) is the professional association of the builders in Nigeria. NIOB was recognized through the promulgation of Decree 45 of 1989 (now known as the ACT CAP 40 of the Laws of the Federal Republic of Nigeria of 1990) (http://www.niobuilding.org/aboutus.html). NIOB functions are "To develop and promote an Institute that will be Nigeria's authority in Building Production Management, Building Construction, Building Maintenance Management, Building Surveying and investigation through continuous professional development, research and training for the benefit of all stakeholders such as the government, the clients, construction professionals, construction industry operators, the Nigerian public and international interest groups through effective information management and efficient propagation of the Institute's activities and appropriate interaction with relevant corporate organizations locally and international" (NIOB-http://www.niobuilding.org/missions.html).

From the description, it is clear who a builder is and his functions and that of the professional body-NIOB. In the author's view, the consultancy services role of the builder needs to be well developed and marketed to the public, because the fact on ground at the moment is that builders are still restricted to the traditional construction role. Among the builders themselves, some commentators when describing the role of builders, still restrict builders' role to physical building construction and not as part of design team (see Mbamali and Okotie, 2012). In order for the builder to be properly equipped to perform in both the design and construction team for sustainability issues to be addressed adequately, the key issues highlighted in the following paragraphs should be looked into.

Building Capacity to Cope with Emerging Responsibilities

Professional upgrade and improvement is constantly needed to meet the emerging realities of the industry (see also Mbamali and Okotie, 2012). A consultant must have 'the necessary experience, qualifications, skills and expertise to help with a task that an individual or company wants performed'. The question is; can the professional/consultant add something of value to the client (Cohen, 2009)? A builder must strive constantly to improve and update skills and professional competence to be able to fit adequately into the scheme of things. For instance a builder must be well versed in the letter and provisions of the building code to be well positioned to perform design, construction and maintenance functions. The importance and benefits of capacity upgrade is not farfetched in the emerging era of Public Private Partnership that is trending the infrastructure provision landscape globally. Now that the traditional role of government as a sole provider of these services is dwindling and giving way to private provision, the stage is set for all professionals to demonstrate their abilities to be relevant. No more 'free lunch'. The private sector that is business oriented is willing to pay only, for professional services duly rendered- added value. Government does not, and will no longer perform their traditional functions of rowing and steering. It will continue to only steer (regulate) the network of systems in the economy. In essence professional bodies should ensure adequate training and retraining for practising professionals about the new development in the industry to ensure sustainability of the built environment (See Olagunju, et al. 2013).

Marketing

A professional builder individually and NIOB as a body, need to embark on some sort of marketing to sell the practice to the consumers. "To build and maintain a viable professional firm, marketing must permeate every activity. The professional sells image, technology, knowledge and insight, competence, creativity, attitude, and even philosophical approach. Unlike other products, professional service cannot be separated from the delivery vehicle (professional). As professionals we should not create the impression that we are hungry to the client. No one wishes to do business with someone perceived to be needy, hungry or unsuccessful. The most successful professional avoid any appearance of needing the business" (Shenson 1994). Professional builders need to present to the client the value they are adding to his present state that he needs to pay for. NIOB and Council of Registered Builders in Nigeria (CORBON) need to do aggressive marketing to sensitize the stakeholders in the built environment of the need to accept the use of professional builders in preparing and using construction methodology as a planning tool in building production (Abdulhammeed et al., 2012).

Sorting out the Unhealthy Rivalry within the Construction Professionals

It is hoped that professionals in the industry will see themselves as colleagues who must work collectively to develop the industry and not as rivals. Otherwise, there will not be any moral justification to blame the government for the industry's peril when the industry professionals fail to put their own house in order. Working together will ensure role definition and agreement on the scope of services of each profession to avoid overlap and rivalry. Architect to design and supervise, QS to cost, engineers to design structures and services, builders to build, and estate surveyor and valuers to market and manage completed structure (Obudu 1998). The design team should through regulation, implement appropriate design quality management system while the construction team should through the builders, produce and implement the project quality plan as envisaged by the code (Izam, 2012). A contractor or a builder can be integrated in the planning and design team to help designer integrate design with technology that ensures efficient and sustainable building production. In this case a builder can prepare work methodology as a consultant to be used by the design team in the

design process (Abdulhameed et al. 2012). This affords the builder to be part of the client's team to prepare production management document or vet the one produced by the contractor. These documents include construction methodology, construction programme, project quality plan, project health and safety plan, early warning system, schedule and so on.

Table 1 Building Collapse Cause-Effect and Solution

Building Sustainability Crisis	**Causal Factors**	**Recommended Solution**	**Desired Sustainability Effects**
- Incessant Building Collapse - Loss of Properties - Deaths and Injuries - Fire Outbreaks - Undermining Sustainable Enviroment	*Government* - Lack of Adequate Planning in project execution - Leadership problem and Political Change - Inconsistent policy fomulation and implementation - Lukewarm attitutde towards urban development and green buildings - Non-implementation of Building Code - Tertiary Education not dynamic to address emerging Industry's demand *Industry's Professionals* - Inadequate design planning in project execution - No referenced design standard document - Use of untested /substandard materials - Faulty design - Duty overlap and unhealthy rivalry among professionals - Lack of laws that regulate and monitor boundaries of professional practice - Inadequate coordination of design and construction among project team to resolve sustainability issues - No feedback mechanism on the performance of completed projects - Inadequate capacity building by professionals to meet new industry's demand *Owners & Professionals* - Use of quacks by building developers - Lack of maintenance culture - Conversion of building use without approval - Non-compliance with building regulation and approved plans	*Government* - Promote capacity building in the area of policy formulation, analysis and implementation - Proper identification of policy analysis segments (Problem stream, policy stream and political stream) - Ensure consistent policy implementation across successive government regimes - Establish an effective change management mechanism - Academic curricula to addrress industry's requirements *Industry's Professionals* - Capacity building by way of training and retraining - NIOB and CORBON to coordinate and monitor building construction practice to eliminate quackery - Ensure the use of tested and standard materials for construction - Adequate participation of all construction professionals and stakeholders from design to construction and maintenance stages - Maintian high level of professionalism - Adequate marketing of building profession especially for incorporation in the design team - Professionals in the industry to encourage team work not unhealthy rivalry and to observe practice boundaries - All stakeholders to work together in a policy network to formulate and implement construction policies *Owners & Professionals* - Prospective building owners to be compelled to use qualified professionals - Ensure adequate routine and periodic maintenance - Buildings should be used for the purpose designed and constructed - Adhere strictly to approved building plans	- Elimination of Building Failures - Fit for Purpose Buildings - Sustainable buildings and Environment - Fuller realisation of Expected Economic Benefits from buildings - Eradicate Deaths and Injuries associated with building failures

Suggested Solutions- Joint Effort

Collaboration with Government in a Policy Network

Summing it up all, an effective and workable strategy is collaborative efforts of government and professionals to achieve the stability and the growth that the industry desires. The new synergy is embedded in the theoretical framework of Policy Network- different actors (government, private and interest groups) working together in policy formulation and implementation for good governance. A Policy network comprises different actors, such as government structures, organizations, labour and trade unions, academicians, researchers, professionals and social critics. Network governance is concerned with 'how other actors, such as civil society organizations, may play a role in taking decisions on matters of public concern' (Graham et al., 2003). Governance is broader than government by covering non-state actors, thereby blurring the boundaries between public, private and voluntary sectors for information and resources exchange. Networks are self-organizing and regulated by laws and not accountable to the state but are being steered by the state (Rhodes, 2000). Accountability in respect of network governance is not linear or one directional pointing towards one specific organization (say government), but must fit the policy and its network', as Rhodes puts it 'accountability disappears in the interstices of the webs of institutions' (Rhodes, 2000). In the network, all stakeholders (Network of professionals and interest groups, and government) are working together towards a common goal to achieve sustainable development of the environment. No more pointing accusing fingers, the entire network is accountable.

A system must be put in place to ensure adherence (by all stakeholders) to the minimum required standard – 'system of plan checks, site inspection, professional responsibilities and regulatory accountability' (Obiegbu 2008). Government can use its state police power to enforce regulation and also use trained and certified professional to ensure compliance. The three tiers of government in Nigeria should collaborate with building professionals including other industry professionals working synergistically to work out strategies and policies to enhance the operation of the industry (Dikko 2002; Mbamali and Okotie, 2012). This collaboration should ensure standardization of local construction methods, education, training, enforcement of building regulations and monitoring, because previous attempts in addressing building sustainability have achieved very little so far (Olagunju, et al., 2013). This new direction is hoped to bring about the much needed sustainable built environment and national development. In Table 1, the paper condensed the current effects of building collapse, factors responsible, recommendations to curb it and sustainability effects realisable upon proper implementation of the recommended solution.

CONCLUSION

The ubiquitous incidents of building collapse and the quest to attain sustainability have been discussed. Causes identified are the non-implementation of standardized building code for building design and construction, the use of quacks in design and construction, lack of clear define roles of professionals in the industry, rivalry among professionals, inadequate use of skills of professional builders and other relevant professionals, and lack of consistent policy implementation by government. The paper recommends immediate implementation of the national building code, more proactive and collective approach by the industry's professionals in a network structure with the government to address the situation. Improvement is required in the curriculum of higher education to meet with the current demand of the industry. Professional builders in collaboration with the professional bodies need to acquire new knowledge and skills to be able to adapt to emerging changes in the industry's practice and advancement in technology. The building industry's professionals and

government need to work together in a policy network to ensure sustainable policy implementation to promote healthy growth of the industry, thereby ensuring sustainability of the environment.

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Economic Impacts of Energy Consumption and Supply in Office Buildings of Kaduna Metropolis, Nigeria

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ABSTRACT

This study sought to present the findings of an energy audit exercise carried out on some selected office buildings in Kaduna metropolis. The investigation is aimed at assessing the cost implications associated with energy demand, supply and consumption pattern in the study area. Four office building facilities are purposefully sampled; where an energy audit exercise that involved questionnaire surveys, structured interviews and physical observation methods is conducted through collection of data from three-year bills of utility and back-up sources of electricity supply. Findings revealed that the major actor in energy consumption is the cooling demand with 53% of the total end use demand, followed by other electrical equipment and lighting demands with estimated values of 35% and 12% respectively. It was also discovered that, although the normalized electricity demand is within an adequate range, the cost of supply is not commensurate to the rate of consumption. A significant level of overdependence on the backup electricity supply systems due to inadequate supply from the national grid also contributed adversely to the Total Energy Consumption Cost (TECC) of running the facilities. This study expresses a primary assessment strategy that is necessary to pave way for pin pointing the areas in which energy consumption can be minimized in such a building typology.

Keywords: economy, energy consumption, energy cost, energy supply, office buildings

INTRODUCTION

In the building industry today, discourses that relate to energy consumption and provision have become the focal point of concern towards achieving the much desired sustainable development within the confluence of our natural environment. It has been established by numerous studies from many parts of the world, that energy consumption in the built environment exceeds that of all other sectors, including transportation (Haoyang, 2012; Brown, 2010; Perez-Lombard, Ortiz, and Pout, 2008). Researches have also shown that commercial buildings and office buildings in particular, accounts for a significant amount of energy consumption that cast a direct impact on their immediate settings (Mu'azu, 2012; Sadrzadehrafiei et al, 2012; US Energy Information Administration (EIA) 2014). Although in Nigeria residential buildings form the major building stock in our cities, office buildings tend to be the dominant buildings in the city's central business districts (energy commission of Nigeria (ECN) 2003). It is therefore consequently connected to the energy challenges in our localities, in term of provision and distribution. It has therefore become imperative that energy consumption and distribution in office buildings is streamlined so as to reduce the potential adverse impacts it inflicts upon its settings both economically and environmentally.

The rise in number, scale, standards and elaborate requirements associated with office buildings today, due to recent economic boom experienced across the world has subjected it to a constant and increasing state of intricate energy demand (Rai, 2004; Ochoa & Capeluto, 2009). It is a building typology that requires uninterrupted energy supply within its activity period, hence it is regarded to be amongst the major energy consuming building typologies anywhere (Mu'azu, 2012). In terms of energy consumption per meter square, office buildings consume about 70-300KWh/m2 to function effectively, which is 10-20 times higher than the

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residential sector (Sadrzadehrafiei et al, 2012). This sort of energy requirement entails a great deal of effort to sustain building performance, a task that has been identified as a key area where significant progress towards meeting the global ambitions of energy efficiency can be made (Ausiello & Raimondo, 2014).

Studies geared towards assessing the pattern of energy use in office buildings have been carried out in the past across Nigeria by many researchers. In their stydies, Akambami (2010); Mu'azu, 2012; Batagarawa, Hamza & Dudek, 2012; and Umar, 2015; posited that, office buildings employ the use of about 40% - 60% of the total energy supplied by the National grid, out of which 40% - 65% is used for cooling. Lighting has been confirmed to take the least percentage with about 12% - 25%. However, with this magnitude of energy requirements, it was gathered that, the national grid does not supply adequate power across all sectors of the building economy (Oyedepo, 2013). This resorts to a large portion of the industry to rely on diesel and petrol generators as primary or back-up source of electricity, which can be expensive, polluting and a significant source of greenhouse gas emission (Energy Commission of Nigeria (ECN) 2015). The study is in line with the aspirations of the National Energy Master Plan (2014), which highlighted that, the driving force behind sustainable energy is to push industrialization of the country by 2030 at a rate of 11-13%.

Using methodologies that involved energy audit and subsequent disaggregation of energy use index as employed by previous researchers, the study aims to highlight the track record of energy consumption and supply patterns in various functions of office buildings in Kaduna metropolis. Subsequently, it is also geared towards presenting the estimated cost implication associated with such energy consumption and supply patterns. Selected as the study context, Kaduna is the largest city in North Western Nigeria (Butler, 2009). It is also one of its leading industrial cities that has a large number of commercial and corporate building stoke capable of casting significant impact on other energy demanding sectors of the city. Presence of such a large corporate stock in Kaduna's CBD could be attributed to the city's former status of being the capital of the federal republic of Nigeria for fifty years, from 1916 to 1966 (*Fletcher and Cruickshank, 1996).*

The study is however limited to carrying out an investigation on only the electricity supply and consumption aspects of the studied facilities, with focus on uncovering the cost implication involved. Although the economic impact of energy utilisation is expressed when placed side by side the total income generated in any commercial set-up (Yudelson, 2010; and Adnan & Riaz, 2008); the study encountered a major limitation in extracting such related information from the facility managers of the studied area. It is therefore limited to uncovering only the cost implication of energy consumption the facilities.

ENERGY CHALLENGES IN THE NIGERIAN ECONOMY

Energy requirement is essential for all operations in the building industry. Like in all other sectors, it serves as the pillar of wealth creation evident by being the nucleus of operations and engine of growth of Nigeria's economy (Ogundipe & Apata, 2014). Unfortunately; even though energy provision in either public or private sector is capital intensive anywhere, it has been found to be facing a more serious challenge in Nigeria (Oyedepo, (2013). Although a major oil producer and investor in the electricity sector, an estimate carried out by the World Factbook (2015), holds the country as low as 69th place in per capita electricity consumption globally; and the 210th in the list of world countries that exploit the use of electricity from other renewable sources.

Energy provision has been a discouraging factor for the Nigerian economy; a study carried out by Ibitoye and Adenikinju (2007) estimated that up to 60% of the population are

unconnected to the national grid, especially those in the remote areas. Political instability, mismanagement, limited funds, long period of return of investment and maintenance neglect are all factors that result in electricity generation deficit, brought about by poor utility performance, and weak transmission and distribution infrastructure (International Conference on African Development Issues (ICADI) 2015). Past studies have also exposed that; in Nigeria, cost of energy production enjoys a free fall nature of energy billing with no regular accountability for energy costs, where government budget has to step-in on settling the payment deficit incurred (Muazu, 2012). However, the resultant use of backup generation system for long hours of the day throughout the year, also consequently leads to cost of diesel and other fuels used in running the generating plants by building owners (Umar, 2015). This sort of endeavor has formed a major glitch to the development of the building industry and the economy in general; whether our economy is ready for developmental take-off should be based on its readiness to ensure adequate and regular power supply, which represents a crucial factor that supports economic growth in developing countries (Ogundipe & Apata, 2014).

Like in all commercial endeavors running an office building entails a lot of financial inferences. A study by Yudelson (2010), has shown that lower utility rates amount to an increase in net annual income which also is a yard stick for determining a building's value. Income generation as the key factor in commercial buildings has a direct bearing with a country's economy with regards to its net energy consumption; where it is believed that national income enhances energy consumption, and adequate supply of energy thus becomes central to the radical transformation of the nation's economy (Adnan & Riaz, 2008; & Energy Information Administration, 2010).

MATERIALS AND METHODS

To conduct the study, purposive sampling method was adopted in selecting four office buildings within Kaduna metropolis. the selection is made in a manner that it will represent different variety of office buildings based on variation in size (large and small), ranges in floor heights and total floor area (between single to ten storeys and 5000m^2 to 500m^2), track record of optimum utilization of the facility, types of ownership (private and public), and ease of access for data collection.

Data collection is carried out mainly through a walkthrough energy audit exercise in respect with regulations stipulated in DOE energy audit guidelines of 2011. Data collected is for three years for each facility. Self-administered questionnaire and structured interviews are also employed in the study. The method of assessing the collected data involves estimations of energy consumption, supply and subsequent cost of such supply. Calculations on the estimated end use demand were grouped into cooling, lighting and electrical appliance.

To conduct calculations and/or estimations in demand and supply of electrical energy on the case studies, various formulas were adopted from previous researches and adapted for the study. To calculate the estimated energy demand, Equations 1 and 2 as adopted by Oyedepo et el, (2015) are used progressively during the study. Total energy demand (TED) in kW is given by:

$$TED = \left(\frac{SW}{1000}\right) n \; x \; F_d \text{ (in kW)} \; \ldots\ldots\ldots \text{equation 1}$$

Where n is the number of appliances (cooling, lighting and other electrical appliances), SW is the system wattage and F_d is the demand factor. F_d is the assumed average percentage of available appliances used at a building's peak time. The demand factor is taken as 34%, this is because all appliances except for the exterior lighting are calculated based on the activity

period of the buildings, which is eight out of the twenty four hours of the day. To estimate the total energy consumption of all the appliances therefore; equation 2 as stated below is adopted, where h is the total hours used by the appliance during the year. To provide an estimate for all appliances, 2080 hours (8 hours of the day x 260 working days of the year) are used in all facilities.

$$TEC = \left(\frac{sw}{1000}\right) n\ x\ F_d \text{ (in kW) } \ldots\ldots\ldots.\text{equation 2}$$

To calculate the estimated electricity supply, a formula is adopted from Batagarawa (2013); where to find the average monthly utility supply, the monthly utility charges are divided by the utility rate per KWh, and for the backup system, the generator capacity (multiplied by 0.8 machine factor) is multiplied by its hours of daily operation against the number of working days in a month. Where Qu is the total electricity supplied from the utility supply and Qg is the total electricity supplied by the back-up power respectively.

$$Qt = Qu + Qg \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..\text{equation 3}$$

The total energy consumption cost (TECC) is obtained by inputting the actual rate of unit electricity tariff on the estimated energy demand earlier determined; it is computed as adopted from Oyedepo et el, (2015) given as:

$$TECC = TEC\ x\ CUE \text{ (in NGN) } \ldots\ldots\ldots.\text{Equation 4}$$

Where TEC is the total energy consumption, and CUE is the current cost of a unit electricity in Nigerian tariff, which is 26.24NGN FOR commercial buildings.
To achieve the aim of this study, all subsequent calculations are geared towards uncovering the cost implication of providing energy for the operation of office buildings within context. Therefore, estimated cost of energy supply is carried out; after which the normalized cost of energy supply, and the total energy consumption cost is presented. This is to enable the provision of data that may help in any further related study involving related endeavors like bench marking and retrofitting exercises.

RESULTS AND DISCUSSION

The buildings selected were Northern Nigerian Development Company (NNDC), Bank of Industry Building, Investment House and Federal Inland Revenue Office (Katsina Road Branch). A walkthrough Inventory of selected buildings as illustrated in Table 1 shows that; the tallest amongst the buildings is the NNDC Building with eleven floors and 329 rooms. It is used in full capacity, and is a publically owned facility rented to individual occupants. The BOI main building is next in size with nine floors and 112 rooms, it is government owned and partly rented to individuals and also used in full capacity. Investment House has four floors and 68 rooms, it is owned by the Kaduna state government and rented to individuals as well. The smallest in representation is the FIRS building with two floors and 18 rooms, it is federal government owned and used in full capacity. The major energy consuming systems found are Lifts, HAVC systems, lighting appliances, and other office equipment like computers, printers, photocopiers, refrigerators, televisions and many other related appliances. Major electricity supply is via National Grid that alternates with backup systems throughout the activity period of 8 hours (8am-4pm). A wide range of generators are used in the facilities; the largest is a 625KVA was found in the NNDC and the smallest a 100KVA in the FIRS, as reported on Table 1.

All the buildings have a high track record of energy consumption as exposed by the records of both utility and backup bills collected. Three year utility bills and cost of diesel/maintenance of generators were also collected and presented on the table. For the NNDC Building, supply from the National Grid is to the tune of 10,125,000NGN/annum

while the back-up cost recorded is 3,074,000NGN/annum from a 625Kva generator. Utility billing rate for BOI Building is to the tune of 6,581,000NGN/annum, and 1,758,855NGN/annum from a 500Kva plant; while Investment House has a total annual electricity bill of 2,550,000NGN, and back up bill of 1,004,000NGN. The smallest building being the FIRS building has a utility bill of 910,000NGN, and back up bill of 1,201,000NGN.

Table 1 Walkthrough inventory of the four office buildings

Item	NNDC Building	BOI Building	Investment House	FIRS Building
Number of Floor	11,6,7&2(4 blocks)	9&1 (2 blocks)	4 & 1 (2 blocks)	2 &1 (2 blocks)
Num. of Rooms	329	112	68	18
Total Area	11312	3816	2653	528
Avg. utility Bill/annum (NGN)	10125000	6581000	2550000	910000
Avg. Backup Bill/Annum(NGN)	3074000	1758855	1004000	1201000
Utility Supply	National Grid	National Grid	National Grid	National Grid
Backup (Kva)	625	500	250	100

Disaggregation of Energy Demand

To determine the disaggregated end use demand, estimation was carried out for the four buildings based on three set of categories namely cooling, lighting and a group of other appliances. Equations 1 was used to calculate the total energy demand (TED), while Equation 2 was used to find the total energy consumption (TEC).

Table 2 expresses the disaggregation of energy demand across the four office facilities. Cooling takes the highest demand of about 53% of the total demand from a cumulative demand of 1,023,979.6kWh in NNDC, 597,580.80kWh in BOI, 398,387.20kWh in Investment House, and 46,686.00 kWh in FIRS. Office appliances used have 35% from a cumulative demand of 713,101.00kWh in NNDC, 388,909.44kWh in BOI, 200,759.84kWh in Investment House, and 54,878.68kWh in FIRS. Lighting being the least took 12%, from a cumulative demand of 247,144.64kWh in NNDC, 142,005.76kWh in BOI, 61,605.44kWh in Investment House, and 24,288.76kWh in FIRS. The disparity of such a difference in total end-use demand in term of percentages is expressed graphically in Figure 1.

Table 2 Disaggregation of energy demand across the four offices

	Cooling load (kWh)	lighting load (kWh)	Other appliances (kWh)	Total (kWh)
NNDC Building	1,023,979.60	247,144.64	713,101.00	1,984,225.24
BOI Building	597,580.80	142,005.76	388,909.44	1,128,496.00
Investment House	398,387.20	61,605.44	200,759.84	660,752.48
FIRS Building	46,686.00	24,288.76	54,878.68	125,853.44
Total	**2,066,633.60**	**475,044.60**	**1,357,648.96**	**3,899,327.16**

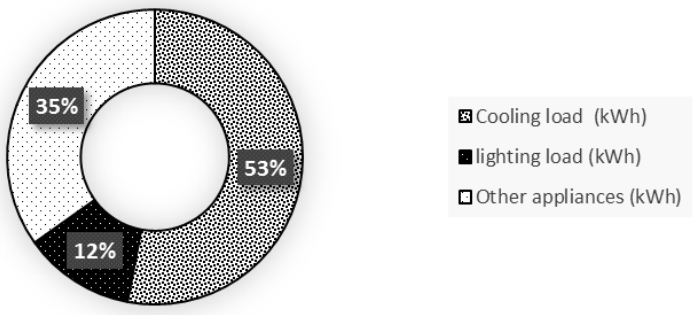

Figure 2: Percentage of total end-use demand across the four office facilities

Electricity consumption per meter square for each facility is also calculated in the normalization process. The disaggregated end-use and the averages per annum across all the studied facilities is determined by dividing each disaggregated end use demand to the total square meters of the facility given in KWh/m^2 . Table 3 shows that the BOI Building has the highest normalized annual demand of 296KWh/m^2, Investment House was calculated to be 249 KWh/m^2, FIRS Building has 239KWh/m^2 and the NNDC Building having the lowest value of 175KWh/m^2.

Table 3: Normalized energy demand (ND) for Cooling, lighting and other electrical Appliances

	Cooling Demand	**lighting Demand(kWh)**	**Appliances Demand**	**Avg. Annual Demand**
	ND (KWh/m^2)	ND (KWh/m^2)	ND (KWh/m^2)	ND (KWh/m^2)
NNDC Building	91	22	63	175
BOI Building	15	37	102	296
Investment House	150	23	76	249
FIRS Building	88	46	104	239
Total	486	128	345	824

Estimated Electricity Supply

The hours of distribution from both utility and backup is shown in Table 4. It shows that utility hours are in all cases more than the backup hours throughout the year. Investment House and NNDC building have the highest hours of 6.5 each, while B.O.I Building and FIRS Building have 6.0 hours each. The amount of Annual power supplied was found to be highest in the N.N.D.C Building and the B.O.I Buildings with 565,850.00KWh and 442,800.00KWh respectively. While FIRS Building has the lowest of 73,080.00KWh, followed by the Investment House with 217,180.00KWh.

Table 4: Estimated electricity supply from the utility and backup energy supply

	power supply (hrs)		**Avg Monthly Supply (Kwh)**		**Annual Power Supplied (KWh)**
	Utility	**Backup**	**Utility**	**Backup**	
NNDC Building	6.5	1.5	32,155.10	15,000.00	565,850.00
BOI Building	6	2	20,900.00	16,000.00	442,800.00
Investment House	6.5	2.5	8,098.32	10,000.0	217,180.00
FIRS Building	6	2	2,890.00	3,200.00	73,080.00

The normalized electricity supply is determined by placing the annual power supplied against the approximated area of the building, and is given in KWh/m^2. Table 5 below shows that; NDDC has the lowest supply of 50.02 KWh/m^2, BOI has a normalized value of 116.03 KWh/m^2, and Investment House has 81.86 KWh/m^2, while the highest recorded value is from the FIRS Building with 138.40 KWh/m^2.

Table 5: Normalized electricity supply per M^2 of each facility.

	Annual Power Supplied (KWh)	**Approximate Floor area**	**Estimated Normalized energy supply (kWh/m2)**
NNDC Building	565,850.00	11312	50.02
BOI Building	442,800.00	3816	116.03
Investment House	217,180.00	2653	81.86
FIRS Building	73,080.00	528	138.40

Cost of Electricity Supplied

To determine the actual cost of electricity paid for by the management, data is collected from the facility managers of the study areas. It is made up of emoluments from electricity supplied by the utility company and diesel generator supplies in the buildings. The actual

three year bills paid from the utility charges of the national grid, and the total cost of fuel and oils are generated and presented.

As gathered from the interview and physical observations, none of the facilities has employed the use of the prepaid meters supplied by the utility companies. The bills paid therefore are based on estimations from maximum demand metering or clamp meters supplied.

Table 5 shows that NNDC building has the highest rate of consumption of up to 13,199,000.00NGN per annum, BOI Building and Investment House have 8,339,855.00NGN and 3,554,000.00NGN respectively, while the FIRS Building has the lowest rate of 2,111,000.00NGN.

Table 5: monthly average, annual cost and Total annual cost of energy supply

Offices	Avg. Monthly Cost of Utility Supplied (NGN)	Total Cost of Utility/Annum (NGN)	Avg. Monthly Cost of Diesel For Backup (NGN)	Total Cost of Diesel/Annum (NGN)	Total Cost of Energy Consumed Per Annum (NGN)
NNDC Building	843,750.00	10,125,000.00	256,167.00	3,074,000.00	13,199,000.00
BOI Building	548,417.00	6,581,000.00	146,571.00	1,758,855.00	8,339,855.00
Investment House	212,500.00	2,550,000.00	83,667.00	1,004,000.00	3,554,000.00
FIRS Building	75,835.00	910,000.00	100,084.00	1,201,000.00	2,111,000.00

Total Energy Consumption Cost

To determine the total energy consumption cost (TECC); a task that exposes the difference between the costs of energy paid for and the actual energy consumed, equation four was used as stated in the methodology. Further calculations of normalized total energy consumption cost are also done in m^2 for each facility.

Table 6 shows the actual total energy consumption cost incurred in the facilities and the normalized range of TECC, given that the current cost of unit (CUE) is 26.24NGN as stated in the methodology.

An average of 40,927,337.87NGN was recorded from the four facilities. Where NNDC has an estimated value of 52,066,070.30NGN and a normalized TECC of 2,982.0 NGN/m^2. BOI has 29,611,735.04NGN with normalized cost of 5,027.4 NGN/m^2, while Investment House and FIRS have 17,338,145.08NGN and 3,302,394.27NGN respectively, with normalized values of 4,234.0NGN/m^2 and 4,234.0NGN/m^2.

Table 6: Total energy consumption cost, and the normalized cost per m^2

	TEC (kWh)/annum	TECC (NGN)/annum	ND (KWh/m2)	Normalized TECC (NGN/m^2)
NNDC Building	1,984,225.24	52,066,070.30	175	2,982.0
BOI Building	1,128,496.00	29,611,735.04	296	5,027.4
Investment House	660,752.48	17,338,145.08	249	4,234.0
FIRS Building	125,853.44	3,302,394.27	239	4,052.1
Total	3,899,327.16	102,318,344.68	959	16,295.4
average	974,831.79	40,927,337.87	240	4,073.9

CONCLUSION

Prompted by the need to conserve the limited energy resources available, the study focused on assessing the cost of energy supply and distribution in office buildings of Kaduna metropolis. The study confirmed that, cooling for thermal comfort for the interior takes the highest rate of energy demand in the buildings. It is responsible for about 53% of the energy use index, and therefore has that equal bearing on the resultant cost of energy consumption.

Other electrical appliances constitute 35%, while lighting has the least with 12% due to the presence of adequate natural lighting during the activity period.

It was observed that there is disparity between energy demand and supply in all facilities, where the estimated annual energy supply of 73,080.00 KWh to 565,850.00KWh as recorded, falls short of meeting up with the required annual demand that ranges from 125,853.44kWh to 1,984,225.24kWh in the buildings. This is why the cost of energy supply in the facilities is on the high side, due to insufficient supply from the national grid. This consequently led to alternative dependence on backup supply to cover up the supply deficit, making the cost of supply economically unsustainable. The normalized supply has also been found to be inadequate with a low estimated range of 138.40kWh as the highest record and 50.02kWh as the lowest.

Despite the high cost of energy consumption however, the study affirmed the claim highlighted from the literature that electricity supply experiences a free-fall billing against energy consumption in our buildings. The study confirmed that there is a huge gap between the total cost of electricity supplied from utility and back-up bills, which ranges from 2,111,000.00 NGN/annum to 13,199,000.00NGN/annum; and the total energy consumption cost, which ranges from 3,302,394.27NGN/annum to 52,066,070.30 NGN/annum. This proves that the energy consumed, though massive in term of quantity and cost is not commensurate to the due rates. The normalized energy demand was found to be within the stipulated range for office buildings as highlighted by the literature, and is between 175KWh/m^2 to 296KWh/m^2; while the normalized total energy consumption cost per annum ranges between 2,982NGN/m^2 in the largest building (NNDC), to 5,027NGN/m^2 in the smallest (FIRS)**.** This implies that energy consumption per square meter in the larger buildings is much lower than that of the smaller ones.

From the cost analysis carried out, the study posits that, high energy consumption rate indicates high cost of operation; a trend that can be reduced to a significant level in order to bring down the cost of operating buildings. The relevance of this study therefore is that, it may serve as a reference point in appreciating the magnitude and impact of cost of energy consumption in running corporate buildings. As a preface to further research, it may also serve as a useful information in pin pointing the basic areas in which retrofitting options are required in order to reap the economic and social benefits of running and maintaining office buildings in a sustainable manner.

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Statistical Investigation of Effects of Different Brands of Cement on the Strength of Pavers

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ABSTRACT

This research was carried out to determine the effect of different brands of cement on the strength of pavers. Stone dust plus Cement A (4:1), stone dust plus Cement B (4:1), stone dust plus Cement C (4:1), stone dust plus Cement D (4:1), sharp sand plus Cement A, sharp sand plus Cement B (4:1), sharp sand plus Cement C (4:1), sharp sand plus Cement D (4:1), formed 8 treatment and were replicated five times. The pavers were analyzed for strength properties, compressive strength at the materials testing laboratory. The data collected was subjected to Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT) was used to separate treatment means. The result shows that Treatment C and Treatment G, were not significantly different with respect to compressive strength. Treatment B, produce the least value of (133KN), while Treatment C has the highest value (285KN) which agrees with the recommended standard of pavers of 150-300 Kilo Newton by the Standard Organization of Nigeria. Also, the cost of production of pavers produced with stone dust is costlier than pavers produced with sharp sand. Cement C, Cement A and Cement B are very neat and strong products. Cement D does not produce a well finished product.

Keywords: ANOVA, Cement, Compressive Strength, Sharp sand and Stone dust

INTRODUCTION

Landscape design is an act of designing, planning management of and or open space and arrangement of natural and man-made through application of cultural and scientific knowledge which concern resource conservation and stewardship to the end that result to environmental service as useful, healthy and enjoyable purpose. (Catriona, 2003). Interlocking concrete pavements are a special dry mix pre-cast of concrete commonly use in exterior landscaping pavement application. Paving stone are installed over a compacted stone sub-base and a leveling bed of sand. Concrete paving stones can be used for walk way, patios, pool decks, drive ways and airport of loading dicks. Instead of connecting the pavers by pouring grout between the joint as one would with tiles, sand particles are spread over the pavers and tamped down. The sand stabilizes the interlocking pavers, yet allows for some flexibility. This type of pavement will absorb stress such as small earth quakes, freezes and thaws, and slight ground erosion by flexing. Therefore, they do not easily creak, break or buckle like poured asphalt or poured concrete. Benefit of pavers than asphalt and poured concrete include high compressive strength, pleasant look, time saving, easy removal and replacing (Timothy, et al., 1997). The most vital aspect of landscape construction is the choice of appropriate materials that will satisfy the basic principles of modern landscaping in order to achieve a balance between safety, elegance and economy. (Adenihun, 2001).

Cement is any material that hardens and become strongly adhesive after applied in plastic form. The term cement is often used as a similar meaning to glue and adhesive. Cement is used for different reasons one is to hold sand and gravel together. It is also used to put different surfaces together made up of various materials, another use can be for coating surfaces to protect them from being damaged by some outside forces of nature or by chemical reasons. The hardening of cement is mostly caused by the hydration of tricalcium silicate, which from the watering substance becomes harden. This substance bind together, the

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particle of sand or stone, which are always include in a morter or concrete mixture into a hard mass (DCCM, 2006).

In Nigeria, production of cement with different trade names is increasing daily. There is availability of more than ten types of cement in the market. Cement is very essential in human's life as regard building, construction and other landscape materials. (Justrus, et al., 2005).

Over the years, paving stones have generated a lot of attention. Hence the demand for it has greatly increased. It is environmental friendly and its beautification also goes a long way in promoting its use. The occurrence or frequent collapse structure due to poor quality construction materials has stirred up the researchers concern on how to test for strength and durability of landscape materials. Therefore, there is need to determine the strength properties of various brands of cement available in the market in order to identify the best for producing pavers.

LITERATURE REVIEW

Road paving with tightly fitted stones resting on a flexible granular base dates back to the Roman Empire. Even, stones are still being used as paving materials the model version of this road techniques utilizes concrete blocks instead (Rada et. al., 1990). Paving stone was the traditional surface material in the Netherlands before the second world war.

British builders realized the importance of selecting clear stones for surfacing to make better roads. The selection of clean stones make road paving a bit costly until later on when concrete pavers would be manufactured. Most of these roads provided a means of fast transportation with the use of horse drawn carriages.

Paving are made from a very dry mix of gravel, sand, cement and color. Since there is very little water, the mixture is moved on conveyor belts and then funneled into the paver mould. Pavers are said to have zero slump, the more the slump the weaker the concrete is achieved in three ways. The amount of water, the amount of cement mix (the more cement the stronger), the amount and size of aggregate (the bigger the stronger).

Sharp sand is generally known as builders sand refer to sand that has a gritty texture. This sand is often mixed with concrete for a number of different constructions applications. Sharp sand can also be added to soil in order to create potting soil or to loosen clay soil. In most instances, this type of sand is made from ground quartz rocks. On occasion, clay and iron may be mixed with quartz in other to create sharper type of sand.

Landscapers and builders use this sharp sand as a base for laying pavement, mixing mortar, dressing lawns and smoothing floors. Sharp sand allows garden soil to drain with ease, which is not the case with fine sand.

Concrete block paving available in a constantly expanding variety of colors, shapes and textures and can be installed bonds and laying patterns (Interpave, 2003). Concrete pavers offer unique aesthetic benefits when compared to other forms of pavement in their ability to integrate and harmonize with both the built and natural environment (CMAA, 1999)

Paving stones offer numerous opportunities in residential and pedestrian areas by their light reflection, water absorption, noise generation features and are often used for traffic management (Interpave, 2003).

Maintenance cost can be kept low as it is possible to rehabilitate areas of concrete segmental pavement without leaving to purchase a new surface. Repair to underground utilities or local deformations in the base materials can be accessed by simply removing and replacing the

concrete pavers. Paving materials are not wasted and jackhammers or heavy equipment are not required (Ackerstone, 2003)

The uniquely flexible surface course of concrete block paving, with its characteristics interlock, prevents the block from moving in isolation and dissipates applied loads sideway and diagonally downwards through the sub-base to the foundations. Combined with the high compressive strengths of the blocks, this prove a working surface with remarkably high load bearing capacity (Interpave, 2003). Paving stones is extremely durable. It withstands severe frost attack and repeated freeze thaw cycle and can be used in harsh environments. It can be laid on airfield or highways where temperature falls below 30 degrees centigrade (Interpave, 2003).

There are two common methods of producing precast concrete: a) wet mix, b) dry mix. In wet mix fresh concrete is placed and compacted into moulds, stripping the moulds when adequate strength has been reached. However, in a dry mix, a semi dry cohesive concrete mix is placed in the mould, which is later, compacted and extruded (pushed out) from the mould, right after compaction. The units are then cured and stored. This latter process is commonly used in the manufacture of concrete masonry and paving units as it is most economic way of producing large volume of bricks, blocks and pavers (CMAP, 2002).

Portland cement is the binder used for the production of concrete blocks just like any other concrete product. In choosing a Portland cement for the manufacture of pavers, rate of strength gain and sensitivity to curing should be considered (CMAP, 2002).

The cement content to achieve the require strength level will depend on the type of cement, rate of strength gain, degree of compaction (CCI, 2001). The only accurate method of establishing the optimum cement content is through a series of trials, using the machine intended for production, in which cement content is varied and the physical properties monitored (CCI, 2001)

The optimum moisture content (OMC) for molding depends on the materials being used, quality of vibration, and moldng equipment. Generally, the coarser the particles are graded and greater the compactive effort, the lower will be the OMC. Using moisture content below OMC will hamper good compaction and may necessitate longer periods of compaction will reduce durability. Using too much water will result in a reduction of density and may cause units to stick in the mould and thus make extrusion difficult, or cause deformation of the unit after extrusion. It must be noted that certain pigments, because of their particle shape, can have a significant effect on OMC (CCI, 2001)

There are many design options available for interlocking pavers. Whether you choose a hexagonal, herringbone or diamond design, there is something to suit all individual taste. Interlocking pavers can create a casual or formal design depending on your style. They are also available in varieties of colors, shapes and sizes, with a thickness that depends on the type of application. The many shapes, patterns, and colors of interlocking concrete pavers allow for design creativity as well as declination of pavement areas, such as parking lanes, cross walks and inter sections. The beauty of the paver add value and visual appeal to any property. By adding flexibility not possible with rigid pavement paver can flow with existing landscaping to deliver beauty to any property.

Good surface and sub-surface drainage is essential for satisfactory pavement performance. Drainage needs to be considered during the design, specification and construction phases of a project. Adequate drainage of flexible and rigid paving systems is an extremely important design consideration for successful performance and durability.

There are three main operation for a successful installation of a concrete block pavement; preparation, detailing, and compaction. Workmanship is a critical factor which has a great impact on the performance of pavement proper preparation and compaction of the base is absolutely critical (BIA, 1993).

One element common to all paving assemblies is the soil or sub grade. Excavation of the sub grade to the proper elevation, removing deleterious materials, and the sub grade compaction are preparation or for the base or sub base (BIA, 1993). It may also be necessary to introduce drainage into sub grade to lower the water table and improve the bearing capacity of sub grade. The entire sub grade should be compacted to 90-95% maximum density (BIA, 1993).

Broken pavers can be easily replaced without patches. Ants and weeds can be prevented by using proper type of sand to fill in the joints between the pavers. Pavers can be repaired by lifting the affected area, re-grading and re-compacting the base and bedding sand and re-installing the same pavers. It is an in-expensive procedure that leaves no unslightly repair patches. Pavers are easy to maintain when properly sealed, an angular sweeping and occasionally rinsing are usually the most maintenance needed for stains, pressure washing with appropriate clearing solutions or a spot treatment with a brush, cleaner, water and some elbow grease will solve problem.

Curing can also be described as keeping the concrete moist and warm enough so that the hydration of cement can continue more elaborately, it can be described as a process of maintaining a satisfactory moisture content and favorable temperate in concrete during the period immediately following placement, so that hydration of cement may continue until the desired properties are developed to a sufficient degree to meet the requirement of service.

Curing is being given a place of increasing importance as the demand for high quality concrete increase. It has been recognized that the quality of concrete shows all round improvement with efficient uninterrupted curing. If curing is neglected in the early period of hydration, the quality of concrete will experience a sort of irreparable loss. An efficient compared to good and wholesome feeding given to a new born baby.

In dealing with the relationship between output and costs there are two situations. First, short run change which cover periods when it is only possible to adjust the variable factors being used and when there is at least one fixed factor. Secondly, long run changes which apply to period of time which are sufficiently long for all the factors to be varied. Increasing returns means that the ratio output, variable input is increasing and this should mean that average cost is falling. Similarly, diminishing return means that the ratio output, variable input is declining and we should expect average cost to be rising (Yusuff, 2004).

MATERIALS AND METHOD

The experiment was carried out at Federal college of Forestry Ibadan at the horticultural nursery, situated at 7.9^0N and 3.58^0W respectively with the annual rainfall of about 1300mm – 1500mm and an average relative humidity of about 80% - 85% (FRIN, 2013).

The materials used are: stone dust, sharp sand, cement, shovel, hand trowel, field book, water, moulds (didalo 5inch), brush, lubricant (diesel), weighing balance. The sharp sand was collected from Federal College of Forestry Ibadan and the cements sample use were purchased at Dugbe Market, Ibadan. All other materials used were gotten from Horticultural Garden, Federal College of Forestry, Ibadan.

Methods

Step 1: The moulds were cleaned and lubricated, with water and diesel.
Step 2: The amount of all aggregate used were measured.

Step 3: The materials were mixed thoroughly and equal amount of water was added to the aggregate.
Step 4: Each treatment were poured into the mould and vibrated manually.
Step 5: Each treatment were placed in an aeration surrounding.
Step 6: The treatment were de-molded after 48hours.

Table 1 Mixing ratio (Treatment Combination) for the production

Treatments	Stonedust	Sharpsand	Cement (A)	Cement (B)	Cement (C)	Cement (D)
A	4	-	1	-	-	-
B	4	-	-	1	-	-
C	4	-	-	-	1	-
D	4	-	-	-	-	1
E	-	4	1	-	-	-
F	-	4	-	1	-	-
G	-	4	-	-	1	-
H	-	4	-	-	-	1

Table 1 shows the different proportion of the materials being used for the experiment which form various treatments. The proportion goes thus, T_A constitutes four buckets of stone dust and one bucket of Cement (A), T_B consisted of four buckets of stone dust and one bucket of Cement (B), T_C consisted of four buckets of stone dust and one bucket of Cement (C), T_D consist of four buckets of stone dust and one bucket of Cement (D), T_E consist of four buckets of washed sharp sand and one bucket of Cement (A), T_F consist of four buckets of washed sharp sand and one bucket of Cement (B), T_G consist of four buckets of washed sharp sand and one bucket of Cement (C), T_H consist four buckets of washed sharp sand and one bucket of Cement (D). The weighed of cement used for each treatment was approximately 12.5kg. For even mixture and to prevent airspace within the pavers, the mixture is shaken thoroughly during casting operation. For each treatment, 8 pavers were produced.

DATA ANALYSIS

The data obtained was subjected to analysis of variance to determine the difference in the weight before and after curing. The experimental design used for their study is Completely Randomised Design (CRD) based on the fact that data are obtained from observational studies.

$X_{ij} = \mu + T_i + \varepsilon_{ij}$

Where X_{ij} is the value of the response variable in the jth trial for the ith factor level or treatment.

μ are parameters or the general means.
T_i Treatment effect
ε_{ij} are random error effect associated with the X_{ij} (experimental error).
i = 1, 2, ..., 8; j = 1,2, …, 6 (Lasisi, 2014).

Procedure for Pavers Compressive Strength Property

Testing of the quality of the materials were designed and performed to ensure adequate quality of construction research being executed. It involved laboratory test of each paving stone which was done at the materials testing laboratory, Ministry of Works and Transport, Oyo State Secretariat, Ibadan.

The comprehensive strength property in the laboratory was done after four days of immersion in water. The procedures are as follows:

Each replicate were separated according to their treatment. Each replicate were placed in between the flat plate one by one. The machine was switch on and the place pull up and pavers until it touches the metal plate at up and compressed the treatment until it get weaken and then the meter stopped reading.

The values of each treatment showed on the meter were recorded and the average was written down in KN/m^2.

Cost Analysis of the Production of Pavers

The cost of production was determined using the formula of economic theory cost of production:

Total cost of production = fixed cost + variable cost

RESULTS AND DISCUSSION

Table 5.1 Cost of production for each treatment (per 8 pavers)

Treatments	A	B	C	D	E	F	G	H
Cost of production	₦1060.4	₦1060.4	₦1060.4	₦1060.4	₦740.4	₦740.4	₦740.4	₦740.4

Table 5.1 shows the cost of producing 8pavers of each treatment. Values obtained ranges from ₦928.4 to ₦743.4k. the cost of producing paver with stone dust and each brands of cement is costly which is ₦928.4k per treatment. The pavers produced with sharp sand and each brands of cement process lesser cost of ₦743.4k compared to the one produced with stone dust. The difference in cost is a direct reflection of the cost of materials acquisition. Treatments with sharp sand and different brands of cement are less costly than that of stone dust. Considering the present government policy whose trust or focus is toward encouraging self-employment and beautification of environment at a reduced cost and utilization of readily available materials. This may justify the choice of Treatment E, F, G, H, as a better replacement of Treatment A, B, C, D.

Table 5.2 Percentage Damage during demoulding

Treatments	A	B	C	D	E	F	G	H
Percentage Damage	0%	0%	0%	10%	60%	0%	0%	30%

Table 5.2 shows that Treatments A, B, C, F, G recorded zero percentage or no damage T_E (60%) recorded high percentage of damage while T_H (30%) recorded the highest damage percentage sharp sand after demolding.after demolding. Cement (G) and Cement (B) does not damage when applied with stone dust and sharp sand after demolding.

Table 5.3 The Compressive strength (KN) of the pavers

Treatments	A	B	C	D	E	F	G	H
Comprehensive strength	260^a	133^c	285^a	200^b	165^{bc}	205^b	280^a	205^b

Mean of the same alphabet following in the same column are not significantly different from each other at 5% level of probability.

Table 5.3 shows the values of compressive strength of the pavers. Treatment C had the highest value of 285 (KN). Treatment H, D, F, was not significantly different from each other. Treatment B has the lowest value of 133 (KN). The result showed that Treatment C produce the best compressive strength, in terms of cement mixed with sharp sand and stone dust even at the same proportion.

Table 5.4 LSD result before curing

Treatments	A	B	C	D	E	F	G	H
Before curing	4.9^b	5.0^a	5.0^a	5.0^a	5.09^{ab}	5.05^{ab}	5.05^{ab}	4.93^{ab}

Mean of the same alphabet following in the same column are not significantly different from each other at 5% level of significant.

Table 5.4 shows the LSD value of pavers before curing. There is no significant different between treatment E, F, G Treatment E has the highest water absorption rate of 5.09 which agrees with Ajayi (2000), that sharp sand enhance water absorption in concrete constructed object due to its high porosity. The least water absorption is Treatment A with a value of 4.9.

Table 5.5 LSD result after curing

Treatments	A	B	C	D	E	F	G	H
Percentage Damage	5.10[a]	5.12[a]	5.24[a]	5.36[a]	5.21[a]	5.05[ab]	5.05[ab]	4.93[b]

Mean of the same alphabet following in the same column are not significantly different from each other at 5% level of significant.

Table 5.5 shows the LSD value after curing. Treatments A, B, C, E, were not significantly difference. Treatment D has the highest water absorption rate of 5.36. Treatment H has the least water absorption rate of 4.93.

CONCLUSION

The study revealed that it is highly feasible to produce pavers from sharp sand and Cement (C) at a much cheaper cost. It also shows that water absorption of pavers increases in sharp sand indicating characteristics of lasting longer. The paver produced wholly of sharp sand provides a good substitute to stone dust with each cement brands. The three variables (Cement, Stone dust, Sharp sand) used in pavers production has significant effect on the strength properties examined. Pavers produced wholly from sharp sand can satisfactory be used for both heavy and light traffic construction work. There is need to create awareness concerning the possibility of replacing stone dust with sharp sand in the production of pavers. However, the effect of difference in cement on the pavers is another important factor to be considered in other to avoid collapse building or construction damage. This will guide lay man who would have interest in beautification of his environment with durability and aesthetic purpose.

Therefore, we hereby recommend for the strength properties of the production of pavers that Treatment G should be used in paver production. Also, cement A, B, D, with sharp sand, are to be used in light traffic construction such as walk way and patios, and areas where humidity is low and less traffic.

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APPENDIX

Appendix 1: ANOVA Table of Pavers before curing

		Sum of squares	Df	Mean square	F	Sig.
Stonedust	Between Groups	.272	3	.090	1.239	.328
	Within groups	1.165	16	.073		
	Total	1.436	19			
Sharpsand	Between groups	.175	3	.058	1.697	.210
	Within groups	.516	15	.034		
	Total	.691	18			

Appendix 2: ANOVA Table of Pavers after curing

		Sum of squares	Df	Mean square	F	Sig.
Stonedust	Between Groups	215	3	.072	1.767	.194
	Within groups	650	16	.041		
	Total	865	19			
Sharpsand	Between groups	172	3	.057	2.008	.156
	Within groups	428	15	.029		
	Total	600	18			

Appendix 3: ANOVA Table of paver showing compressive strength

		Sum of squares	Df	Mean square	F	Sig.
Stonedust	Between Groups	94647.600	3	31549.200	3019.062	.000
	Within groups	167.20	16	10.450		
	Total	94814.800	19			
Sharpsand	Between groups	187276.150	3	62425.383	422.221	.000
	Within groups	2365.600	16	147.850		
	Total	189641.750	19			

Appendix 4: Cost Analysis

Items	Quantity	Unit Price (₦)	Amount (₦)	1% of Amount
Mound	40	120	4800	48.00
Shovel	1	1200	1200	12.00
Hand trowel	2	150	300	3.00
Bucket	2	350	700	7.00
Labour per m^2	1	200	200	2.00
Wheel barrow	1	6000	6000	60.00
Total				132

Appendix 5 Chemical Oxide Composition (%) of Cement Samples

Sample	Cement (A)	Cement (B)	Cement (C)	Cement (D)
CaO	62.6	61.4	59.6	62.2
Fe_2CO_3	3.20	3.23	3.22	3.59
S_1O_2	20.34	20.55	20.62	20.77
Al_2O_3	5.09	5.56	6.01	5.63
MgO	1.74	2.22	3.65	1.21
SO_3	2.19	2.38	2.46	2.19
K_2O	0.29	0.42	0.71	0.22

Variable Item	
A lorry load of river sand	₦5,000
A lorry load of stonedust	₦10,000
A bag of cement	₦1,900
One bucket of stonedust	₦165
One bucket of riversand	₦65
One bucket of cement	₦475

Variable cost of treatments A, B, C, D

Items per 8 pavers	Quantities	Unit Price (₦)	Amount (₦)
Sharpsand	-	-	-
Stonedust	4	165	660
Cement	1	59.4	59.4
Lubricant	0.05	180	9
Transportation		200	200
			928.4

Total production cost = fixed cost + Total variable cost
= ₦132 + ₦928.4
= ₦1,060.4

Variable cost of treatment E, F, G, H

Items per 8 pavers	Quantities	Unit Price (₦)	Amount (₦)
Sharpsand	4	85	340
Stonedust	-	-	-
Cement	1	59.4	59.4
Lubricant	0.05	180	9
Transportation		200	200
			608.4

Total production cost = fixed cost + Total variable cost
= ₦132 + ₦608.4
= ₦740.4

NOTE: See Appendix 4 for fixed cost.

Comparative and Statistical Analysis of the Strength of Pavers made from *Milicia excelsa* and *Gmelina arborea* Sawdust

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ABSTRACT

Pavers are increasingly being used by corporate bodies and individuals for its function, ability and aesthetic values. The demands for those expensive landscaping materials are increasing steadily, hence the need to look for close alternative that will drastically reduce the cost of the production. Therefore, the cell means model was employed to compare the strength of pavers from Milicia excelsa and Gimelina arborea sawdust. Sawdust from Milicia excelsa and Gimelina arborea undertook the pre-treatment, treatment combination and making ratio. Pavers were tested for their weight and strength properties. After, the data were subjected to statistical analysis called SAS command file and the results show that; the mean weight indicates that T2 (stonedust + boiled Milicia excelsa sawdust + cement) and T5 (stonedust + cold Milicia excelsa sawdust + cement) had the highest comparative strength and mean value. There was significant difference between the treatment of compressive strength with stonedust + sawdust (Milicia excelsa) performing better than stonedust + (Gimelina arborea) sawdust. The stonedust + Milicia excelsa had the lowest percentage damage which is the good indicator in the production of paver. Milicia excelsa in any form (cold or boiled) can enhance water absorption in concrete object due to its high porosity. It was recommended that the water absorption of pavers containing sawdust was very low and the fact that sawdust produced pavers could withstand total immersion for 2 weeks in water and have low absorption rate which will be able to withstand environmental stress and reduce the cost of production.

Keywords: Cell Means Model, Gimelina arborea, Milicia excelsa, Pavers and Sawdust

INTRODUCTION

Hard landscaping or landscape design has become a major instructional field in the use of man solid substance to design the environment. Hard landscaping involves the use of pavers, kerbs etc. in designing the environment and other materials are asphalt, concrete, paving stone or brick gravel etc. The use of each material depends on the choice of individual as well as the function of the area of the landscaped (Hoskin, 2011).

Pavers or paving stones are flat slabs which are designed to be used outdoors. Paving is a stylist, low cost way to create feature or utility area in outdoor space. One classic use of pavers is in garden pathways, and pavers are also used for making or producing patios and other recreation areas, or to line pools, ponds, and water features, along with raised beds and other decorative landscaping features. There are wide varieties of colours, textures and formats available. Pavers are more versatile than other hard surfaces (Adenihun, 1994).

Correctly laid pavers can have a long life time lasting and low maintenance. Also the valuable materials for the construction of walk ways, drive way, hard surface outdoor, outdoor step, pathways can also be constructed with paver. The environment can also be beautified by hard and soft landscape which must be given a proper attention with use of paving tiles, kerbs and ornamentals (Cateriona, 2002).

Hard and soft landscapes materials are also used to control noise, direct sunlight, and wind, even protect the soil or environment from erosion and flood. It has been observed that the production of pavers, kerbs and their uses like created an impression of neat and beautiful environment (Steve, 2007).

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Pavers or paving stones are increasingly being used by corporate bodies and individuals for its function, ability and aesthetic values. The demands for those expensive landscaping materials are increasing steadily, hence the need to look for close substitute or alternative that was drastically reduce the cost of the production (Cateriona, 2002).

Sawdust is a material made from wood or wood waste, in consideration for low cost and locally available materials meet desired needs, enhancing self-efficiency and leading to an overall reduction in construction cost and sustainable development. Sawdust made from *Milicia excels* and *Gmelina arborea* wood or waste agricultural product was developed in this research, intending to achieve the strength properties of pavers, since other recovered wood available are also large. Sawdust could be loose particles or wood chipping obtained as by product from sawing of timber into standard useable sizes (Aigbomain, 2013).

The occurrence of frequent or frequent collapsed structures due to poor quality construction materials had stirred up the researchers concern on how to produce pavers with different production materials to test for its strength, physical properties and how the cost of production can be reduced. Paving stones have been used for thousands of years in which it plays a vital role in our environment and have generated a lot of attention; hence the demand for it has greatly increased. The environmental and friendlities have also contribute to the promotion of the use of pavers. However, the materials use in the production (stone dust, cement and grave etc) is becoming too expensive and scarce thereby raising the overall cost of production. Therefore the need of using by-product (saw dust) in replacement of stone dust wholly or partially without any diverse effect on the quality of pavers is necessary. It is always available, it reduces light reflection and making the environment more conducive for living. Therefore, there is need to use saw dust (*Milicia excelsa* and *Gmelina arborea*) in production of pavers.

This study was designed to determine the strength of pavers using of saw dust and other binding materials such as stone dust, pigment, and cement in the production of pavers and also to know the durability of *Milicia excelsa* and *Gmelina aborea* wood saw dust on pavers.

LITERATURE REVIEW

Concrete block paving is versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenance if correctly manufactured and laid. Most concrete block paving constructed in South Africa has performed satisfactorily but there are two main areas of concern; occasional failure due to excessive surface wear, and variability in the strength of blocks. This technical note covers basic principles and aims to assist manufacturers, particularly new manufacturers to produce a durable and consistent product. It discusses: requirements for blocks; selection of materials; materials for manufacture; manufacturing equipment; proportioning of ingredients; manufacture and quality control. Scope is limited to blocks with a relatively small top surface area, i.e. about 50 blocks per square meter of paving (Adenihun, 1994).

Pavers or paving stones are flat slabs which are designed to be used outdoors. Paving is a stylist, low cost way to create feature or utility area in outdoor space. One classic use of pavers is in garden pathways, and pavers are also used for making or producing patios and other recreation areas, or to line pools, ponds, and water features, along with raised beds and other decorative landscaping features. There are wide varieties of colour, textures and formats available. Pavers are more versatile than other hard surfaces. (Adenihun, 1994).

Correctly laid paver has a long lifetime lasting and low maintenance. Also the valuable materials for the construction of walkways, drive way, hard surface outdoor, outdoor step, pathways can also be constructed with pavers. The environment can also be beautified by

hard and soft landscape which must be given a proper attention with use of paving tiles, kerbs and ornamentals (Cateriona, 2002).

Gmelina arborea wood (in English Beech wood) is a fast growing tree, which grows on different localities and prefers moist fertile valley with 750-4500mm rainfall. It does not thrive on ill, drained soil and remain stunted on dry, sandy or poor soils, drought also reduced it to a shrubby form. The tree attain moderate to large height to 30m with girt of 1-2 to 4 chlorophyll layer just under the outer back. It has pale yellow white inside. The wood is pale yellow cream coloured or plukish – buff when fresh, turning yellowish brown or exposure and is "soft to moderately hard", light to moderately heavy, lustrous when fresh, usually straight to irregular or rarely wavy grained and medium course textured. It is commonly planted as a garden and an avenue trees. It is a light demander tolerant (Olowogbon, 2011). *Gmelina arborea* wood is a popular timber for making pictures and slate frame, turnery articles and various types of brush back, brush handles and toys also for handles of chisels, files saws, screw drivers sickles. *Gmelina arborea* wood comes from conifer, which usually remains evergreen and it grows in huge tracks of trees which may spread for miles. Softwood comes from types of tree known as gymnosperm. It has less complex structure which has a simple anatomy with only few different cell types. (Putheti et al., 2008).

Milicia excelsa wood (Iroko or Africa teak), is a large deciduous tree growing to 50 meter (160ft) high. The trunk is bare lower down with the first branch usually at least 20 meter (66ft) above the ground. It often has several short buttresses root at the base. The bark is pale or dark grey, thick little fissured. There are few thick branches in the crown all fairly horizontal giving an umbrella shape. The leaves are 10 centimeters (2.0 to 3.9in) long, ovato or elliptical with a finely toothed above the slightly downy beneath. Older leaves turn yellow, and all leaves have a prominent rectangle mash of veins visible on the undesired. The trees are deciduous. Distribution is found in Angola, Benin, Ghana, Ivory Coast, Nigeria. African teak has strong dark brown hardwood resistance to termites and is used for construction furniture, joinery, paneling, floors and boats etc (Bizoux et al., 2008). *Melicia excelsa* wood is a deciduous trees that loses its leaves annually. *Melicia excelsa* wood tend to be slower growing and are therefore usually more dense, but not always, hard wood tend to be found mixed with a variety of other species. *Milicia excelsa* wood have a more complex structure; it is a wood from angiosperm trees which have more cell types, including large vessels known as "pores" and hardwood has also been reported to have a lower compatibility with cement (Weiy et al., 2000).

Pigment is a material that change the colour of reflected or transmitted light as a result wavelength selective absorption. Material that human have chosen and developed for use as pigment usually have a special properties that makes them ideal for colouring other materials. Pigment must have high tinting strength relative to the materials it colour. It must be stable in solid for at ambient temperatures, pigment are use in manufacture of pressed concrete product such as paving walling, in roof tile and wet cast concrete paving. The hardened cement paver by which the particles are held together is coloured by adding finely ground pigment. The aggregate itself cannot be colour, its particles merely being surrounded by the coloured cement paste. The pigments used for this purpose are generally light fast and have a high resistance to alkali and weathering. Adding pigment to concrete enhances easy and strong paving stone, it prevents easy penetration of water and it is resistant to insect attack to the pavers. Inorganic pigment such as iron oxides, Chromium oxides, Cobalt oxides and titanium dioxide are generally regarded as the best found pigment used for the colouring of concrete. (Egbert, 2003).

The cement content to achieve the required strength level will depend on the type of cement, rate of strength gain, degree of compaction (Cement and Concrete Institute, 2001). The Optimum Moisture Content (OMC) for molding depends on the materials being used, quality of vibration. Generally, the coarser the particles are graded and the greater the compactive effort, the lower will be the OMC. Using moisture content below OMC will hamper good compaction and may necessitate longer periods of vibration which in turn will reduce output. Lack of compaction will reduce durability. Using too much water will result in a reduction of density and may cause units to stick in the mould and thus make extraction difficult, or cause deformation of the units after extrusion. It must be noted that certain pigments because of their particle shape, can have a significant effect on OMC. Newly molded blocks was subjected to some form of curing. The form of curing ranges from the prevention of moisture loss to the use of temperature and high humidity (Cement and Concrete Institute, 2001).

Materials and Methods

Materials used are: *Milicia excelsa* and *Gmelina arborea* wood (saw dust), cement (Elephant), Stone dust, water, lubricant, universal testing tensile machine and pigment. The following tools were also used for the research; spade, plastic moulds, mason trowel, wheel barrow, head pan, sieve, foam, bowl, glove, stove and pot.

Source of the materials

***Milicia excelsa* saw dust:** The saw dust was collected from Industrial Development Unit (IDU) in Forestry Research Institute of Nigeria (FRIN), Ibadan, Oyo State.
***Gmelina arborea* saw dust:** The saw dust was collected from Bodija Sawmill at Bodija market.
Cement: Elephant brand of cement was purchased from depot at Dugbe.
Stone Dust: The stone dust was purchased from Aleshinloye Market, Ibadan, Oyo State.
The method used are as follows:
Step 1: The mould was cleaned and lubricated with lubricant (engine oil)
Step 2: The different mixing ratio was used as treatment combination.
Step 3: The materials was mixed thoroughly and equal amount of water was added to the aggregate.
Step 4: The treatment was poured into the mould and was placed in surrounding or environment
Step 5: The treatment was demoulded after 48hours.

The collected saw dust was sieved in order to have homogenous materials in terms of the particles sizes and also to remove unwanted materials. The saw dust was divided into two, the half was pre-treated separately in hot water at about 80^0C for a soaking period of 2hours and the other was socked in cold water for period of two days. This pre-treatment was carried out in order to remove extractives such as tannin, gum, resin etc. which may retard the setting and cutting of the cement binder. At the end of the soaking period, the hot water was drained off while the saw dust was washed in cold water before used.

Treatment Combination

Treatment 1: 4:1:0 = Four headpans of stone dust with one head pan of cement and no saw dust.
Treatment 2: 3:1:1 = Three headpans of stone dust, one head pan of boiled *Milicia excelsa* (saw dust) with one head pan of cement.
Treatment 3: 3:1:1 = Three head pan of stone dust, one head pan of cold *Gmelina arborea* (Saw dust), and one head pan of cement.
Treatment 4: 3:1:1 = Three headpans of stone dust, one head of boiled *Gmelina arborea* (saw dust), and one head pan of cement.

Treatment 5: 3:1:3 = Three headpan of stone dust, one head pan of cold *Melicia excelsa* (saw dust) with one head pan of cement.

Table 3.1: Mixing ratio (Treatment Combination for the production)

Treatment	Stone dust	Boiled saw dust *Milicia excelsa*	Cold saw dust *Gmelina arborea*	Boiled saw dust *Gmelina arborea*	Cold saw dust *Milicia excelsa*	Cement
T_1	4					1
T_2	3	1				1
T_3	3		1			1
T_4	3			1		1
T_5	3				1	1

Research Variables

The following are the specification of the research variables for this study:

Selection of Subject: The pavers or paving stones

Treatment: These are treatment combination for the production. The parameters are:

T_1 = Stone dust and cement

T_2 – Boiled saw dust *Milicia excelsa* and cement.

T_3 = Cold saw dust *Gmelina arborea* and cement.

T_4 = Boiled saw dust *Gmelina arborea* and cement.

T_5 = Cold saw dust *Milicia excelsa* and cement.

Data analysis:

Based on the field layout and process taken in this research, the appropriate experiment design to be used is cell means model because data are from observational studies or data from experimental studies based on a complete randomized design (Michael, 2005).

The general statistical model for single factor studies is a cell means model/design which is:

$$Y_{ij} = \mu_{ij} + \varepsilon_{ij}$$

Where Y_{ij} is the value of the response variable in the jth trial for the ith factor level or treatment.

μ_{ij} are parameters or the general means.

ε_{ij} are random error effect associated with the Y_{ij} (experimental error).

i = 1, 2, 3, 4, 5; j = 1,2,3,4

Procedure for testing compressive strength (N/mm^2)

Each treatment was taken to the laboratory to test for its compressive strength parallel or not parallel to grain properties at the Ministry of Works and Transport, Oyo State Secretariat, Ibadan.

RESULTS

Table 4.1: Mean weights (kg) of pavers before and after curing

Treatments	Mean weight before curing (kg)	Mean weight after curing (kg)	Different of mean weight (kg)
T_1	2.95	2.80	0.15
T_2	2.65	2.45	0.20
T_3	2.42	2.35	0.07
T_4	2.65	2.50	0.15
T_5	2.50	2.30	0.20

Table 4.1 above contains the average weight of pavers before and after curing operation. The samples were determined using a weighing scale. The difference in values, obtained ranged from 2.30 to 2.80kg after 3 days immersion in water, water absorption increased in the proportion of *Milicia excelsa* (T_2, T_5) because of its high density. The density of wood is in general related to wood anatomy and hence the relative proportion of cell types of tissues most especially in hardwood species (vessels, fibre, axial and radial parenchyma). In this study, the density of *Milicia excelsa* was higher than *Gmelina arborea* and this was reflected in the pavers produced from *Milicia excelsa* saw dust. *Milicia excelsa* have great strength and

hardness and is very resistant to insect and fungal attack because of its high tannin content. This observation agrees with the findings of (Bartoutis, 1991) that moist enhance the durability of concrete that is, pavers having higher absorption has the tendency of hasting longer due to rain or constant contact with water.

Table 4.2: Percentage damage during demoulding

Treatment	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**
Percentage damage	0	0	60	40	0

Table 4.2 above shows that stone dust and hard wood recorded the zero damage. Compare with the stone dust + *Gmelina arborea* that recorded the highest damage (60%), that means stone dust is preferred when hard wood saw dust in any form is to be included as constituent of pavers.

Furthermore, it was also noticed during production of pavers that the *Gmelina arborea* saw dust was lighter in weight coarse texture than the *Milicia excelsa* saw dust which made compaction in the mould more difficult than when using the saw dust from *Milicia excelsa* which was finer and dense thus making more compact.

Table 4.3: The Compressive Strength (Kn) of the pavers

Treatment	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**
Crushing load (kn)	90	138	250	260	135
Crushing strength (kn/m^2)	1051	1612	2921	3037	1577

Table 4.3 shows that T_1 (stone dust and cement) recorded the highest value of 1051kn while T_2 and T_5 which has the value 1612 and 1577 (3 ratio of stone dust + 1 ratio of boiled *Milicia excelsa* saw dust + 1 ratio of cement and 3 ratio of stone dust + one ratio of cooled *Milicia excelsa* saw dust + one ratio of cement) also recorded the best value, due to its great strength and hardness and are usually more dense. It is very resistant to insect and fungal attack because of its high tannin content. (Mitani et al., 2010). The density of wood is in general related to wood anatomy and hence the relative proportion of cell types or tissues most especially in hardwood species (vessels, fibre, axial and radial parenchyma). In this study the density of *Milicia excelsa* was higher than *Gmelina arborea* and this was reflected in the pavers produced from *Milicia excelsa* saw dust. But compare with the pavers produced with *Gmelina arborea* saw dust (Treatment 4), which recorded the lowest value. Furthermore, it was noticed that *Milicia excelsa* Pavers compressed less and have more strength than *Gmelina arborea* pavers which is total damage during compression therefore has less strength.

Table 4.4: Cost of production of pavers

S/No	**Tools**	**Cost(N)**
1.	Head pan	270.00
2.	Hand trowel	100.00
3.	Shovel	300.00
4.	Wheelbarrow	1000.00
5.	Pointing trowel	100.00
6.	Mould (Rentage Double T)	4000.00
S/No	**Materials**	
1.	Labour	2500.00
2.	Cement (25kg)	900
3.	Stone-dust	2400.00
4.	Pigment	3000.00
5.	Cost of Test Strength	3000.00
6.	Transportation	1000.00
	Total	**18,750.00**

Table 4.4 above highlights the cost of producing the pavers which amounts to ₦18,750.00

CONCLUSION

This study shows that it is possible to produce pavers from stone-dust that is durable by incorporating *Milicia excelsa* and cement. Conclusively, pavers made from *Milicia excelsa* saw dust with the incorporation of stone-dust and cement will still be as durable as that of cement and stone-dust alone. The nature of the wood sawdust also aids the strength and durability of pavers. It also shows that, comparably, stone-dust that has highest compressive strength is a good indicator of durability. The variable, stone-dust and *Milicia excelsa* saw dust, used in paver's production had serious effect on the strength properties examined.

Therefore, pavers produced for stone-dust and *Milicia excelsa* saw dust can be satisfactory used to produce pavers for the construction of walk way.

Hardwood saw dust is suitable for the production of pavers. Hardwood saw dust can absorb more water and withstand environmental stress. This research project work therefore recommends that saw dust should be included in the production of pavers. The cost of producing paver will be reduced with the presence of saw dust because it reduced the cost of cement used since saw dust also serves as a binding agent.

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APPENDIX

Anova Table for the Mean Weight before and after Curing

		Sum of squares	Df	Mean square	F	Sig.
Before curing	Between Groups	1.642	4	.410	600.271	.000
	Within groups	.031	45	.001		
	Total	1.673	49			
After curing	Between groups	1.530	4	.382	1.366E3	.000
	Within groups	.013	45	.000		
	Total	1.543	49			

Significant at 0.05 level of probability

Treatment	N	Subset for alpha =0.05			
		1	2	3	4
T3	10	2.4180			
T5	10		2.5000		
T2	10			2.6300	
T4	10			2.6330	
T1	10				2.9500
Sig.		1.000	1.000	.799	1.000

Means for groups in homogeneous subsets are displayed.

Treatment	N	Subset for alpha =0.05				
		1	2	3	4	5
T3	10	2.3000				
T5	10		2.3500			
T2	10			2.4500		
T4	10				2.500	
T1	10					2.8000
Sig.		1.000	1.000	1.000	1.000	1.000

Means for **groups** in homogeneous subsets are displayed.

Reconceptualising Research on Housing Quality and Conditions in Nigeria

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ABSTRACT

There is a growing body of literature on housing quality and housing conditions in Nigeria. These terms are often used interchangeably even within the same studies, suggesting that they are synonymous. The seeming definitional ambiguity makes the findings of such studies not readily amenable to objective comparative analysis. A more coherent conceptualization of these terms, their interrelatedness, and appropriate applications may therefore be required. Through a critical review of the literature and analysis of case-studies, this paper aimed at delineating the notions of housing quality and conditions, and highlighting the related issues, with a view to enhancing research in these areas. This study reveals the significance of the research aim, context, and methodology in resolving the conceptual incongruities. It concludes that the interrelationships between these concepts do not diminish their critical distinctions, which could add value to further studies in this vital area of housing research, especially in developing countries.

Keywords: Conditions, Housing, Needs, Quality, Research

INTRODUCTION

There is an expanding body of literature on 'housing quality' (HQ) and 'housing conditions' (HCs). The terms are often used interchangeably even within the same studies, suggesting that they are synonymous (Streimikiene, 2015; Adjei and Kyei, 2013; Toyobo, Muili and Ige, 2011). Mandic and Cirman (2012) attest to a definitional dilemma which may be due to the complex nature of housing. This definitional ambiguity makes the findings of such studies not readily amenable to objective or comparative analysis. Moreover, perceptions may vary in the same location due to differences in personal and socio-economic characteristics. While the terms are used interchangeably in some studies, others focus exclusively on either HQ (Lee and Oh, 2012; Buckenberger, 2012) or HCs (Zainal, Kaur, Ahmad and Khalili, 2012; Govender, Barnes and Pieper, 2011; Bagaeen, 2006). This implies that the two concepts may be distinct in certain respects. A more comorehensive conceptualization in terms of their interrelatedness and applications would therefore be useful. The following review of literature examines the issues related to HQ and HCs, their definitions, indicators, relevance to quality-of-life (QoL) and health implications.

LITERATURE REVIEW

The literature on HQ and HCs vary in contexts, purposes and approaches. The contexts range from rural housing, slums, squatter settlements and informal low-cost housing, to public housing and high-rise condominium apartments; and from developed countries to developing countries. Studies range in purpose and method from conceptual to empirical surveys or case-studies. This review section addresses three broad areas: conceptual and definitional issues; measurement and indicators; and health-related issues.

Conceptual and Definitional Issues

Housing Quality

Housing quality (HQ) is a complex multi-dimensional concept, which has been defined in diverse ways, depending on the stakeholders' rationale and objectives (Franklin, 2001). It is widely acknowledged that HQ transcends the physical structures of dwellings (Buckenberger, 2012). Meng and Hall (2006) define HQ as "the grade or level of acceptability of dwelling

Ilesanmi, A. O. (2016). Reconceptualising Research on Housing Quality and Conditions in Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 394-402

units and their associated and immediate residential environment, including the design and functionality of housing structures, building materials used, the amount of internal and external space pertaining to the dwelling, housing utilities, and basic service provision." HQ is however more complex, with broader social and economic meaning, and incorporates both quantitative and qualitative dimensions. The quantitative aspect refers to objective structural, material, social and economic constituents or measurable outcomes, such as price, quantity, tenure, economic impacts, and structural housing standards. The qualitative dimension includes the perceived meanings and values of factors such as 'comfort' or 'quality of life' afforded by different dwelling types, lifestyles and residents' preferences and aspirations.

Irrespective of the dimension however, HQ is a relative rather than absolute or static concept; it varies over space and time (Teo and Kong, 1997). Lawrence (1995) proposed a reappraisal of the concept of HQ to extend beyond the traditional, architectural, technical and qualitative dimensions, to embrace economic and political dimensions. In a study of suburban Auckland, New Zealand, for example, Buckenberger (2012) reveals that owner occupants perceived the physical housing qualities to be central for families. To the cohort of elderly people however, intangible qualities such as the meaning of nature, gardens and lifestyle, and accessibility to shops and public transport outweighed physical qualities. This suggests a life-cycle shift in qualities from physical to intangible, emotional qualities in later life.

Housing Conditions

The word 'condition' refers to a state in which something exists. Discussion and study of HCs have an extensive tradition in the social sciences and suggest that HCs focus mainly on the physical attributes of dwellings and denote a concern for an acceptable, adequate level of housing. Much of earlier literature focused on the shelter function – housing as a physical resource for the satisfaction of basic need for shelter, while giving less attention to other functions of housing such as privacy, location, investment and social indicators.

Gwedu (2003) reports the evaluation of environmental problems at a low income urban area of Gaborone, Botswana. The study restricted evaluation to the quality of structures, apart from access to water, sanitation facilities and waste disposal, and interpreted HQ from a HC perspective. Bagaeen (2006) profiles the conditions in the Palestinian quarters of the old city of Jerusalem relative to the buildings, structures, utilities and services. He emphasizes the measurement of physical condition: provision of living space, aesthetic qualities of buildings, construction materials used, state of disrepair and the provision of services and environmental conditions. Similarly, Reuschke (2012) relates commuters' objective dwelling conditions and subjective dwelling preferences to multi-locational lifestyles.

According to Mandic and Cirman (2012), HCs tend to focus more on physical characteristics that reflect the ideas of 'adequate' or 'decent.' They denote mainly those physical attributes of dwellings that are significant for residents' wellbeing and meeting basic social norms, expressed in terms of 'decent', 'adequate' or 'acceptable' housing. These socially constructed norms are usually incorporated into public policies for intervention purposes. However, HCs do not only refer to the conditions of dwelling unit, but also wider living conditions of the environment, including basic facilities and supporting services (Konadu-Agyemang, 2001).

Some studies have related HCs to the quality-of-life concept (Daly, 2007), while others focused on the health implications of HCs (Adjei and Kyei, 2013; Shortt and Hammett, 2013; Milstead, Miles and Robbel, 2006; Evans, Saltzman and Cooperman, 2001). Housing improvement campaigns were undertaken in many European countries during the 19th century, as part of large-scale public health interventions to respond to inadequate housing conditions relating to crowding, hygiene, sanitation, ventilation, lighting, and structural deterioration (Braubach, 2011). Filali's (2012) analysis of HCs of households in Tunisia

focuses mainly on dwelling attributes and household size, related to five housing deprivation thresholds, with a view to reducing housing deprivation and preventing health vulnerability among deprived households. Housing conditions are often discussed in terms of inadequate housing of deprived groups, such as poor households, ethnic minorities and immigrants (Buckley and Mathema, 2008). They have also been referred to as 'slum severity' (Patel *et al.*, 2014) and 'slum conditions' (Gulyani, Bassett, and Talukdar, 2014; Omole, 2010).

Quality-of-Life

A number of studies have linked HQ or HCs to quality-of-life (Streimikiene, 2015; Ilesanmi, 2012; Zainal et al., 2012; Torrington, 2007). The 'quality of life' (QoL) perspective defines and conceptualizes HQ and HCs as elements of overall well-being (Daly, 2007). The QoL concept recognizes housing as one of nine components, which include: health and access to health care, employment and working conditions, economic resources, education and skills, family and social integration, security of life and property, recreation and leisure time, and culture and political resources (Wadley, 2011; Moser, 2009). Zainal et al. (2012) provide empirical evidence that relates poverty, HCs (dwelling types and physical conditions, house tenure, surrounding environment and availability of amenities) and QoL in Malaysia. Housing condition may therefore be viewed as a socio-economic indicator of urban poverty.

Indicators and Measurement Issues

Indicators are tools that measure, simplify and communicate phenomenon and trends, usually for the purposes of tracking progress, developing policies, monitoring their effectiveness and results, or deciding on interventions (Streimikiene, 2015). Due to the context-specific nature of HQ and HCs, there has been little consensus about defining indicators for measuring them. Konadu-Agyemang (2001) examines population growth trends and HCs in Accra, comparing the situation in the 1950s and 1990s in terms of tenure pattern, dwelling type, household size, occupancy rate, privacy, facilities available, and dwellings' material composition. The author found that HCs in the city were worse than they were in the 1950s. Fiadzo's (2004) indicator for estimating the determinants of HQ in Ghana, is a composite of items such as: type of lighting fuel, type of cooking material, main source of water, and type of wall material, as well as distances to nearest public transportation, hospital, market, water source, and secondary school – items which appear to be unique to the context.

The basic measures of HCs are 'number of persons per room' and 'amenities' – indicators that emphasize the physical condition of housing. Other factors which may affect HCs include: dwelling type, room size, provisions of bathrooms and toilets, construction materials, in-house facilities and services, and the neighbourhood (Torrington, 2007). Sanusi (2008) uses a three-dimensioned indicator similar to Human Development Index (HDI), comprising housing facilities (toilet, bathroom and kitchen), adequacy/space (house renting, squatting, spill-over population, occupancy ratio, bedroom, sitting room, cross-ventilation, internal open space); and solid waste disposal, to assess housing deprivation. Filali (2012) identifies overcrowding, ownership rates and basic public services as primary indicators individually employed to appraise household HCs, especially for international comparisons.

Yakubu *et al*. (2014) examine the effect of wealth on HCs of households in the Tamale, Ghana, based on three components of HCs: (a) residential density (average room occupancy rates); (b) material composition of the houses (wall, roofing, flooring and ceiling materials – their durability, maintainability and susceptibility to damp conditions); and (c) in-house facilities and services (potable water supply, toilets, waste disposal, cooking options, access to electricity and street lighting). In summary, physical conditions of dwelling units, availability of facilities and services, and environmental quality are critical elements in

assessing HCs (Lawrence, 2006). Streimikiene (2015) proposes a comprehensive set of indicators under three main groups, all of which have impact on quality of life, namely:

i. Dwelling's socio-physical and physical characteristics: overcrowding rate; housing deprivation rate (lack of basic facilities); deterioration or otherwise of roofs, floors, doors and window frames; and availability of electricity, water supply and cooking facilities.
ii. Housing environment: subjective perception of residents to exposure to crime, violence or vandalism in the area, noise from neighbours or from the street, pollution, grime or other environmental problems; and the proximity of public services (schools and hospitals).
iii. Housing expenditures burden: housing cost overburden rate, inability to keep home warm, share of housing costs in disposable household income, and inability to pay utility bills.

Health-related Issues

Much of the literature focuses on the health implications of HQ and HCs. Tanaka, Nakano, Nakamura and Takeuchi (1996) found significant correlation between residential-condition indicators and health levels of residents in Tokyo, after adjusting for socio-economic differences between communities. Evans *et al.* (2001) relate a standardized HQI to children's psychological distress and motivation. Milstead *et al.* (2006) associate increased cockroach infestations with housing and neighbourhood conditions in three European cities. Gifford and Lacombe (2006) link the socioemotional health of children 9-12 years old to physical quality aspects of their residence and neighbourhood in a Canadian city. Northridge, Ramirez, Stingone and Claudio (2010) reveal how factors associated with HQ explain the clustering of childhood asthma in public housing in New York. Govender *et al.* (2011) associate the structural living conditions of government-subsidized low-cost housing settlements in Cape Town, South Africa with inhabitants' health conditions. The study reveals how structural aspects of HCs contribute to an increased risk of communicable diseases. Adjei and Kyei (2013) confirm a positive correlation between poor housing conditions and disease occurrence in selected rural communities in Ghana. Ogundahunsi and Adejuwon (2013) draw similar conclusions regarding HCs and residents' health in villages of Osun State, Nigeria.

RESEARCH METHOD

This study employed a qualitative research approach involving the collection of secondary data from research reports and case-studies on housing quality and housing conditions. Sixty-eight (68) pieces of literature were consulted or reviewed to varying degrees. These included 6 conceptual papers, 47 peer-reviewed journal articles, 4 theses, 7 technical reports and 4 conference proceedings (See Table 1). Content analysis of thirty-four (34) of the journal articles which reported empirical evaluations of housing quality or housing conditions was conducted and the findings briefly discussed in the section following.

Table 1: *Summary of Reviewed Literature*

Type of Literature	No. of Units	Consulted/Reviewed
Journal articles	Conceptual Papers	6
	Empirical Research Papers	47
Theses		4
Technical Reports		7
Conference Proceedings		4
Total		68

ANALYSIS, FINDINGS AND DISCUSSION

The qualitative analysis and findings of this study are presented and discussed under three subheadings, namely: purposes of HQ and HCs evaluation; perceived shifts in nomenclature;

distinguishing between 'housing quality' and 'housing conditions.' These are with a view to minimizing the conceptual ambiguities.

Purposes of Housing Quality and Conditions Evaluations

Studies on HQ and HCs may be intended for academic research, to formulate and implement housing policies, to identify targets for improvement or upgrading of housing stock, and to disseminate information to the professions or the public. Table 2 summarizes some of these.

Table 2: *Some Purposes of Housing Quality and Conditions Evaluation*

S/N	Case-study	Primary Purposes
1	Fiadzo *et al.* (2001) Ghana	To evaluate housing needs and effects on spatial inequity To estimate the extent of poverty
2	Meng and Hall (2006) Lima, Peru	To identify areas of deficient HQ; in greatest need of improvement; clearly visualize areas with high HQ inequity. To reveal spatial distribution of HQ and map disparities. To provide government housing planners with household and area-based information for identifying areas of HQ deficiency.
3	Sanusi (2008)	To assess housing deprivation in urban Minna, Nigeria.
4	Zainal et al. (2012)	To show HC as a socio-economic indicator of urban poverty.
5	Filali (2012)	To identify households suffering from housing deprivation.
6	Lee and Oh (2012)	To provide information on housing choices in Korea.
7	Adjei and Kyei (2013)	To explain the relative incidence and severity of disease occurrence as public health implications of poor rural environment in Ghana.

Perceived Shifts in Nomenclature

It appears from the literature on HQ and HCs in Nigeria and Ghana, that there have been shifts in nomenclature over time. Older studies seem to have focused on HCs, especially with regard to housing the urban poor. Jagun (1983) estimated 'urban housing need' as a proxy for HCs; Ozo (1987) analyzed HCs of the urban poor in Benin City; while Awotona (1988) examined the perceptions of HCs in Nigeria by the urban poor. However, Ogu (1994) examined rural HQ in Imo State; Fiadzo *et al.* (2001) view HQ as a basis for poverty evaluation and development policy analysis. Pacione (2003) and Coker, Awokola, Olomolaiye and Booth (2008) extend the scope of evaluation beyond housing units to neighbourhood environmental quality, relative to health and well-being. Ilesanmi (2010, 2012) focus on the quality of housing and neighbourhoods in public housing estates.

Other recent studies freely mix HQ and HCs. Olotuah's (2010) appraisal of environmental degeneration in Nigeria emphasizes physical housing conditions. Omole (2010) assesses HC and socio-economic lifestyles of slum-dwellers in Akure. Toyobo *et al.* (2011) highlight the socio-economic correlates of HQ in Ogbomosho. Amao (2014) integrates the concepts of HQ and HCs in a case-study of selected urban fringes of Ibadan; while Jiboye (2014) isolates the effect of house-type on residential quality in Osogbo. Ogunleye (2013) relates socio-economic characteristics to HC – physical state of buildings – in the low-income core area of Akure, Nigeria. With the growing interest in the qualitative dimensions of housing, it is important that conceptual ambiguities be reduced, so that concepts are better operationalized for more useful application of research results, especially of studies in contiguous contexts.

Between Housing Quality and Housing Conditions

Based on the review and case-studies, it is possible to draw few distinctions between HQ and HCs. 'Housing quality' often assumes the form of a 'measure' – such as Housing Quality Index (HQI) – which enables comparison between contexts, and may relate to housing satisfaction. While HCs may also assume the form of a measure – Housing Condition Index (HCI) – it is often more descriptive than defined as a single index. Studies that develop single composite indicators have been more common in developed countries due to the availability

of more comprehensive and consistent housing data. Such studies are gradually evolving in the developing countries based on residents' evaluation (Sanusi, 2008).

While many studies on 'quality' have focused on contexts of planned housing developments such as public housing, 'conditions' are usually descriptive of less organized settings such as informal private housing, slums and squatter settlements. It is usual for example, to refer to 'slum conditions' rather than 'slum quality' (Omole, 2010; Garau, Sclar and Carolini, 2005). Moreover, while HQ usually refers to conventional standard(s), 'conditions' relate more to socially-constructed basic needs that households perceive, relative to local norms.

Although both concepts usually transcend the scope of the dwelling unit to embrace its surrounding, 'quality' will often encompass broader issues of the neighborhood, supporting amenities, facilities or infrastructure – availability, affordability, and adequacy. Older studies on HCs emphasized the physical conditions of dwellings and living conditions, viewing it essentially as an issue of inadequate housing of disadvantaged or deprived groups, such as low-income households, ethnic minorities, immigrants, and run-down neighborhoods. In order to decide what form of evaluation to conduct therefore, important consideration should be given to the study's aim or purpose, context and method. The framework in Figure 1 and summary in Table 3 illustrate how aspects of HCs (shaded boxes) could be conceptualized as being subsumed within the broader concept of HQ, and their possible applications.

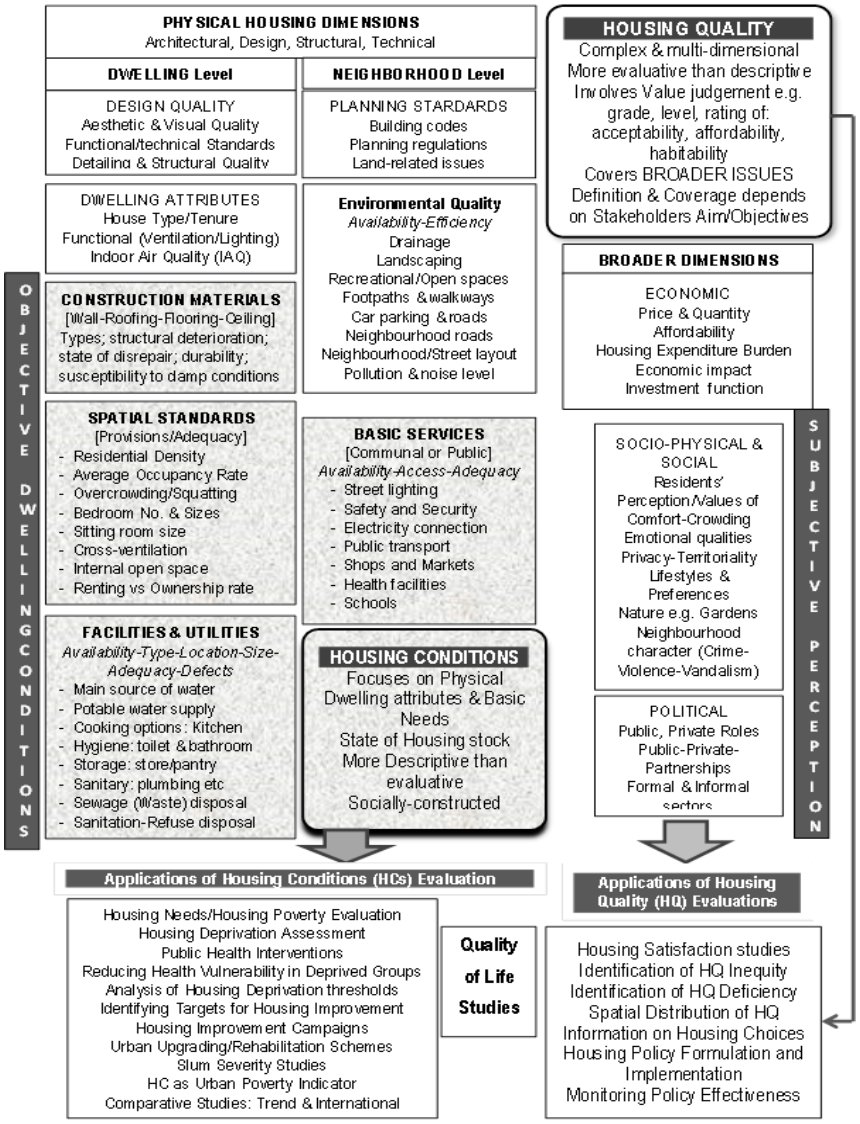

Figure 1: Conceptual Framework Relating Housing Quality and Housing Conditions

Table 3: Contexts and Methods of Evaluation

	Housing Quality	Housing Conditions
Context	- Formal Housing - Public Housing - Institutional housing (e.g. staff housing) - Apartment blocks/Condominiums	- Informal private housing - Slums and squatter settlements - Housing for the low-income - Rural housing - Temporary housing
Purpose	- Information to policy-makers and planners on areas of HQ deficiency. - Policy formulation and analysis - Information on housing choices - Cross-city/national comparisons	- Evaluation of housing needs and effects on spatial inequity. - Mapping of poverty profiles. - Assessment of housing deprivation. - Public health and housing conditions.
Methodology	Rigorous analysis e.g. correlation, regression, principal component analysis (PCA), factor analysis	Descriptive analysis e.g. frequency, cross-tabulation, Chi-square

CONCLUSION

The seeming definitional dilemma regarding the terms 'housing quality' and 'housing conditions' forms the thrust of this paper. By means of a literature review and appropriate case-studies, the paper examined the notions of housing quality and housing conditions in terms of their definitions, indicators, relevance to quality-of-life and health impacts. These were with a view to gaining clearer insight and drawing applicable distinctions between the terms, even though they appear to be synonymous. The interrelationship between the concepts of housing quality and housing conditions do not diminish their critical distinctions, an understanding of which could add value to the conceptual basis of further studies in this vital area of housing research, especially in developing countries.

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Effect of Blended Cement on the Hydration Properties, Compressive Strength and Environmental Compatibility of Concrete

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ABSTRACT

This paper investigated the effect of blended cement (or cement combination) containing Portland cement, fly ash, silica fume and metakaolin on the hydration properties (using the standard consistency, setting times, workability and pozzolanic reactivity), compressive strength and environmental compatibility (using the embodied carbon-dioxide contents) of concretes or pastes. The results showed that cement combination concretes have lower embodied carbon-dioxide contents and are therefore more environmentally compatible than Portland cement concrete. Fly ash would reduce water demand and superplasticiser dosage (to improve workability), increase setting times and reduce early-age strength development. Silica fume and metakaolin will increase water demand and superplasticiser dosage and reduce setting times to support early-age strength development. While silica fume and metakaolin are more reactive than fly ash due to their higher fineness, the ternary combinations coupled with the slow but long-term pozzolanic reaction will make the supplementary materials to produce concrete with good workability and support both early-age and later-age strength development. Due to its higher fineness and particle shape, silica fume would perform better than metakaolin at equal replacement levels. Also, for optimum performance, the metakaolin content should be limited to 10%. Blended cement concretes would acquire equal strength with Portland cement concrete at lower water/cement ratios (thus requiring higher quantities of the cements). Nevertheless, if appropriately proportioned, blended cement concretes that are cheaper and more workable and environmentally compatible than Portland cement concrete are available at equal strengths.

Keywords: Blended cement concrete, compressive strength, hydration properties, pozzolanic reactivity, environmental compatibility

INTRODUCTION

The production of conventional concrete is faced with the problem of high level of carbon dioxide (CO_2) emissions which stands at about 930kg per tonne of Portland cement produced (The Concrete Industry Sustainable Construction Forum, 2009). With about 10% of CO_2 emissions being generated by the cement industry (Oxley, 2003), the partial replacement of Portland cement content of concrete by supplementary cements like fly ash, silica fume and metakaolin which are more environmentally compatible due to their low embodied CO_2 content (Table 1), became inevitable in concrete construction. Fly ash is characterized by low water demand and improved workability of concrete (Dhir et al., 2002) and low cost and quality fly ash could be made available for future use (Jones et al., 2006; Antiohos et al., 2007). However, the use of fly ash would result in increased setting times (Langan et al., 2002). This is because the pozzolanic reactivity of fly ash depends on the $Ca(OH)_2$ produced by the hydration reaction of Portland cement and would be delayed when the alkalinity of the pore water is low (Fraay et al., 1989). While this would result in poor performance at early ages (Hassan et al., 2000; McCarthy and Dhir, 2005), its improved pozzolanic reactivity with curing age would produce better performance at later ages (Lam et al., 1998).

Despite their high water demand and workability problems (Bouzoubaa et al., 2004) and high cost (Table 1), the fineness of silica fume and metakaolin would result in more nucleation sites to accelerate hydration reactions (Mehta and Aitcin, 1990), reduce setting times (Ambroise et al., 1994; Bouzoubaa et al., 2004), enhance strength (Day, 1992; Uchikawa and Okamura, 1993; Korpa et al., 2008), refine pore structure to increase the resistance of

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concrete to permeation (Bentz et al., 2000; Frias and Cabrera, 2000; Poon et al., 2006; Korpa et al., 2008) and offset the poor performance of fly ash at early ages. Hence, to exploit their complimentary roles in concrete performance, ternary combinations of Portland cement, silica fume or metakaolin and fly ash became worthwhile. This is because, while silica fume or metakaolin would contribute to the early age performance of concrete, fly ash would continue to refine the properties of the hardened concrete as it matures (Thomas et al., 1999; Khan et al., 2000, Khan and Lynsdale, 2002; Bai et al., 2002). However, these supplementary cements are underutilized in construction. Since these cements are more environmentally compatible than Portland cement and their use is supported by cement and concrete standards like BS EN 197- 1, BS EN 206- 1 and BS 8500, among others, it becomes necessary to investigate their implication for concrete construction.

For good quality of workmanship, hydration properties of concrete like standard consistency, setting times and workability would assist contractors and concrete suppliers in making appropriate decisions on handling (transportation), placing (including choice of formwork), compacting and finishing of concrete. While the engineering or durability performance of the supplementary cements would depend on their pozzolanic reactivity, their patronage would depend on their economic and environmental implications. Hence, this paper presents the effect of the supplementary cements on the hydration properties, compressive strength, cost and environmental compatibility of concrete.

EXPERIMENTAL MATERIALS AND METHODS

The cementitious materials consist of ordinary Portland cement (PC, 42.5 type) conforming to BS EN 197- 1, siliceous or Class F fly ash (FA) conforming to BS EN 450, silica fume (SF) in a slurry form (50:50 solid/water ratio by weight) conforming to BS EN 13263- 1 and metakaolin (MK) conforming to BS EN 197- 1. The physical and chemical properties of the cements are presented in Table 1. The aggregates consist of 0/4mm fine aggregates and uncrushed 4/10 mm and 10/20 mm coarse aggregates of varied shapes. While the 4/10 mm aggregates were rough, the 10/20 mm aggregates were smooth. Potable water, conforming to BS EN 1008, was used for mixing and curing the concrete specimens. To achieve good cohesion and finishability within a consistence level of S2 (BS EN 206- 1) defined by a nominal slump of 50-90 mm, a superplasticiser based on carboxylic ether polymer conforming to EN 934- 2 was applied to the concrete mixes during mixing. The concrete mix design was based on the BRE Design Guide (Teychenne et al., 1997), selected cement combinations (Table 3) and a free water content of 165 kg/m^3 to avoid an excessively sticky mix.

Cement paste was prepared to BS 196- 3 using a small mixer bowl conforming to BS 196- 1. The materials were carefully added to water in the mixer bowl and mixed carefully to avoid loss of materials and ensure thorough mixing and uniform consistency. Tests were carried out on the fresh specimens of the cement pastes to determine the standard consistency and setting times and on the hardened specimens of cement paste at the water/cement ratio of 0.50 to investigate the pozzolanic reactivity of the cement combinations. Concrete was prepared to BS EN 12390- 2. Tests were carried out on fresh specimens of concrete to investigate the workability, superplasticiser dosage, cohesion (or stability) and finishability and on the hardened concrete specimens to determine the cube compressive strengths. The paste and concrete specimens were cast, cured under a layer of damp hessian covered with polythene for about 24 hours, demoulded and cured in water at about 20^{o}C until the tests' dates.

Table 1. Physical and chemical properties of cements

PROPERTY	CEMENTS			
	PC	FA	MK	SF
Blaine fineness, m^2/kg	395	388	2588	*
Loss on ignition, % [a)]	1.9	6.1 [b)]	0.9	2.7
Particle density, g/cm^3	3.17	2.26	2.51	2.17
% retained by 45µm sieve [b)]	-	11.0	-	-
Particle size distribution, cumulative % passing by mass [c)]				
125 µm	100	100	100	100
100 µm	98.2	99.2	100	100
75 µm	93.2	96.5	99.8	100
45 µm	81.8	87.0	99.4	100
25 µm	57.1	66.2	96.0	98.8
10 µm	30.1	40.6	76.2	93.8
5 µm	13.5	24.1	50.7	87.5
2 µm	5.6	10.9	18.2	85.5
1 µm	2.9	4.8	4.7	78.7
0.7 µm	1.3	1.9	1.4	50.7
0.5 µm	0.2	0.3	0.1	10.5
Bulk oxide composition, % [d)]				
CaO	64.5	3.2	0.0	0.4
SiO_2	20.0	52.0	57.6	96.6
Al_2O_3	4.6	26.0	38.9	0.7
Fe_2O_3	3.7	10.1	0.6	0.2
MgO	2.5	1.5	0.3	0.6
MnO	0.1	0.1	0.0	0.0
TiO_2	0.3	1.5	0.0	0.0
K_2O	0.7	2.8	2.4	0.8
Na_2O	0.3	1.2	0.1	0.3
P_2O_5	0.1	0.5	0.1	0.1
Cl	0.1	0.0	0.0	0.1
SO_3	3.1	1.1	0.0	0.2

* Fineness for SF = 15,000-30,000 m^2/kg (Holland, 2005)
a) In accordance with BS EN 196-2 (except for FA)
b) In accordance with EN 450- 1
c) Obtained with the Laser Particle Sizer
d) Obtained by x-ray fluorescence (XRF)

The standard consistency test involves determining the quantity of water, by trial and error, which will give a standard consistence in accordance with BS EN 196- 3. The test is time specific and the procedure involves preparing the mould, calibrating the Vicat apparatus and raising the plunger to a standby position ready for the test. 500 g of cement or combinations was carefully mixed with an initial amount of water (e.g. 125g) on a low speed to avoid loss of water or materials at a known time recorded as the 'zero time' on which the determination of the initial and final sitting times was based. After thorough mixing, the mould (with the base plate) was filled with paste, tapped gently to remove the voids, finished smooth surface and positioned centrally on the calibrated Vicat apparatus before releasing the gently lowered plunger to penetrate vertically into the centre of the paste. The reading on the scale was recorded 5 seconds after penetration has ceased or 30 seconds after the release of the plunger, whichever is earlier. The test was repeated by varying the water content until a distance of 6±2 mm between the plunger and the base plate was obtained.

The setting times were determined with the automatic Vicat apparatus launched on the computer and test machine complying with BS EN 196-3. The machine drops a 300g needle into the paste prepared at standard consistency and the depth of penetration was recorded. The initial setting time was obtained as the time from when water was added to cement to the time when the needle can only penetrate a distance of 36±1 mm while the final setting time

was obtained as the time from when water was added to cement to the time when the needle can only leave a mark on the surface (i.e. when the penetration is less than 1mm).

The quantity of $Ca(OH)_2$ consumed at a particular age, obtained as the difference between the quantity of $Ca(OH)_2$ present in the Portland cement paste specimen and the quantity of $Ca(OH)_2$ present in the other cement paste specimens at that age, was used to assess the pozzolanic reactivity of the cement mixes. The quantities of $Ca(OH)_2$ present in the cement paste specimens were determined by thermogravimetric (TG) analysis which involves measuring the weight loss of a sample with respect to temperature change. From the plot of the sample weight against the temperature, physical and chemical changes that involve thermal decomposition (or weight loss) were identified and measured. To avoid weight gain which could result if the sample reacts with atmospheric gases, the experiment was conducted in an inert atmosphere using Nitrogen gas. The TG equipment also allows a constant replacement of its internal atmosphere in order to flush out the gases evolved and prevent reactions between the volatilized substances in the material which could complicate the interpretation of the thermogravimetric plots. The TG equipment (a STA- 1 installation unit fitted with a 1500^{o}C capacity furnace) is connected to a computer which automatically log and analyse the data generated. Fragments from the core of paste cubes were selected, quenched in acetone to stop the hydration process, oven-dried at 40^{o}C to avoid carbonation, cooled to room temperature in a dessicator containing silica gel and ground into powder. A minimum powder sample of 10mg was placed in a platinum crucible, installed on the TG equipment and heated to a temperature of 1000^{o}C at a rate of 10^{o}C/minute. The TG plot produced was used to determine the quantity of $Ca(OH)_2$ left in the samples at the respective ages as stated below. The % water loss (wL) from the dehydroxylation region (defined by a temperature range of 400-500^{o}C on the graph of the first derivative) was obtained and used in conjunction with equation 2 to determine the %$Ca(OH)_2$ content as stated in equation 1.

$$\%Ca(OH)_2 = \frac{wL}{18}\ x\ 74 \qquad (1)$$

$$\underset{(74\text{g/mole})}{Ca(OH)_2} \rightarrow \underset{(56\text{g/mole})}{CaO} + \underset{(18\text{g/mole})}{H_2O} \qquad (2)$$

To investigate the effect of cement combinations on workability, the superplasticiser dosages, cohesion and finishability of the concretes were assessed with the aid of slump test carried out in accordance with BS EN 12350- 2. The slump test could be used to determine the capacity of concrete to hold water and coarse aggregates (Metha and Monteiro, 2014). The superplasticiser dosages for the cement combinations were determined at a consistence level of S2 defined by a nominal slump of 50-90 mm in BS EN 206- 1. A dampened truncated cone (100mmΦ x 200mmΦ x 300mm) placed on a horizontal base plate and held firmly in position with the aid of the foot rests, was filled with fresh concrete placed in three layers, each approximately one-third of the height of the cone when compacted. Each layer was compacted with 25 strokes of the tamping rod (16mmΦ x 600mm) uniformly distributed over the cross-sections and depths of the layers. The top layer was over-filled and the excess, after tamping, was removed by the sawing and rolling movement of the compacting rod. After this, the spilled concrete was removed from the base plate and the cone was carefully lifted vertically and placed inverted next to the slumped concrete. The difference between the height of the mould and the highest point of the slumped concrete was then measured, to the nearest 5mm with the aid of a ruler, as the slump and the quantities of superplasticiser used to achieve a consistence level of S2 were recorded for the mixes. Cohesion and finishability of concrete were visually assessed. While cohesion was assessed by the extent of firmness or looseness of the slumped concrete when tamped many times with a rod, finishability was assessed by the quality of finish.

The compressive strength of concrete was obtained in accordance with BS EN 12390- 3. The test specimens were loaded to failure using the Avery Denison crushing machine with a base load of 10kN at a loading rate of 7.0 kN/m^2. Two water-cured 100mm cubes were tested at the curing ages of 28, 90 and 180 days after casting.

The material cost of concrete, used in this research, was obtained as the summation of the costs of the constituent materials. Hence, it excludes all costs associated with profit and overhead and the use of other construction resources (i.e. equipment, manpower, money and management). The embodied carbon dioxide (eCO_2) is a measure of carbon dioxide emitted owing to the energy used in heating the kiln and in the chemical reaction that takes place in the kiln when cement is manufactured. The material costs and eCO_2 contents of concrete mixes (Table 7) were obtained with the aid of the mix proportions as the summation of the costs and eCO_2 contents of the constituent materials at the different water/cement ratios using the costs and eCO_2 values presented in Table 2. The costs, eCO_2 contents and strength values were interpolated or extrapolated to obtain the values at equal strengths (Table 8).

Table 2. Costs and embodied CO_2 contents of concrete constituent materials

Concrete Constituent Material	COST OF MATERIAL [a)], £/tonne	e-CO_2 CONTENT OF MATERIAL [b)], kg/tonne
Portland cement (PC)	60.00	930
Fly ash	20.00	4
Silica fume	140.00	14 [a)]
Metakaolin	100.00	300 [a)]
0/4 mm aggregates	10.00	4
4/10 mm aggregates	10.00	4
10/20 mm aggregates	10.00	4
Water	10.00	0.3
Admixture (superplasticiser)	1300.00	0.72

Sources: a) Suppliers b) Mineral Products Association (MPA) figures

RESULTS AND DISCUSSION

Hydration Properties of Cement Combination

Water requirements of cement combination

Table 3 shows that the water requirement of cement pastes reduced with increasing fly ash (FA) content and increased with increasing silica fume (SF) and metakaolin (MK) content. But, despite the increasing water demand of these ternary cements, the Table shows that ternary cement combinations at not more than 5%SF still have same water demand with Portland cement (PC). Table 3 also shows that water required by the finer and spherical SF is lower than that required by the coarser and angular MK at equal replacement levels. It therefore follows that water demand would be influenced by particle shape than by particle fineness. While the replacement of 5% FA in 65%PC+35%FA with 5% MK increased water demand by 1.5%, the comparison of the water requirements of 80%PC+15%FA+5%MK paste and 65%PC+30%FA+5%MK paste shows a slight reduction of 0.5% in water demand despite the fact that the FA content reduced by 15%. Since similar trend was observed in the other ternary cement pastes despite the reducing effect of FA, it shows that the water requirement of ternary cement pastes would be primarily influenced by the SF or MK content than by PC or FA content.

Initial setting times of cement combination

Table 3 shows that fly ash, as a binary cement component, increased the initial and final setting times of the cement pastes with increasing content. This would be due to the reduced content of Portland cement (dilution effect) resulting in low alkalinity of the pore water and the subsequent delay in the reactivity of fly ash (Fraay et al., 1989). Although the control of

the particle size of fly ash is based on residue larger than 45µm, particle sizes less than 10µm are most reactive (Metha, 1985). Since Table 1 shows that a higher proportion of the fly ash particles falls above 10µm, the particle size distribution of fly ash might have contributed to the slow reactivity and increased setting times of fly ash binary cement pastes.

Table 3. Standard consistency and setting times of cement paste samples

MIX COMBINATION	STANDARD CONSISTENCY, % [1)]	SETTING TIMES, Minutes	
		Initial Setting Times	Final Setting Times
100%CEM I	27.5	120	195
80%CEM I+20%FA	27.0	145	270
80%CEM I+15%FA+5%MK	28.5	140	225
80%CEM I+15%FA+5%SF	27.5	135	165
65%CEM I+35%FA	26.5	155	285
65%CEM I+30%FA+5%MK	28.0	150	225
65%CEM I+25%FA+10%MK	31.5	145	210
65%CEM I+30%FA+5%SF	27.5	150	210
65%CEM I+25%FA+10%SF	29.0	140	180
45%CEM I+55%FA	26.0	210	330
45%CEM I+45%FA+10%MK	31.0	190	285
45%CEM I+40%FA+15%MK	35.0	195	300
45%CEM I+45%FA+10%SF	28.5	190	225
95%CEM I+5%MK	29.5	125	165
90%CEM I+10%MK	32.5	130	165
85%CEM I+15%MK	36.0	140	180
95%CEM I+5%SF	28.0	120	150
90%CEM I+10%SF	29.0	125	150

1) % Total cement content

The addition of silica fume and metakaolin, as binary cement components, increased the initial setting times (due to the non-commencement of their hydration reactions until the release of $Ca(OH)_2$ into the pore water) and decreased the final setting times of cement pastes because enough $Ca(OH)_2$ is available to allow their higher reactivity. The initial setting times increased with increasing content of silica fume and metakaolin up to 10% and 15% respectively and there was no difference between their final setting times at 5% and 10% contents of either silica fume or metakaolin. However, the final setting time at 15% metakaolin content was higher than at 10% metakaolin content. The ternary combinations mostly have higher initial and final setting times than Portland cement. However, while the the initial and final setting times reduced with increasing content of silica fume and metakaolin up to 10% content, the setting times at 15% metakaolin content was higher than at 10% metakaolin content. Hence, 15% would be more than the optimum content of metakaolin as both binary and ternary cement. Due to higher fineness resulting in more nucleation sites, silica fume binary and ternary cement pastes have lower initial and final setting times than metakaolin pastes at equal replacement level. The setting times were also observed to increase with increase in the total cement addition content.

Superplasticiser dosage of cement combination

Table 4 shows that superplasticiser dosage reduced with increasing water/cement ratio. While fly ash, as a binary cement component, reduced superplasticiser dosage with increasing content, silica fume and metakaolin, as both binary and ternary cement component, increased superplasticiser dosage with increasing content at equal water/cement ratio. Also, the superplasticiser dosages of the ternary cement concretes reduced with increasing content of fly ash. Metakaolin required higher superplasticiser dosage than silica fume at equal replacement level. As silica fume is finer than metakaolin and should require higher content of superplasticiser than metakaolin at equal water/cement ratio, the higher superplasticiser

dosages recorded for metakaolin concretes would therefore be due to the fact that the effect of angular shape of metakaolin supercedes the effect of the higher fineness of silica fume on water requirement.

The cohesion of the concrete mixes was assessed as described earlier with the aid of the slumped concretes. Cohesion of concrete was observed to generally reduce with increasing water/cement ratio. Compared with Portland cement, the use of supplementary cements resulted in improved cohesion and stability of the concrete mixes at equal water/cement ratio. This is probably due to improved particle packing, improved viscosity or higher water content needed by the fine materials (especially silica fume and metakaolin). Compared with the fly ash binary cement concrete, the higher fineness of silica fume and metakaolin also resulted in ternary cement concrete with higher cohesion. However, increasing cohesion was observed to have a negative effect on finishability. This is because the higher the cohesion, the higher the stickiness and the difficulty in obtaining a smooth finish.

Table 4. Superplasticiser dosage and slump of concrete at a consistence class S2 in BS EN 206-1 (defined by a nominal slump of 50-90 mm)

MIX COMBINATION	SUPERPLASTICISER DOSAGE AND SLUMP OF CONCRETE					
	w/c = 0.35		w/c = 0.50		w/c = 0.65	
	SP[a], %	Slump, mm	SP[a], %	Slump, mm	SP[a], %	Slump, mm
100%PC	0.41	85	0.33	90	0.25	90
80%PC+20%FA	0.37	90	0.30	95	0.23	95
80%PC+15%FA+5%MK	0.43	80	0.35	85	0.26	85
80%PC+15%FA+5%SF	0.40	85	0.31	90	0.24	90
65%PC+35%FA	0.33	90	0.27	85	0.20	95
65%PC+30%FA+5%MK	0.40	80	0.35	80	0.27	85
65%PC+25%FA+10%MK	0.45	75	0.39	80	0.31	80
65%PC+30%FA+5%SF	0.38	80	0.29	90	0.23	90
65%PC+25%FA+10%SF	0.40	85	0.35	90	0.26	90
45%PC+55%FA	0.31	95	0.26	90	0.19	95
45%PC+45%FA+10%MK	0.38	90	0.34	90	0.27	95
45%PC+40%FA+15%MK	0.41	85	0.37	85	0.28	85
45%PC+45%FA+10%SF	0.36	95	0.31	90	0.24	95
95%PC+5%MK	0.43	80	0.35	85	0.26	85
90%PC+10%MK	0.47	75	0.39	85	0.29	80
85%PC+15%MK	0.51	75	0.43	80	0.33	80
95%PC+5%SF	0.43	85	0.35	90	0.26	90
90%CEM I+10%SF	0.46	85	0.38	90	0.28	85

a) % Superplasticiser (SP) is related to the total cement content. b) Plastic density of concrete

Pozzolanic reactivity of cement combination concrete at equal water/cement ratio

The $Ca(OH)_2$ contents and consumption of the cement pastes, at the curing ages of 28, 90 and 180 days at the water/cement ratio of 0.50, are presented in Table 5. As expected, the quantity of $Ca(OH)_2$ in the Portland cement paste increases with increasing curing age. On the other hand, due to the dilution effect (reduction due to Portland cement replacement) and the consumption of $Ca(OH)_2$ by the pozzolanic reactions of the supplementary cements, the quantity of $Ca(OH)_2$ in the binary and ternary cement pastes reduced with increasing curing age and increasing content of the cement additions.

The quantities of $Ca(OH)_2$ consumed by the binary cement pastes increased with increasing curing age due to the pozzolanic reaction of the supplementary cements but they were generally low at 28 days probably due to the delay in the commencement of the pozzolanic reaction. The addition of 20%, 35% and 55% fly ash shows no consumption of $Ca(OH)_2$ at 28 days. However, the $Ca(OH)_2$ consumption levels increased progressively with increasing curing age to 2.5%, 3.3% and 2.0% respectively at 180 days. The $Ca(OH)_2$ consumption

increased with increasing content of fly ash up to 35% and reduced at fly ash content of 55%. The latter might be due to the reduced content of Portland cement (dilution effect), resulting in $Ca(OH)_2$ content lower than needed for pozzolanic reaction at that higher contents of fly ash. Hence, for better reactivity, fly ash content of a fly ash binary cement combination should not exceed 35%.

Table 5. $Ca(OH)_2$ consumption of cement combination pastes

MIX COMBINATION	$Ca(OH)_2$ CONTENT AND CONSUMPTION OF CEMENT PASTE, % Cement Mass					
	w/c = 0.50					
	28 DAYS		90 DAYS		180 DAYS	
	CH^1	CH^2	CH^1	CH^2	CH^1	CH^2
100% PC	22.4	-	23.3	-	23.7	-
80%PC+20%FA	18.2	0.0	17.2	1.4	16.5	2.5
80%PC+15%FA+5%MK	17.5	0.4	16.5	2.1	15.8	3.2
80%PC+15%FA+5%SF	16.7	1.2	15.8	2.8	15.2	3.8
65%PC+35%FA	14.5	0.0	13.2	1.9	12.1	3.3
65%PC+30%FA+5%MK	14.2	0.4	12.9	2.2	11.8	3.6
65%PC+25%FA+10%MK	13.5	1.1	12.2	2.9	11.0	4.4
65%PC+30%FA+5%SF	13.8	0.8	12.5	2.6	11.2	4.2
65%PC+25%FA+10%SF	12.8	1.8	11.5	3.1	10.4	5.0
45%PC+55%FA	10.1	0.0	9.3	1.2	8.7	2.0
45%PC+45%FA+10%MK	9.6	0.5	8.7	1.8	8.0	2.7
45%PC+40%FA+15%MK	9.4	0.7	8.4	2.1	7.6	3.1
45%PC+45%FA+10%SF	9.2	0.9	8.0	2.5	7.2	3.5
95%PC+5%MK	20.1	1.2	19.2	2.9	18.5	4.0
90%PC+10%MK	19.4	0.8	18.1	2.9	17.3	4.0
85%PC+15%MK	18.9	0.1	17.5	2.3	16.8	3.3
95%PC+5%SF	19.2	2.1	17.8	4.3	17.0	5.5
90%PC+10%SF	18.5	1.7	17.0	4.0	16.2	5.1

1) $Ca(OH)_2$ content measured. 2) % $Ca(OH)_2$ consumed by additions
= (Expected % $Ca(OH)_2$ released by PC minus % $Ca(OH)_2$ content measured).
Expected % $Ca(OH)_2$ released by PC is assumed = 100%PC content x %PC content of mix.
Hence for 80%PC+20%FA, the expected % $Ca(OH)_2$ released by PC at 90 days = 23.3 x 0.8 = 18.6
% $Ca(OH)_2$ consumed by 80%PC+20%FA at 90 days = 18.6 – 17.2 = 1.4

Silica fume at equal age and replacement level consumed more $Ca(OH)_2$ than metakaolin. At 28 days, the quantities of $Ca(OH)_2$ consumed by silica fume and metakaolin, as binary cement components, increased with increasing curing age and decreased with increasing content of the cement additions. Since silica fume binary cement combinations consumed higher quantities of $Ca(OH)_2$ than metakaolin binary combinations at equal replacement levels, silica fume would be preferred to metakaolin where higher reactivity is required for early age performance up to 28 days. Also, lower content of silica fume or metakaolin (5% SF or MK) would be preferred to 10% content of silica fume or metakaolin as binary cement component. Beyond 28 days, while there is little or no difference in the quantity of $Ca(OH)_2$ consumed at 5% and 10% silica fume content or at 5% and 10% metakaolin content, the quantities of $Ca(OH)_2$ consumed at 15%MK content were lower than at 10%MK content. While silica fume would consume more $Ca(OH)_2$ than metakaolin at equal replacement level, there is no difference between their performances at 5% or 10% contents. Hence, the choice of content between 5% and 10% would depend on other factors like cost and environmental compatibility. Since the quantities of $Ca(OH)_2$ consumed at 15%MK content were lower than at 10%MK, it shows that 15%MK content might be more than the optimum content of metakaolin as a binary cement component.

Compared with the fly ash binary cement pastes, the addition of silica fume and metakaolin reduced the $Ca(OH)_2$ contents of the pastes with increasing curing age and increasing content

of the ternary cement. Hence, the addition of silica fume and metakaolin as ternary cement components would result in increased consumption of $Ca(OH)_2$ and therefore increased pozzolanic reactivity of the ternary cement pastes. Also, silica fume ternary cement pastes at equal replacement levels, consumed more $Ca(OH)_2$ than metakaolin ternary cement pastes. Hence higher pozzolanic reactivity would be expected in silica fume pastes than in metakaolin pastes and concretes. The quantities of $Ca(OH)_2$ consumed by the binary and ternary cement pastes at 180 days were much lower than the quantity of $Ca(OH)_2$ released by the hydration reaction of Portland cement. This also shows that the pozzolanic reaction is somehow slow and would take a long time to complete.

Compressive strength of cement combination concrete at equal water/cement ratio

The cube compressive strengths of concretes at 28, 90 and 180 days at water/cement ratios of 0.35, 0.50 and 0.65 are presented in Table 6. As expected, compressive strength decreased with increasing water/cement ratio and increased with increasing curing age. At equal water/cement ratio, the cube compressive strengths of the fly ash binary cement concretes are lower than that of ordinary Portland cement concrete and they reduced with increasing content of fly ash at all the test ages. This must be due to the slow pozzolanic reaction of fly ash at early ages as a result of its delayed reactivity until the alkalinity of pore water is high enough for its pozzolanic reaction and its low fineness (Table 1). Compared with Portland cement concrete, the strengths of fly ash binary cement concretes improved with curing age due to improved pozzolanic reaction of fly ash. Hence, the reduction in the disparities between the strength values of the Portland cement concrete and fly ash binary cement concretes shows that fly ash would support later-age strength development.

Table 6 Compressive strength of cement combination concretes

MIX COMBINATION	COMPRESSIVE STRENGTH OF CONCRETE, N/mm^2								
	28 DAYS			90 DAYS			180 DAYS		
	0.35	0.50	0.65	0.35	0.50	0.65	0.35	0.50	0.65
100% PC	80.0	54.0	38.5	90.0	61.0	43.0	96.0	64.0	45.0
80%PC+20%FA	72.0	46.5	30.0	83.0	55.0	37.0	92.0	59.0	41.0
80%PC+15%FA+5%MK	82.0	53.0	34.0	91.0	60.0	39.0	95.0	63.0	42.0
80%PC+15%FA+5%SF	83.0	55.0	36.0	92.0	62.0	43.0	96.0	65.0	46.0
65%PC+35%FA	60.0	35.0	20.0	72.0	45.0	28.0	80.0	50.0	34.0
65%PC+30%FA+5%MK	64.0	42.0	24.0	73.0	49.0	30.0	80.0	52.0	34.0
65%PC+25%FA+10%MK	68.0	43.0	25.0	80.0	50.0	31.0	87.0	54.0	36.0
65%PC+30%FA+5%SF	65.0	43.0	26.0	78.0	51.0	34.0	84.0	55.0	38.0
65%PC+25%FA+10%SF	77.0	49.5	32.0	87.0	61.0	43.5	92.0	66.0	50.0
45%PC+55%FA	42.0	24.0	12.0	55.0	34.0	20.0	62.0	40.0	26.0
45%PC+45%FA+10%MK	47.0	32.5	18.5	59.0	43.0	31.0	65.5	48.0	36.0
45%PC+40%FA+15%MK	50.0	33.0	20.0	59.0	41.0	28.0	64.0	46.0	32.0
45%PC+45%FA+10%SF	57.0	36.0	22.0	70.5	50.5	36.0	80.0	59.0	44.0
95%PC+5%MK	80.0	56.0	37.0	86.0	63.0	41.0	90.0	66.0	42.0
90%PC+10%MK	78.0	54.5	38.0	84.0	63.0	42.0	87.0	66.0	43.0
85%PC+15%MK	76.0	54.0	41.0	84.0	63.0	44.0	87.0	66.0	46.0
95%PC+5%SF	81.5	56.5	41.0	92.0	64.5	46.0	98.0	68.5	48.0
90%PC+10%SF	82.0	59.0	42.5	93.0	66.0	48.0	98.5	72.0	50.5

The addition of silica fume and metakaolin resulted in binary cement concretes with comparable strengths with Portland cement concrete. Hence, due to their higher fineness (Table 1) resulting in more nucleation sites for hydration reaction and improved pozzolanic reactivity, silica fume and metakaolin would contribute to strength development than fly ash. The partial replacement of fly ash in the binary cement concretes with silica fume and metakaolin resulted in ternary blended cement concretes with better strengths at equal ages. Also, silica fume ternary cement concretes exhibited higher strength than the metakaolin ternary cement concretes at equal replacement levels.

Cost and environmental implication of cement combination

The environmental impact of blended cement on concrete construction was examined with the aid of the embodied CO_2 (e-CO_2) contents of the concrete mixes. The supplementary cements are by-products from industrial wastes and their use as raw materials would reduce the environmental impact of opening up of pits for their disposal. Their use would also reduce the quantity of Portland cement used in construction and therefore reduce the pressure on the raw materials for its manufacture as well as the environmental impact associated with its manufacture. Since the patronage of these supplementary cements would partly depend on cost, Table 7 presents the embodied carbon-dioxide contents and the material costs of the concretes.

The embodied CO_2 of the concretes decreased with increasing water/cement ratio. The addition of fly ash as binary cement reduced substantially the e-CO_2 of the binary cement concretes with increasing fly ash content. The addition of 20%, 35% and 55% fly ash reduced the e-CO_2 contents by an average of 20.7%, 34.9% and 55.0% respectively. Hence, compared with Portland cement concrete, the addition of 1.0% fly ash would lead to a reduction of about 1.0% e-CO_2. Silica fume and metakaolin as binary cements also reduced the e-CO_2 of concretes with increasing silica fume or metakaolin content. The addition of 5% and 10% SF reduced the e-CO_2 by an average of 5.1% and 10.0% respectively while the addition of 5%, 10% and 15% metakaolin reduced the e-CO_2 by an average of 3.5%, 7.0% and 10.4% respectively. These show that, compared with Portland cement concrete, the addition of 1.0% SF or MK would lead respectively to a reduction of about 1.0% and 0.7% e-CO_2 respectively.

Table 7: Costs and embodied carbon-dioxide contents of concrete

MIX COMBINATION	COST AND EMBODIED CARBON-DIOXIDE CONTENT PER CUBIC METRE OF CONCRETE					
	w/c = 0.35		w/c = 0.50		w/c = 0.65	
	Cost, £	e-CO_2, kg	Cost, £	e-CO_2, kg	Cost, £	e-CO_2, kg
100%PC	50.48	449	41.82	315	37.43	245
80%PC+20%FA	45.86	356	38.67	250	34.90	194
80%PC+15%FA+5%MK	48.23	364	40.40	259	36.36	199
80%PC+15%FA+5%SF	49.04	356	40.46	250	36.85	194
65%PC+35%FA	42.67	291	36.39	203	33.46	162
65%PC+30%FA+5%MK	45.09	299	37.93	208	34.90	166
65%PC+25%FA+10%MK	46.87	305	39.70	214	35.83	169
65%PC+30%FA+5%SF	45.85	287	38.28	203	35.36	162
65%PC+25%FA+10%SF	48.04	287	40.93	204	36.66	162
45%PC+55%FA	38.10	199	33.55	143	30.81	111
45%PC+45%FA+10%MK	42.45	217	36.21	152	33.55	123
45%PC+40%FA+15%MK	44.63	224	38.06	158	34.78	127
45%PC+45%FA+10%SF	43.58	199	37.24	143	33.96	111
95%PC+5%MK	51.51	433	42.50	305	38.01	236
90%PC+10%MK	52.52	416	43.47	292	38.51	229
85%PC+15%MK	53.42	400	44.25	283	39.24	220
95%PC+5%SF	52.51	426	43.10	301	38.61	231
90%CEM I+10%SF	53.91	403	44.83	282	39.48	222

a) % Superplasticiser (SP) is related to the total cement content. b) Plastic density of concrete

The ternary cement concretes have lower e-CO_2 than Portland cement concretes at all the water/cement ratios. While the metakaolin ternary cement concretes have slightly higher e-CO_2 values than that of their respective fly ash binary cement concretes, there is no considerable difference between the e-CO_2 values of the silica fume ternary cement concretes and that of their respective fly ash binary cement concretes at all the water/cement ratios.

Hence, silica fume concretes would have lower e-CO_2 values than metakaolin concretes at equal replacement level.

As expected, the material cost of concrete decreased with increasing water/cement ratio. This is because the quantity of the costliest materials, the cements and superplasticiser, decrease with increasing water/cement ratio. While fly ash as binary cement would reduce material costs with increasing content, silica fume and metakaolin as binary cement would increase material costs with increasing content. The materials costs of the ternary cement concretes (though higher than that of their respective fly ash binary cement concretes) are lower than that of ordinary Portland cement concrete at all the water/cement ratios. Hence, the use of cement combinations could make concrete more economical.

Table 8 Concrete options at equivalent 28-day compressive strengths of 40 and 45 N/mm^2

Mix combination	28-day compressive strength, f_{cu} = 40 N/mm^2			28-day compressive strength, f_{cu} = 45 N/mm^2		
	w/c	Cost[1], £/m^3	eCO_2, kg/m^3	w/c	Cost[1], £/m^3	eCO_2, kg/m^3
100%PC	0.63	37.77 (10,737)	251	0.57	39.49 (11,226)	272
80%PC+20%FA	0.55	37.04 (10,529)	226	0.51	38.31 (10,890)	245
80%PC+15%FA+5%MK	0.59	37.52 (10,666)	217	0.55	38.53 (10,953)	233
80%PC+15%FA+5%SF	0.61	37.32 (10,609)	204	0.57	38.15 (10,845)	218
65%PC+35%FA	0.46	37.56 (10,677)	220	0.43	38.81 (11,033)	238
65%PC+30%FA+5%MK	0.51	37.45 (10,646)	201	0.47	38.73 (11,010)	218
65%PC+25%FA+10%MK	0.52	38.99 (11,084)	205	0.48	40.28 (11,450)	221
65%PC+30%FA+5%SF	0.52	37.47 (10,652)	194	0.48	38.89 (11,055)	211
65%PC+25%FA+10%SF	0.57	38.59 (10,970)	179	0.53	39.85 (11,328)	192
45%PC+55%FA	0.36	37.57 (10,680)	192	0.32	39.21 (11,146)	212
45%PC+45%FA+10%MK	0.41	39.31 (11,175)	184	0.36	41.54 (11,809)	208
45%PC+40%FA+15%MK	0.43	40.72 (11,576)	184	0.39	42.56 (12,099)	203
45%PC+45%FA+10%SF	0.46	38.45 (10,930)	154	0.43	39.82 (11,320)	167
95%PC+5%MK	0.62	38.55 (10,959)	245	0.58	39.54 (11,240)	261
90%PC+10%MK	0.62	39.08 (11,109)	236	0.57	40.38 (11,479)	253
85%PC+15%MK	0.66	39.02 (11,092)	217	0.59	40.74 (11,581)	239
95%PC+5%SF	0.66	38.45 (10,930)	228	0.61	39.32 (11,178)	245
90%PC+10%SF	0.70	38.48 (10,939)	212	0.65	39.48 (11,223)	223

[1] £1 (Pound Sterling) = #284.26 (Naira) on February 4th 2016 (www.oanda.com)

Concrete is specified in practice on the basis of strength and in order to examine the cost and environmental implications of blended cement on concrete construction, Table 8 presents the costs and e-CO_2 contents of concrete options at the 28-day strengths of 40 and 45 N/mm^2. Table 8 shows that equal strength with Portland cement concrete would be achieved at lower water/cement ratios (and therefore at higher cement contents) by the blended cement concretes. Hence, equal strengths at equal ages, would be achieved at different water/cement ratios, material contents, material costs and embodied carbon dioxide contents. While all the cement combination concretes at the strengths of 40 and 45 N/mm^2 were generally more environmentally compatible than ordinary Portland cement concrete because of their lower embodied carbon dioxide contents, concrete options cheaper than ordinary Portland cement concrete are available. These are the fly ash binary cement concretes and ternary cement concretes with not more than 5% silica fume or metakaolin at a total replacement level of not more than 35%. Hence, at equal strength, fly ash has the propensity to improve the strength of concrete.

CONCLUSION

The following conclusions have been drawn from this investigation:

i. While fly ash would reduce water demand and silica fume and metakaolin would increase it. Nonetheless, ternary cement combinations with not more than 5%SF would have equal level of water demand with Portland cement at equal consistence.

Also, water demand would be influenced by particle shape than by particle fineness and by silica fume and metakaolin content than by Portland cement and fly ash content.

ii. Due to its low reactivity, fly ash would increase both the initial and final setting times. Silica fume and metakaolin would increase the initial setting times due to delayed hydration reaction and reduce the final setting times due to the availability of enough $Ca(OH)_2$ for high pozzolanic reactivity. The ternary combinations mostly have higher initial and final setting times than Portland cement.

iii. While fly ash would reduce superplasticiser dosage, silica fume and metakaolin (as binary and ternary cement component) would increase superplasticiser dosage with increasing content. Hence, the superplasticiser dosages of the ternary cement concretes would reduce with increasing content of fly ash.

iv. The supplementary cements would generally improve the viscosity and cohesion (or stability) of concrete. Cohesion would be higher in silica fume and metakaolin concrete than in fly ash concrete and too much of silica fume or metakaolin would result in higher cohesion, stickiness and poor concrete finish at equal water content.

v. $Ca(OH)_2$ is required for pozzolanic reaction and its consumption would increase with increasing age and increasing content of the supplementary cements. The $Ca(OH)_2$ consumption increasing with increasing content of fly ash up to 35% and reducing beyond 35% shows that, for optimum performance, fly ash content should be limited to 35%. Due to the higher fineness of silica fume and metakaolin than fly ash, the $Ca(OH)_2$ consumption and reactivity of the ternary cement pastes is higher than that of the binary cement pastes. Also, since the quantity of $Ca(OH)_2$ released by Portland cement is far greater than the quantities consumed by the supplementary cements at 180 days, pozzolanic reaction is slow and long-term.

vi. Fly ash concretes have lower compressive strengths than Portland cement concrete. But because the strengths improved progressively with age to reduce the disparity in their strength values, fly ash would contribute to later-age strength development. Due to their higher fineness, the strengths of silica fume and metakaolin binary and ternary cement concretes were found to be comparable with that of Portland cement concrete. Hence, they would support both early and later age strength development.

vii. All the blended cement concretes have lower e-CO_2 contents and are therefore more environmentally compatible than Portland cement concrete. The e-CO_2 contents reduced at an average of 1% per 1% fly ash or silica fume content and 0.7% per 1% metakaolin content.

viii. Fly ash would reduce the cost of concrete and silica fume and metakaolin would increase it. However, while the ternary cement concretes would be costlier than the fly ash binary concretes, it is possible to have ternary cement concretes that are cheaper than Portland cement concrete.

ix. Equal strengths of concrete would be achieved at different water/cement ratios, material contents, material costs and embodied carbon dioxide contents. At equal strengths, blended cement concretes are more environmentally compatible than Portland cement concrete and fly ash has the propensity to improve concrete strength. Hence, all the fly ash binary cement concretes and ternary cement concretes with not more than 5% silica fume or metakaolin at a total replacement level of not more than 35% would produce cheaper and more environmentally compatible blended cement concrete than Portland cement concrete at equal strength for concrete construction.

x. Since the final setting times were lower at 10% metakaolin content than at 15% metakaolin content and the quantities of $Ca(OH)_2$ consumed were higher at 10%

metakaolin content than at 15% content, 10% metakaolin content would likely be the optimum content of metakaolin as a binary or ternary cement component.

xi. At equal replacement level, silica fume specimens have lower initial and final setting times, exhibited higher compressive strengths and lower eCO_2 contents, consume more $Ca(OH)_2$ and require lesser superplasticiser dosage than metakaolin. Hence, silica fume probably because of its higher fineness and spherical shape would perform better than metakaolin at equal replacement levels.

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Degradation of Paint used as External Finish in Buildings: A Review

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ABSTRACT

The assessment of both private and public buildings is usually based on their external appearance simply because it is the first point of attraction to the people and the most visible element directly linked to the environment. Paint which is used in buildings worldwide for walls, not only because of its decorative but also protective functions is manufactured in different shades of colour, quality and make. It has been the most popular aesthetic expression in Nigeria both for interior and exterior walls. The early deterioration of the exterior of both private and public buildings envelopes however reflects their low durability. Unfortunately, an increasing number of cases of poor maintenance of painted facades characterized by early onset of defects and damages to the surface have been reported. This paper presents comprehensive and qualitative factors that affect the performance of paint and its service life on building facades of private and public housing. The review shows that the main sources of degradation which are controllable fall under design/ construction problems and material deficiencies while the uncontrollable sources are climatic factors. Also, interaction between the different materials that compose building elements lead to selective decay.

Keywords: Degradation, service life, building facade, paint, external image

INTRODUCTION

Paint is used extensively as an external finish on cement plastered facades and concrete surfaces. Fawehimi and Adeosun (2001) asserts that paint application on building surfaces is the most popular aesthetic expression in Nigeria and is used in the surface treatment of both interiors and exterior walls of residential and public buildings. Onibokun and Agboola (1990) reports that about 60% of the total cost of the housing expenditure goes into building materials, in which the surface treatment of a building is represented by approximately 5% of the initial cost of construction

The maintenance and upkeep of the external finish of the building is seen as an essential component of any building programme because of its decorative or aesthetic purpose thus epitomizing the image of the building and providing protective functions to the underlying layers of the building (Boussabaine and Kirkham 2004). Building components however require varying degrees of maintenance, repair and replacement during the life cycle of a building. The extent and intensity of maintenance, repair and replacement varies significantly, depending on how appropriately the service life of materials, assemblies, and systems are harmonised, accessed and replaced.

Building materials especially those used in the building envelope are exposed to physical, mechanical, chemical, biological weathering and other factors acting in combination, or even all at the same time. The principal climatic elements that affect the external paint finish are rainfall, solar radiation, wind and moisture which lead to rapid deterioration and ultimately reduce the life span of the finish especially in the tropics necessitating frequent maintenance.

Therefore, the degradation of the exterior surfaces of buildings is one of the major concerns of building owners and maintenance managers since in most cases maintenance actions are often based on the outward appearance of the buildings (i.e. building aesthetics) (Balaras et al., 2005) Teo etal (2005) submits that paint finish may not perform in the manner intended and fails to provide the desired functionality for the intended time period possibly due to i)

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exposure to adverse environmental conditions, ii) poor workmanship during application, iii) inadequate quality of the finish material and/or substrate. Defects on the facade or external finish of a building are a common maintenance problem caused by improper design, poor material quality, inferior workmanship, inadequate maintenance or adverse environment (Assaf, Al-Hammad and Al-Shihah 1995). Aluko and Akingbohungbe (2010) opined that the defects in buildings that call for maintenance are usually caused by inappropriate design, faulty construction techniques, substandard building materials, weathering of materials; cumulative effect of rain, wind and sun; pollution, earth movement and load bearing capacity

Kashim, Fadairo & Adedeji (2013) observe the constant revisit of the painted surface of buildings gulp more money than when some other lasting materials like mosaic, tiles and laterite's blocks are used. They argue that tropical weather that Africa is endowed with do not help matters and that long months of rainfall and severe sun shine usually impact negatively on the paints and make them to fade as soon as they are painted. Furthermore, interaction between the different materials that compose building elements can lead to selective decay (Cultrone et al. 2007).

The need to identify and evaluate the different nature and influence of the degrading factors and their influence on the external paint finish in order to mitigate the negative effect on maintenance activities and ensure that the paint finish reaches its desired lifespan is the thrust of this paper.

EFFECT OF DESIGN ON EXTERNAL PAINT FINISH

The envelope or enclosure of a building or structure serves a variety of basic functions. As noted by Straube and Burnett (2005), the enclosure is a separation between the interior and exterior environment that experiences a variety of loadings, including, but not limited to, structural loadings- both static and dynamic, heat, air, and moisture loads. The enclosure must then control and support these loads. This includes both short-term and long-term loadings. These enclosures will have several aesthetic attributes, which can be summarized as finishes. Enclosure can also be used to carry or distribute some services within the building. Straube and Burnett (2005) have defined four general building enclosure function categories to include:

i. Support

Enclosures, including exterior wall systems, must be capable of withstanding all internal and external forces applied to them. The majority of these forces are structural loading. The loads include both static and dynamic loading including, but not limited to, dead load, live loads, wind loads, earthquake loads and possible blast loads. These loads have to be properly supported, resisted and transferred.

ii. Control

Enclosures, including wall systems, have to be able to control mass, energy, and particulate flows both within and across the system. These include, but are not limited to, heat, air, moisture, smoke, odour, fire, blast, birds, and insects

iii. *Finish*

The finish expresses the aesthetic functions of both the exterior and interior surfaces for people and is expressed in terms of colour, texture, reflectance, pattern and other aspects the designer wishes to convey with the visible elements of the system. Of the elements of an enclosure, wall systems typically have the largest consideration for finish.

iv. Distribution

This function relates to the distribution of services through a building both within a single element and also through multiple elements. Ishak, Chohan and Ramly (2007) identified the inadequate detailing of components in the design as a factor that can lead to building deterioration especially on the exterior façade. This agrees with Ali, Keong, Zakaria, Zolkafi

and Akashah (2013) that suggests that adequate attention should be paid to the design of the main fabric especially the walls if unplanned maintenance will be avoided. According to Chew and Harikrishna, (2005), the poor performance of the paint finish can also stem from defective building design and detailing and inappropriate construction methods. The possibility of accident, loss of equipment, loss of life and multiple litigations is also a reality. While maintenance can go on unhindered in the interior spaces, the elements of weather such as rain, snow, sun and turbulent wind most often hinder the smooth running and schedule of works on the external surface.

It requires proper planning with precise forecast of weather in most cases to avoid waste of materials, man-hour, loss of profit and patronage. The spaces allowed in-between buildings in most urban cities as setback are usually inadequate for maintenance works. This constitutes a serious hindrance to the manoeuvring of needed equipment for maintaining the buildings The resistance of an exterior wall to the elements of climate depends largely on the design of the wall structure. A multi-storey building that is designed and built with plain wall without any ingress and egress overhang is exposed totally to the elements. Walls without self-shading will reduce the ability of the building to protect itself from external forces of climate (Capeluto, 2003).

A building that will be maintainable must inculcate at the design stage elements that will aid the ease of maintenance works. Some maintenance equipment's are required to be designed with the building while adequate provision is made for work space in and around the building. The poor performance of the paint finish can also stem from defective building design and detailing and inappropriate construction methods (Chew and Harikrishna, 2005). It is important to give proper attention during the building design phase so that defects arising from such factors can be minimized

External Paint Finish and Climatic Factors

External surfaces of building enclosures and its coatings are directly affected by climate. Climate is one of the factors causing deterioration of building envelope and coatings (Chew and Harikrishna 2005). Buildings nowadays are deteriorating at an alarming rate due to the erratic nature of the climate with its attendant consequences (Stewart, Wang and Nguyen, 2011). Norvaišiene, Miniotaite and Stankevicius (2007) classified atmospheric factors into natural (precipitation, wind, temperatures, solar radiation) and complex chemical and biological processes caused by air pollution. Ramanauskas and Stankevičius (2000) maintained that the durability of external finishes is determined by the following properties:

a. Frost resistance, i.e. the capability of a moisture-saturated material to resist temperature fluctuation through freezing and thawing cycles
b. Moisture resistance, i.e. the capability of a material to resist the periodical moisturizing and drying cycles
c. Corrosion (chemical impact) resistance, i.e. the resistance to solutions of dissolved aggressive destructive chemical agents. Ultraviolet radiation, causing photochemical reactions on surfaces, can also be considered as a chemical impact.

Haneef, Dickinson and Johnson (1999) summarized the mechanisms that contribute to deterioration as;

a. Physical mechanisms. The presence of water is known to be a key factor in promoting the fracturing and erosion of building envelope and coating. Water penetrates the pores and cracks and causes mechanical stresses both by freezing and by the hydration and subsequent crystallization of salts.
b. Chemical mechanisms. Some deposited chemical agents react with surfaces. Sulphur compounds have been indicted as the most critical factors in this regard, mainly

because they are often acidic and can have high concentrations in city and suburban air; however, nitrogen compounds should be considered as well. Fluxes of trace gases (e.g., sulphur dioxide) can be high, especially when promoted by biological activity. Dissolution by chemical reactions with contaminants contained in precipitation is one of the most familiar eroding processes, particularly in the case of carbonaceous stone.

c. Biological mechanisms. Many different biological factors have been found to be important. Growths of lichens, mosses, algae, mould, fungi and bacteria are capable of promoting surface deterioration. Some bacteria can synthesize sulphuric (or nitric) acid from airborne sulphur dioxide (or nitrogen oxides).

Buildings that are sensitive to the climate have been built by almost all indigenous builders for centuries. However, of recent owing to obvious climate change, builders have hitherto lost the skill and expertise of building in harmony with the climate (Hyde, 2000). The Oxford Advance Learners‟ Dictionary defines climate as the regular pattern of weather condition of a certain place. It is the synthesis of weather or as it is generally known – the average weather condition of an area under studied over a period of time not less than 25 years. Site conditions and prevailing climatic conditions determine the longevity or otherwise of any chosen finishes. Hyde (2000) opines that the basic idea behind climate responsive design is the understanding of the characteristic of the climatic condition in which the building is situated.

Different climatic conditions impose different requirements on the use of materials. Due to high relative humidity, high temperature and precipitation prevalent in the warm humid zone in the tropics, the rate at which buildings and especially the external walls absorb moisture and building materials used for wall finishes that are exposed to climatic elements are therefore seriously affected. Materials undergo dilatations and contractions with temperature variations. In extreme cases, like fires, the rate of change and the amplitude of the temperature can generate a thermal shock capable of disrupting the material. Even though theoretically possible, the surface temperature required to produce damage by thermal gradient is unlikely to occur through the sun's action ((Groot et al. 2009). In most cases, temperature-induced decay is caused by stresses at the interface between distinct materials produced by different thermal and hygric expansion coefficients (Palomo et al. 2002). Mechanical differences, especially of strength, deformability and elasticity modulus, can also be an underlying cause of decay, as seen by Sanchez-Moral et al. (2005) in Roman catacombs

Besides extreme events such as tornados, wind can participate in the deterioration of wall renders by dragging rain, solid particles or other deleterious substances (e.g., salts) across them. Except for earth constructions, wind-driven rain has been proven to be essentially responsible for enhancing the impact of other agents of degradation, i.e. water, bio deterioration and pollution (Tang et al. 2004; Abuku et al. 2009). Wind driven solid particles can erode material surfaces and the degradation potential depends on local wind intensity and availability and size of solid particles to be carried.

Tropical Climate and Its Effect on External Paint Finish

The climate of each locality presents a unique natural environment and is an effective factor on the architectural design and material use. Identifying, understanding and controlling climatic influences at the building site are perhaps the most critical part of the design process (Ozay, 2005). Tropical regions are the areas within latitudes 23^0 27^1 North and South of the Equator (Horby 1974). Henderson-Seller and Robinson (1986) noted that tropical climates are usually characterised as climates where there is no true temperature distinction between summer and winter. Blair (2014) categorised them into:

i. Hot Wet Equatorial Climate with about 80mm annual rainfall

ii. Tropical Monsoon and Tropical Marine Climate with about 60mm and 70mm respectively.
iii. Sudan type with about 30mm rainfall mainly in summer and
iv. Sahara and mid Latitude type with little rainfall of about 5mm.

The external walls of building in the equatorial climate zone is subject to rapid degradation as a result of torrential rain, the exterior paint of building is easily washed and also provides a fertile atmosphere for other agents of paint destruction (Akinbogun, 2001). Givoni (1976) remarked that the high temperature and humidity levels in the equatorial zone encourage insect breeding and the growth of fungi are agents of destruction. Ultraviolet radiation is another climatic element that leads to pigment discolouration. Addison and Rice (1991) alluded that sunlight is the source of ultraviolet radiation which is responsible for the breakdown of organic compounds and discolouration of pigment. Direct solar radiation and diffused radiation reach very high intensities in tropical region. Chen and Chen (2013) noted that due to the earth's inclination, the mid – day sun is almost overhead within the tropics and the sun rays heat the tropics in straight lines while the regions outside the tropic at shorter distance, temperature diminishes from equatorial regions to the poles. Fading of pigments is likely to be more rapid in the tropics than other climatic regions as a result of ultraviolet radiation, which tends to be higher in the tropics.

The tropical climate is characterised by raining and dry seasons which are brought about by the prevailing South East Trade winds and North East Trade winds respectively. In West Africa, between November and March, the North East Trade wind blows off shore from the Sahara Desert and reach the West Coast as a dry dust-laden wind referred to as harmattan (Blair, 2014). The accumulating effect of the dust on building surfaces particularly the exterior is highly noticeable as it acts as agent of discolouration.

DEGREE OF WORKMANSHIP

A good degree of workmanship plays an important role in preventing or minimizing the occurrence of defects or in prolonging their onset. Paintwork is a labour intensive operation and is hence subject to the quality of the labour and work execution. Site conditions essential for good paint application are adequate protection from both weather and dirt. Also simple tasks like making sure the plaster is sufficiently dry before painting over would reduce the possible occurrence of defects in the future.

Factor	Characteristic features	Associated defects
Poor surface Preparation	Inadequate surface preparation in the form of no treatment of existing loose paint films results in poor adhesion with the underlying layers	Flaking/ Peeling
Insufficient drying Time	Application of a subsequent coat on a partially dry coat leads to mixing of the two coats together. Can have implications for durability by not allowing the coats to perform their individual functions effectively	Discolouration and Chalking
Surface Discontinuities	Disturbance or non-uniformity to be avoided during paint application	Loss in Appearance and Peeling
Uneven paint Spreading	Coverage in specification provided in terms of consumption rate measured in kg. of paint used per sq. m of area per coat to avoid use of excess or insufficient amount of paint	Loss in appearance and desired thickness of paint finish
Over dilution of Paint	Lead to reduction in protective properties and performance degradation of paint finish	Greater risk of Weathering. Loss of adhesion with substrate
Poor substrate Condition	Unacceptable condition of substrate (plaster or brick) over which the paintwork is applied can be responsible for occurrence of defects on paint finish Common points to be borne in mind include ensuring sufficient curing time for the underlying cement plaster and moisture entrapped in the substrate layers	Cracking Efflorescence

Source: Teo, Chew and Harikrishna (2005)

Building Characteristics

Some of the problems of external wall according to Wood (2009) are: spalling or delamination of surfaces, cracks, discolouration and staining, dampness and dislocation. Others are erosion of mortar, high level of penetrating damp, salt contamination on internal plaster, high level of mould and algae growth, spalling bricks and erosion of pointing joints. They also include peeling of paints, tiles and moisture accumulation. The major factors under building characteristics that affect the durability and service life of paintwork and their effects according to Chew and Tan (2003) as summarised in Table 2 are orientation, height, surrounding environment, age and shape of plan view.

Table 2 Building characteristics that affect the durability and service life of External finishes

Factors	Characteristic features/ Considerations	Associated Defects
Orientation	Façades directly exposed to sunlight undergo greater physical weathering leading to chalking of paint. Facades facing away from direct radiation are comparatively colder and damper providing ideal conditions for algae and other microbial growth The intensity and duration of sunlight that a surface receives affect the limit of runoff flow, the type of biological stains and hence the pattern of staining.	Chalking Algae Growth Staining
Height	Tall buildings are at greater risk to deterioration due to their direct exposure to impacting rain and ultraviolet radiation [Choi 1994] Wind speed varies with height due to the level of openness as well as the instability of air at higher levels Costs of maintenance and repair of defects to the façade higher for higher storeys due to additional costs in the form of scaffolding Safety during work in higher storeys is another concern	Greater rate of weathering and discolouration at higher storeys
Surrounded by other buildings	Presence of adjacent buildings provides a sheltering effect May result in slower drying period for façade after it has been wetted, leaving it damp for longer periods and therefore promoting biological staining	Biological staining Algae growth
Age	Natural tendency of material to undergo deterioration with time Condition and serviceability period of the underlying substrate layers of the building has an effect on the exterior paint finish Gradual loss of protective and other properties of the paint finish itself with age	Cracking Chalking Flaking/ Peeling

Source: Teo, Chew and Tan (2005)

Teo and Harikrisha (2007) in the development of a defect index identified crazing, crackliness delamination, efflorescence, chalking, algae growth, peeling, and uneven discolouration as major defects that are associated with paint while Chai etal (2015) grouped the main defects that affect paint coatings as follows:

i. Staining and color change mostly affects the visual quality of a façade and generally appears in the very early years of the service life of paint coatings.
ii. Chalking usually occurs after loss of gloss and causes the wear, detachment, and loss of material.
iii. The ranking by degradation level of cracking is based on visual patterns, in terms of cracking frequency. Contrary to cracking in other materials, in paint coatings it is usually less than 1-mm wide, which makes it difficult to distinguish the size without magnifying equipment
iv. Loss of adherence generally arises because of the combined effect of various defects and degradation agents. Its degradation mechanisms are thus complex and tend to be preponderant as the material ages.
v. Blistering and peeling.

Sousa, Almeida, Meireles and Brito (2011) grouped the anomalies into five broad categories;

i. aesthetic/visual, which comprise stains, dust, superficial growth and other non-structural defects;
ii. superficial deterioration, including, along with erosion/abrasion, anomalies such as pitting and sanding;
iii. internal deterioration designates anomalies that can produce a general destruction of the mortar over the entire depth resulting at the end in crumbling (it may also manifest itself in a similar way to interfacial deterioration);
iv. interfacial deterioration, comprising anomalies such as flaking, delamination, blistering, spalling; and
v. cracks/fissures, related to situations where a tension is created able to produce a visible crack or fissure without being a consequence of other phenomena (e.g. crypto florescence resulting in superficial fissures).

ANOMALIES IN PAINTED SURFACES

The incidence of anomalies on the external envelope of buildings appears to have a great importance. (Census 2001) assert that about 50% of anomalies recorded negatively affect the external building envelope. Moreover, according to a survey of BRE (1998), these anomalies directly contribute to the decrease of about 50% in the performance of important building functional requirements (waterproofing, durability and maintenance) and substantially influence others (thermal insulation and acoustic performance) in over 10% of related requirements.

According to Harris (2001), the decay noticed in buildings is a natural process and unavoidably takes place in time, not being necessarily the result of design error or construction deficiency. In fact, the mechanisms of deterioration are the consequence of the interaction of two independent variables: the building, as a physical object and the environment, as a source of agents. The degradation of building components is a normal consequence of the ageing process, there is a set of factors influencing that process, such as building quality, weather conditions, lack of maintenance, and so on. These factors will increase the building operation costs and expand the rehabilitation needs, if no actions are taken to halt the degradation process (Fernanda etal, 2011).

Pires etal (2016) identified 14 main anomalies divided into 5 groups that distinguish between the various forms of pathological manifestation as; Adherence to the substrate anomalies; Film cohesion anomalies; colour anomalies; stains and texture anomalies. Sa etal (2014) classified the anomalies in wall renderings to include;

a. aesthetic anomalies: graffiti, corrosion stains, dirt/deposits of particles, colour change/discolouration
b. anomalies associated with humidity: infiltrations/dampness, stains, efflorescence/cryptoflorescence, biological colonization. carbonation, vegetation growth
c. mechanically-related anomalies: adherence loss/detachment, map cracking, cohesion loss/crumbling, scratches/grooves and linear cracking

EXTERNAL PAINT FINISH AND HUMAN FACTOR

Sousa. Almeida, Meireles and Brito (2011) asserts that human influence on the deterioration of buildings is often forgotten, but it also contributes directly and indirectly to wall render degradation. Direct influences include the execution of renders itself, in which the selection of unsuitable materials, the preparation of the support, and the application of the mortar or curing cause many cases of premature deterioration.

Among the human activities that may pose the most significant indirect threat to wall renders on historical building are tourism which can be a significant cause of degradation due to building use (e.g., abrasion, impacts) and the creation of microclimatic conditions favourable to other degradation agents. Sanchez-Moral et al (2005) observed that micro environmental conditions resulting from the presence of visitors in Roman catacombs created temperature, humidity and light conditions propitious for the development of biological agents.

CONCLUSION

A comprehensive evaluation of the various factors that cause degradation and ultimately reduces the service life of external paintwork on building facades has been discussed in this paper. The multitude of factors influencing the degradation of buildings in general makes it extremely complex to identify all the underlying causes, their relative importance and eventual interrelation. However, the understanding of various factors that are within human control as well as the uncontrollable is germane so as to cater to their effects during the paint formulation, design and application process; this would ensure that the desired service life for the paint finish is attained. This is crucial for the subsequent development of any quantitative model that would serve to establish the timing of the various maintenance and repair costs that would need to be incurred to rectify the defects and damage to the paint finish during its intended lifetime. The system can be applied to buildings in Nigeria and can be extrapolated to any other country that has similar climatic conditions since painted renderings are common worldwide.

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Utilization of Fly Ash in Road Construction in South Africa: Environmental Assessment

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ABSTRACT

Using fly ash as alterative material in place of conventional materials is continually gaining interest over decades. This results from its international recognition as non-hazardous construction material. However, fly ash composition varies and thus it cannot be generalized that every fly ash is non-hazardous. In South Africa, fly ash is produced in large quantity, yet its utilization on annual basis remains at 6 percent which is majorly utilized in cement and concrete production. Thus, this study focuses on investigating leaching of major elements in South Africa Class F fly ash when used as a stabilizer in road construction. Three different specimens of fly ashes, namely; Kendal Dump Ash, Durapozz and Pozzfill enhanced with different cements were used as stabilizer for G5 soil use in road construction. Using an X-Ray spectrometry analyser the samples were tested for any possible leach elements. Leach tests results show that fly ash enhanced with cement as soil stabilizer in road construction is not harmful as the fly ash constituents' exhibit limited mobility. However, results also indicated that fly ash left in dump sites can be harmful, if some of the leached elements find their way to the ground water. Thus, utilization of fly ash for road construction is an environmental sustainable option and has engineering advantages when properly used for soil stabilization.

Keywords: Class F fly ash, drinking water, leach tests, pavement materials, and soil stabilization

INTRODUCTION

Material Shift

Material selection for pavement design is based on a combination of suitable materials, environmental consideration, construction methods, economics and previous experience (Bureau for Industrial Cooperation, 2012). Previously, road construction had depended mainly on the virgin materials from the nearest borrow pit, but in situations where the available soil lacks some geotechnical properties or need some improvement for a particular work such soil needs to be stabilized. Soil stabilization aimed at increasing or maintaining the stability of soil mass through mechanical or chemical means (Takhelmayum, Savitha & Krishna, 2013). However, stabilizing soil using lime, cement, chemicals, plastics, rice husk ash, millet husk ash, corn cob ash, coconut shell ash, foundry sand, cement kiln dust, granular blastfurnace slag (GBS), or fly ash increases the soil's resistance, strength and permeability (Marto, Latifi & Sohaei, 2013). Furthermore, results and experience show that lime as a stabilizer yields better results than others, but its use will make pavement structure uneconomical, which in turn makes fly ash an alternative stabilizer.

South Africa: Fly Ash Producer

South Africa is the fourth largest producer of fly ash at 30 mega ton per year after the likes of China, USA and India. This results from the fact that coal plays an important role in its economy and it serves as the primary energy source for electricity generation (National Inventory, 2001; Furter, 2011). Thus, the disposal of fly ash is increasingly becoming a major concern due to possible environmental disaster. Yet, this ash has recognition as a suitable pozzolanic material and successfully used as construction materials, even on large scale. Globally, fly ash is being used for various purposes such as; raw material for cement and concrete production, soil and asphalt stabilizer, embankment works, flow-able fill, and waste stabilizer, all owning to its cement-like property (Li, Benson, Edil & Hatipoglu, 2008; Torii, Hashimoto, Kubo, & Sannoh, 2013). Withal, South Africa only utilizes 6 percent of the

Heyns, M. W., Adedeji, J. A. & Mostafa H. M. (2016). Utilization of Fly Ash in Road Construction in South Africa: Environmental Assessment. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 426-432

annual production. However, one of the major factors contributing to its low utilization is the concern of contamination of the surface and ground water during leaching process. Therefore, this study focuses on investigating leaching of major elements in South Africa fly ash when used as a stabilizer in road construction.

LITERATURE REVIEW

Chemistry of Fly Ash

Fly ash, a finely divided residue that results from the combustion of pulverized coal, an amorphous ferroaluminium silicate with a matrix very similar to soil and its elemental composition varies with types and source of coal (Comberato, Vance & Someshwar, 1997). These ash particles are transported from the combustion chamber by exhaust gases as a result of their light weight and collected in control devices such as filter bags and electrostatic precipitators. They are spherical in shape and range in size from 0.5 micron to 100 micron. Its chemical and physical properties depend greatly on several factors such as production type, raw feed and the handling method. This in turn gives the two classes of fly ash based on the chemical composition. Class C ashes are from sub-bituminous and lignite coals and may contain more than 20 percent CaO with 1 percent to 3 percent free lime, while Class F ashes are generally obtained from bituminous and anthracite coal and contain less than 20 percent CaO with no free lime ASTM C618 (ASTM-C618, 2011).

In addition, fly ash is a heterogeneous material, which consists of major element such as; Silicon (Si), Calcium (Ca), Aluminium (Al), Magnesium (Mg), Iron (Fe), Sodium (Na) and Potassium (K) (Oppenshaw, 1992). Various trace elements also contained in Fly Ash are Cobalt (Co), Cadmium (Cd), Arsenic (As), Selenium (Se), Zinc (Zn), Molybdenum (Mo), Manganese (Mn), Lead (Pb), Boron (B), Copper (Cu), and Nickel (Ni) (Ojo, 2010; Snellings, Mertens, & Elsen, 2012). These chemical compositions give it variability in properties (Gitari, 2009). In the United States, the Environmental Protection Agency issued reports on the environmental friendliness of fly ash and protected legislatively as non-hazardous waste. In like manners, it was successfully used in transportation projects and thus, regarded as an important component of the high performance designs in Europe (American Road and Transportation Builders Association, Transportation Development Foundation (ARTB-TDF) (ARTB-TDF, 2014)).

Fly Ash as Stabilizer

Various studies have been conducted on fly ash utilization as soil stabilizer and as an alternative to the use of virgin materials. Senol, Bin-Shafique, Edil & Benson, (2002) carried out a study on the use of self-cementing class C fly ash for the stabilization of soft sub-grade. In this study, the optimum mix design and stabilized layer thickness were estimated by strength and modulus-based approaches. The results obtained showed that the engineering properties such as unconfined compressive strength (UCS), California bearing ratio (CBR) and resilient modulus increase substantially after fly ash utilization. Also, in 2002, Pandian and Krishna conducted laboratory CBR tests on the stabilized fly ash-soil mixtures and observed that fly ash is an effective admixture for improving the soil quality. In addition, Brooks (2009) reported the soil stabilization with rice husk ash and fly ash mixed together with natural soil, the study showed improvement in CBR values and UCS. Also, researchers have proven that mixtures of fly ash with inert materials reach 50 percent to 70 percent of the strength of the corresponding cement-inactive materials (Eskioglou & Oikonomou, 2008).

According to literatures, it was noted that the use of Class C is more dominant especially in road construction while Class F is only finding usage in concrete works; this however, results from Class C self-cementing properties and its endorsement as non-hazardous material from international bodies. Generally, fly ash landfill sites are an environmental concern due to

possible release of contaminants to the ground and surface water, however according to Heebink and Hassett (2001) when fly ash is used as stabilizer; chemical reaction takes place, which binds the particles of fly ash and consequently, reduce the chances to pollution. Furthermore, Heebink and Hassett conducted laboratory leaching and field run-off sample; results indicated that fly ash constituent's exhibit limited mobility. Consequently, fly ash Class C is an environmental option and of engineering advantages when used properly for soil stabilization. In essence, leachate test should be conducted on fly ash to analyse its solubility (Oppenshaw, 1992; Solc, Foster, & Butler, 1995). However, studies show that leachate of fly ash is highly variable as it's depends on the type of coal and plant in question, and also decreases with age (Moolman, 2011).

However, in South Africa, the public has not yet been convinced that fly ash is environmentally safe, due to the fact that European and American countries completed research on Class C Fly Ash and South Africa only produces Class F. Nevertheless, for a Class F to use as stabilizer, a reaction starter such as lime and cement is needed because it is low calcium (American Coal Ash Association, 1995). Yet, there are only limited studies on the environmental friendliness of Class F produced in South Africa. Considering its production per year in South Africa, the government is at the stage where it is strategically finding ways to reduce fly ash through treatment, re-use and beneficiation. Overall, the use of fly ash in road construction provides viable alternative to non-renewable primary aggregates, yet the question remains; what is the environmental impact of using Class F fly ash as soil stabilizer in road construction?

MATERIALS AND METHODOLOGY

In this study, basic construction materials for road construction are used. A G5 granite material specified for sub-base construction and this material will be stabilized using three different Class F fly ash which are; Kendal dump ash, Durapozz and Pozzfill. Kendal dump ash was sampled directly from the dumpsite while other samples were sourced from processed fly ash suppliers. Durapozz is the highest quality processed ash in South Africa that conforms to international standards while Pozzfill only conforms to certain international standards. However, both Durapozz and Pozzfill are successfully utilized for cement production in South Africa.

As early mentioned, cement would be use to start-up the reaction process, cementing agent such as; LAFARGE CEM II 32,5 VA(S-V) and AFRISAM CEM II 32,5 B-M(S-V). The justification for the selection of these cements is because they are specially developed for stabilization purpose and commonly used for road works here in South Africa. In addition, these cements are more effective for low clay content and gain strengths early, and both cement types have an improved durability and is effective across a wide range of materials.

Based on the scope of this study, leach testing was conducted on classified G5 material stabilized with cement and fly ash with the following mixtures:

- 1% LAFARGE
- 1% AFRISAM
- 1% LAFARGE mixed with 16% Dump Ash
- 1% LAFARGE mixed with 16% Pozzfill
- 1% LAFARGE mixed with 16% Durapozz
- 1% AFRISAM mixed with 18% Dump Ash
- 1% AFRISAM mixed with 18% Pozzfill
- 1% AFRISAM mixed with 18% Durapozz

The above mixtures were subjected to leach testing and compared to maximum allowed trace elements in water. Stabilization with fly ash and cement is not only to gain strength and meet required specifications but it can also be used to "entomb" the harmful elements that can enter and contaminate the ground water system. Once these elements are shown to be less than the maximum allowed elements found in drinking water, then it can be concluded that the use of fly ash in road stabilization can be used and that the risk of harmful elements being released to the environment will be negligible.

FINDINGS AND DISCUSSIONS

Using an X-Ray spectrometry analyser, elements similar to those found in other fly ash around the world were noticed in typical Class F fly ash. Some of the elements with their range in part per billion (ppb) are; Bi (3.8), Br (<2), Ce (235), Co (16), Cs (7.8), Zr (476), and those listed in Table 1 were found in this South Africa Class F fly ash. However, in order to environmentally assess this ash and understand these elements, a comparison analysis must be conducted to show the impact of their on the environment, if any. Water is the main source for human and environmental survival; therefore, elements are compared to the maximum allowed concentrations in water fit for human consumption (Bicki & Hirschi, 1993). Table 1 further showed the comparisons of required maximum allowed elements also found in fly ash with possible health effects. It must be noted that these results are from ash found in dump sites without any treatment; therefore, it is critical that leach tests are conducted for potential hazards before considering the use of fly ash in any destined road construction project. Fly ash with no treatment shows that leached elements namely: Barium (Ba), Chromium (Cr) and Lead (Pb), are of a concern once the elements have leached into the groundwater and the possible effect is also reflected in Table 1. Arsenic (As) however, is low and does not create a concern if leached into the groundwater.

Furthermore, table 1 shows higher levels of Ba and Cr in fly ash, thus this implies that fly ash left in dump sites can be harmful once leached elements find their way into the ground water. However, when samples enhanced with cement as stabilizer for G5 soil were tested, results show that the leach elements have limited mobility (Table 2) when compared with those of table 1. In addition, comparing table 1 and 2, one must keep in mind that the results in table 2 are shown as ppm while those in table 1 are shown as ppb. Considering this, the cement enhanced fly ash can be said to have experience a tremendous reduction in leach element as a result of the entombed reaction that takes place between the soil, fly ash and cement. Also, it is worthy to note that G5 soil stabilized with only cement did produced these leach elements yet, the results are all below the maximum allowable in drinking water.

Table 1 Some elements in typical Class F Fly Ash and maximum allowable in drinking water

Element	Class F Fly Ash (ppb)	Maximum Acceptable Level (ppb)	Possible Effects of Higher Levels
As	20	50	Lung Cancer, kidney damage
Ba	1502	1000	Heart damage
Cr	190	50	Liver, kidney damage
Cu	49	49	Metallic taste, blue-green stains on fixtures
Pb	54	50	Brain damage
Se	2.8	10	Growth inhibition
Zn	49	N/A	Metallic taste

Conclusively, fly ash at fresh stage has an approximate pH of 11.5; this pH tends to reduce to about 8.5 due to weathering process as a result of being left on dump sites (Surridge, van der Merwe & Kruger, 2009; Ayanda, Fatoki, Adekola & Ximba, 2012). However, considering the results presented in table 3, the pH of the G5 soil stabilized with cement enhanced fly ash, shows that the material maintain an alkalinity pH position. This implies that when Class F fly

ash is enhanced with cement, it can perform as a stabilizer without affecting the environment negatively.

Table 2 Leach results of G5 soil stabilized with cement enhanced fly ash

	Leachate (parts per million (ppm))						
	As	Ba	Cr	Cu	Pb	Se	Zn
G5 + 1% LAFARGE	5.36	< 4	8.56	18.89	< 6	< 0.4	< 60
G5 + 1% AFRISAM	5.32	< 4	8.18	15.91	< 6	< 0.4	< 60
G5 + 1% LAFARGE + 16% Dump Ash	7.59	< 4	23.97	16.39	< 6	< 0.4	< 60
G5 + 1% LAFARGE + 16% Pozzfill	13.65	< 4	58.11	14.88	< 6	1.56	< 60
G5 + 1% LAFARGE + 16% Durapozz	15.30	< 4	46.35	14.24	< 6	< 0.4	< 60
G5 + 1% AFRISAM + 18% Dump Ash	8.19	< 4	8.89	17.11	< 6	< 0.4	< 60
G5 + 1% AFRISAM + 18% Pozzfill	15.04	< 4	59.14	17.14	< 6	< 0.4	< 60
G5 + 1% AFRISAM + 18% Durapozz	19.41	< 4	50.29	14.20	< 6	2.33	< 60

Table 3 pH values of G5 soil stabilized with cement enhanced fly ash

Description	**Leachate**		
	pH	**Alkalinity**	**Acidity**
		mg/L CaCO3	**mg/L CaCO3**
G5 + 1% LAFARGE	10.54	51.47	0
G5 + 1% AFRISAM	10.56	51.47	0
G5 + 1% LAFARGE + 16% Dump Ash	10.57	60.2	0
G5 + 1% LAFARGE + 16% Pozzfill	10.82	71.92	0
G5 + 1% LAFARGE + 16% Durapozz	10.77	66.49	0
G5 + 1% AFRISAM + 18% Dump Ash	10.29	42.89	0
G5 + 1% AFRISAM + 18% Pozzfill	10.65	60.05	0
G5 + 1% AFRISAM + 18% Durapozz	10.77	60.05	0

CONCLUSION

Using fly ash as alterative material in place of conventional materials is continually gaining interest over decade. This results from its international recognition as non-hazardous construction material. However, it must be noted that fly ash composition varies and thus it cannot be generalized that every fly ash is non-hazardous. Although, fly ash is produced in large quantity in South Africa, yet it utilization on annual basis remains at 6 percent which is majorly utilized in cement and concrete production. Thus, this study investigated the environmental effect of Class C fly ash when used as a soil stabilizer for road construction.

The results of this study showed that trace amounts of elements which might be leached to the ground water when fly ash is used in road project is not harmful. This is based on the laboratory leach test results which indicated that fly ash constituents when used as soil stabilizer exhibited limited mobility, thus it can serve as an alternative stabilizer in road construction when used properly and environmental sustainable. Results also show that elements in fly ash vary from different classes and if South Africa Class F fly ash is left on dumps sites without utilization; potential hazardous elements can be release into the ground water and thus, before utilization for any project a full comprehensive test must be conducted at the design stage.

Furthermore, critical variables which include the sample size and particles size distribution, leachant volume, pH, and duration of leachant test. The project objective, type of material and type of data desired will determine the most appropriate method. It must be kept in mind that when tests are performed with some methods, extraneous variables, such as analytical

sensitivity and sample inhomogeneity may influence the reproducibility of the results. The leach results have shown that the elements in the ash were "entombed" and the possibility of leachant releasing agents of a dangerous nature are to a minimal. The results have shown a tremendous reduction in leach agents and have shown that it is even safe if the minor leach agents do enter the drinking water tables. The leach tests in this study have shown that the fly ash enhanced with cement as stabilizer is environmental friendly. It also shows that the fly ash particles that are normally released are bound within the soil due to chemical reactions and continue to be bound as long as reactions take place.

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Trash to Treasures Exploring 'Re-Material' In Architecture as a Means of Reducing Waste Generated in Urban Centres

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ABSTRACT

Sustainable Architecture seeks to minimize negative environmental impacts through a conscious approach to energy efficiency and ecological conservation. The use of recycled building materials and low impact materials often termed "Green Materials" are common, but in most cases solid non-biodegradable wastes generated in our urban centers are neglected. Wastes generated from construction and demolition (C&D) debris, remodeling, renewing the furniture in our offices, homes, schools, and hospitals gather up daily and become an eye-sore to our environment. Huge amounts of resources are spent daily to dispose or recycle these wastes and a lot of heat is generated when they are eventually incinerated. However, when creativity meets resourcefulness, these wastes can be converted to remarkable pieces of art and architecture. This paper explored the concept of "Re-material", how solid wastes generated within our urban centers can be sorted, re-used, redesigned, reconfigured, and transformed to become a useful material for architecture with minimal processing. It examined previous studies on how architects approached construction waste minimization and how they have been able to convert wastes to remarkable Architecture. The findings revealed that most of the wastes that we dispose are not truly waste. They can be utilized in many ways in residential designs, schools, parks, recreation, sculptures, water fountains, landscaping and building components that can give lasting impressions to our environment and help reduce project costs. Re-material can also help reduce volume of municipal solid waste (MSW) by about 10%. Architects and other allied professionals should see waste as a material to re-use for better and more efficient project delivery. The use of material efficiently which is termed 'material resource efficiency' is a highly effective sustainability strategy for better environmental conditions in urban centres.

Keywords: Re-material, Re-use, Sustainable Architecture, Urban Centers, Waste minimization

INTRODUCTION

Waste management is not usually seen as a priority in the design process. Most Architects, developers, and other stake-holders in the building industry seem to take the view that waste is mainly produced during site operations and rarely generated during the design stages. This can be said to be the consequence of having so many considerations to deal with in the initial design stages. According to Osmani (2012), major issues such as waste generation are often neglected at the initial stage of a design and emphases are only given to problems that may arise at the construction phase of a project. However, about one-third of construction waste could essentially arise from design decisions. The current thinking on construction waste minimization is heavily focused on several issues relating to the physical construction waste and waste recycling guides (Richard, 1999).

Waste can be used in different forms for architecture; Reynolds (2015) opines that waste materials could be used as a complete building material for construction through the concept of *Eco architecture*. He further said that construction waste could also be used as a complimentary material to reduce cost and waste generated from site. Some researchers such as; Lennon (2005) and Ekanayake et al. (2008) are also of the opinion that waste materials could be used as finishing in normal construction in form of decoration, cladding, landscape elements in form of sculptures, artworks on buildings, and furniture.

According to Ferguson (1995) in Hassan et.al (2012), different forms of waste are suitable for different categories of 'Re-material'. This is a concept that explores the utilization of waste

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used as material in construction within the same site, in another site, or as a material in re-use. It provides practical means of prioritizing waste saving strategies and of systematically considering waste reduction alternatives. Larger and structurally stable materials such as steel, wood, plastics, paper, and glass have been used to form the building envelope, while smaller debris comprising of a mixture of different materials can be used as additives to other stronger materials for surface claddings in interior and outdoor elements, and for decoration (Reynolds, 2015).

This paper focuses on the possibility of using waste materials with minimal processing that is commonly used in recycling, with the view of encouraging professionals and artisans to take advantage of the research at minimal cost to add value to the environment.

Waste Generation in Urban Centers

The World Bank in 2013 estimated that about 3 billion residents are generates 1.2 kg per person per day (1.3 billion tons per year). By 2025 this will likely increase to 4.3 billion urban residents generating about 1.42 kg/capita/day of municipal solid waste (2.2 billion tons per year). The cost of solid waste management is projected to rise from $205 billion to $375 billion by 2025. This was reported in a global review of a World Bank report titled "What a Waste". This is an issue of major concern to the built environment and its administrators. Wastes in our environment have been on the increase basically due to increase in the population of urban centers arising mainly from rural urban migration and increase of commercial and industrial activities in our cities. As the city grows, the problems of the city also grow.

The excavation, construction and demolition (C&D) waste arising in England was estimated at 91 million tons in 2003 (Dolan et al 1999). In the United States C&D waste accounts for an estimated 35 to 40 percent of the municipal solid waste (MSW) generated. The countries with the highest per capita rates are islands, likely due to waste generated by the tourism industry. The annual waste generation in East Asia and the Pacific Region is approximately 270 million tons per year. This quantity is mainly influenced by waste generation in China, which makes up 70% of the regional total. Waste generation in sub-Saharan Africa is approximately about 62 million tons per year, from 0.09 to 3.0 kg per person per day, with an average of 0.65 kg/capita/day.

A significant amount of debris resulting from these activities is currently disposed of in landfills for recycling, composting, or incineration. Land filling debris results is a large burden on the world's natural resources and an increasingly expensive problem for solid waste management due to its effects on the environment and its ever increasing volume.

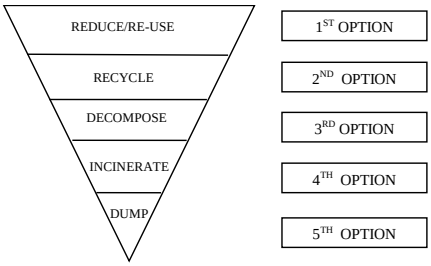

Fig. 1: Waste triangle showing the priority in waste management.
Source: Author, 2015

In Nigeria, waste generation rate is 25 million tons annually at a daily rate of 0.44-0.66 Kg/capital/day (Ogwueleka, 2009). The Per capital rate of MSW production in Lagos, Nigeria is reported to range from about 0.21 kg/day/person (Bamgbose et al., 2000; World Bank, 2004) to about 0.35 kg/day/person (CSL, 2002; Aboyade, 2004). This is equivalent to about 49 million kg waste per day (17.9 million metric tons/year). With an estimated

population of about 170 million and a growth rate of 3.2% annually the waste generation is on a rapid increase.

Most cities spend 20-50% of their annual budget on solid waste disposal yet only 20-80% of the waste is collected (Achankeng, 2003). This is a similar problem to most developing countries where the standards of waste management is still poor and outdated, coupled with poor documentation of waste generation rates and its composition, inefficient storage and collection systems, disposal of municipal wastes with toxic and hazardous waste, indiscriminate disposal or dumping of wastes and inefficient utilization of disposal site space (Ayuba et al, 2013). These problems have contributed to increased floods, health deterioration, and excessive pollution of the environment. The increase in squatter settlements and slums give rise to illegal dump sites that are mostly not properly documented or efficiently managed. The rapid growing waste generation rates and high cost of waste disposal, depletion of landfill space and the problem of obtaining new disposal sites resulting in open dumping are unresolved issues (AEPB, 2012).

Most waste generated in urban cities in Nigeria, consist of about 80% recyclable and re-use materials but the main and popular methods of it management are incineration and dumping in landfills. These methods according to Ayuba et al, (2013) are considered less economic environmental friendly. They posit that re-use and recycling methods are the best ways of waste management. See fig. 1 above and table 1.

Table 1: Waste Generation in Some Urban Cities in Nigeria

City	Agency	Tonnage /month	Density (kg/m3)	Kg/cap/day
Lagos	Lagos state management authority	255,556	294	0.63
Kano	Kano state environmental protection commission	156,676	290	0.56
Ibadan	Oyo state environmental protection agency	135,392	330	0.51
Kaduna	Kaduna state environmental protection agency	114,443	320	0.58
P/H	Rivers state environmental protection agency	117,825	300	0.60
Makurdi	Urban development board	24,242	340	0.48
Onitsha	Anambra state environmental protection agency	84,137	310	0.53
Nsuka	Enugu state environmental agency	12,000	370	0.44
Abuja	Abuja state environmental protection agency	14,785	280	0.66

Source: AEPB, 2012

THE COMPOSITION OF WASTES IN URBAN CENTERS

The different categories of wastes common to our landfills in order of volume include organic materials, paper, polythene, plastics, glass, metals, e-waste and other organic materials. The first seven materials in the waste category excluding organic waste that is biodegradable can be re-used in buildings. Paper waste, plastics, glass and metals can be used directly as a material on site. This research will focus on these materials and the possible ways they can be used in buildings that are suitable to the tropics.

Table 2 Municipal Waste Characterization for the Federal Capital City, Abuja, Nigeria

Composition of municipal waste	**Quantity (tons)**	**(%)**
Paper	16,112.94	25.30
Textile	1,930.30	3.03
Plastics	5,357.68	3.40
Water sachets	9,257.82	14.50
Glass	2,250.38	3.00
Metals	2,642.80	3.14
E-waste	1,786.32	2.80
Organic materials; food and garden waste	2,8420.76	42.60
Other organic materials	1,948.06	2.15
Total	6,3707.10	100%

Source: AEPB, 2012

Causes of Waste in Design and Construction

Construction wastes account for about 35% of waste generated in urban centers that have a lot of construction activities. The major causes of waste in construction are numerous. The major ones include the following:

i. Design decisions (Clients, Architects, and Contractors)
ii. Lack of detailed brief and feasibility study of projects
iii. Changes in Design
iv. Errors in design
v. Lack of proper detailing
vi. Change of use
vii. Lack of on-site waste management plan
viii. Lack of proper supervision
ix. Poor craftsmanship
x. Complex and excessive designs

The major stakeholders in these major causes in design waste are the architects and engineers. It is not enough to think of a good design for a project without considering the process and effect of the project waste to the environment. The method and the process of construction chosen are very crucial to the amount of waste that will be generated. Wastes that are unavoidable need not necessarily be disposed. They can be utilized for landscape elements or other smaller elements of the design.

DESIGNING-OUT WASTES

There are several publications on ways to improve on-site waste management and recycling activities but very few attempts made to address the effect of design practices on waste generation (Fishbein, 2008). However, there is a consensus in literature that the architect has a decisive role to play in helping to reduce waste by focusing on 'designing out waste'. According to Whatt (1978) in Hassan et.al (2012) the factors underlying material waste during construction include inadequate material scheduling, inadequate design and lack of proper planning by the architect. An architect can explore designing out waste in his own site, or using waste generated from other sites or within the urban center. Simple and flexible design options generate less waste than complex rigid ones. Research carried out by WRAP (Waste and Resource Action Program) in the United Kingdom has identified five basic design principles that can be adopted to reduce the waste burden of projects through design. These principles provide a proven practical method of achieving waste reduction through the design process. These principles are:

i. Design for reuse and recovery:
ii. Design for off-site construction:
iii. Design for materials optimization:
iv. Design for waste efficient procurement:
v. Design for deconstruction and flexibility:

Designs for Reuse and Recovery

Major considerations at initial design stages can help in reuse and recovery of materials. These materials include excavation material, cut and fill soil, demolished building components, material off cuts, and pilferage from construction activities. These can be minimized through detailed standard specification that matches design to product specification. It can also be achieved by creating balance from cut and fill soil, re-using excavated soil, and minimizing excavation. Building redesign can make best use of the existing building elements and foundations to reduce demolition debris thereby reducing waste.

Designs for Off-site Construction
Waste generated during production, transportation and fabrication can be minimized by paying attention to details and proper packaging and delivery systems. Damage to pre-fabricated materials, pre-stressed and precast concrete elements is very commonly caused by handling and transportation. However, prefabrication offer better optimization of materials when properly handled.

Designs for Materials Optimization
This approach focuses on "material resource efficiency". Less material used in the specification (lean design) can help reduce construction waste without compromising the design concept. Good practice advocates adopting a design approach that focuses on material resource efficiency.

Designs for Waste Efficient Procurement
Designers must consider how the work sequence affects the generation of construction waste. Omitting an installation in construction can generate a lot of waste when it is later installed. Unavoidable waste can be reduced through manufacturer cut-off take back scheme and waste utilization plans on site.

Designs for Deconstruction and Flexibility
The use and function of buildings change and expand with time. Designers need to consider how materials can be recovered effectively during maintenance and refurbishments. Use of demountable methods of construction can help reduce waste arising from remodeling. This can achieved through the use of coordinated modular grids and materials that can be easily demounted for re-use within the site or in other construction site. We must also consider that the building will eventually be demolished at the end of its life cycle. Designs that do not consider flexibility limit the future potentials of the building. The consideration is about re-usability, recyclability and recovery of materials used.

Other Methods of Designing-out Waste
There are several other methods of designing out wastes used over time to reduce construction waste. The commonest methods include, but are not limited to the following:

i. On site construction waste sorting.
ii. Professional body incentive for waste reduction.
iii. Legislation.
iv. Creating stake-holder awareness.
v. Design competitions.
vi. Research and development in wastes that can easily be converted to materials.
vii. Reducing rates of accidents on site through proper packaging and transportation.
viii. Good safety and security standards on site.
ix. Strict penalties on improper construction waste disposal.

WASTES THAT CAN BE UTILIZED FOR ARCHITECTURE

Different categories of waste can be utilized in the site in a variety of ways depending on the function of the building. Several attempts by architects and artists provide insight on how useful waste can be to the architect. Alejandro Bahamon & Maria Camilla San-Jines''re-material' focused on projects that rescue discarded materials from cargo containers to cups, and change them into buildings and projects that are sustainable and practical. These materials are slightly modified and reconfigured to create a building. Movements of diverse professionals who reuse materials with architecture projects in mind are growing daily. Lucy Wang in South Africa used reclaimed wood artwork to beautify the exterior of a brick

building in downtown Johannesburg that was built with bricks. Glass, metal and plastic bottles have been used to build classrooms, houses and furniture.

This gave birth to the first Nigerian bottle house built with discarded plastic bottles in Yelwa village. Each house was built with one bedroom, living room, bathroom, toilet and kitchen using an estimated 7,800 plastic bottles (See Fig. 1 and 2). This "bottle brick" technology started nine years ago in India, South and Central America providing a cost-effective, environmentally-friendly alternative to conventional building bricks that is much stronger than bricks.


Fig. 1&2: Nigeria's first house built from discarded plastic bottles under construction.
Source: globalwasteideas.org (2015)

Sand bags, paper bags and fabrics have been used to create walls of the building in several projects. Architects and engineers should however explore use of these materials in contemporary construction in form of aggregate or additives in concrete and processed raw materials for producing cheap wall cladding and roofing tiles.

Smaller debris of waste that cannot be used directly can be utilized in different ways to create useful elements of the building or the landscape or additives to other materials. Interesting example of this is seen in projects that utilized shredded tyres, plastics, and paper as aggregates in concrete (see Fig. 3).

Plate 3: Conversion of discarded tyres in to an earthship.
Source: Life.gaiam.com/article/garbage-warrior-turns-trash-green-built-houses

CONCLUSION

For waste to be reduced, hard wastes such as Glass, metal and plastic bottles must be used as sustainable building materials especially now that the most countries are looking for ways to control and manage the environment successfully. The conversion of these generated wastes for use as material, art or landscape elements creates a more sustainable and pleasing environment and can help reduce wastes to landfills by an estimated 10%. Suggested waste

reduction initiatives target halving waste to landfills, this cannot be done through recycling alone, but it can however be achieved through Re-material.

Architects and engineers are however advised to engage in collaborative researches to experiment the provision of housing using wastes generated within a community. This will however provide alternative materials from waste that can be used as aggregate in concrete and other building materials.

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The Nigerian Water and Waste Water Industry: Governance, Efficiency, Procurement and Infrastructure

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ABSTRACT

Nigeria is a signatory to the Millennium Development Goal (MDGs) target but the country is far below meeting its water and sanitation target. A recent report by the World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF) shows that access to potable water has increased from the advent of the MDGs in 1990 from 45.6% to 64% of the population, this increase still leaves over 65 million Nigerians; a population of many African countries combine together without access to safe drinking water. On sanitation, the report indicates that there is actually decrease in access to sanitation from 36.9% to 27%, with over 23 million of Nigerians still practicing open-defecation. This means over 120 million people about two third of the country's population lack access to good sanitation. Therefore, this study attempt to uncover challenges facing the sector and proffers sustainable solution that could mitigate this trend. A quantitative research approach was deployed to conduct, collect and analyse data obtained from major water and waste water industry stakeholders in Nigeria and Statistical package for social scientists software (SPSS) used to analyse the data. Findings from this study indicated that the water sector could attract renewed interest by investors due to its scarcity thus a very large market. However, the country's inability to make significant service increase could be blamed on lack of political will on the sector, the dearth of policies and good governance strategies for regulating the water and waste water industries. The research also discovered that managing this important but neglected social sector efficiently would help boost the availability of potable water supply and waste water infrastructure to meet the expectation of the Sustainable development goals (SDGs).

Keywords: Service Provider, Stakeholder, Waste Water, Water governance, Water infrastructure

INTRODUCTION

Literature reveals that while the world population has increased by a third in the 20th century, access to clean water for human used has grossly decreased (Wibowo 2009). Over 90% of portable water supply and access to sanitation in developing countries such as Nigeria is being provided by Public utilities because public ownership is seen as the best way to protect the market and ensure access to this vital social service, UNDP (2013). Management of these utilities however has not been efficient, (WUP 2001). In most cases as stated by Omoregie and Ehiorobo (2013), existing institutions and Governance methods aimed at reproducing or maintaining effective infrastructure in areas that require them has been grossly unsuccessful, especially in sub-Saharan Africa due to poor governance. Nigeria has an estimated population of over 170 million people and of this population, 36% do not have access to safe drinking water while about 73% lack access to sanitation, (JMP 2012) resulting in various diseases affecting the Nigerian public particularly children under the age of five. Even in Abuja the Nigerian capital, a large proportion of the residents get their drinking water from local water vendors selling in jerry cans popularly called "Mairuwa" thus putting their lives in danger due to uncertainty of the source and its quality causing diseases and thus putting pressure on the city hospitals and clinics. This ugly scenario could be attributed to poor governance and efficiency of the water sector despite its essential need for human existence, (Shaw, 2005).

Water governance can be said to be a system requiring the participation of all stakeholders, anti-corruption equity, transparency promotion of water legislation and regulation (Kajenthrira, 2013). Improvement in the water and waste water sectors in Nigeria has always been claimed to be an important goal for each successive government. Adequate provision of

Sanga, J.; Renukappa, S. & Suresh, S. (2016). The Nigerian Water and Waste Water Industry: Governance, Efficiency, Procurement and Infrastructure. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 440-448

water and sanitation services is also critical to the achievement of other economic objectives of the country (Hawkins and Wells, 2007) and Unicef/WHO (2015).

DEMANDS FOR WATER AND SANITATION SERVICES

At The Hague, March 2000, which was the second World water Forum (WWF2) the World water vision for 2025 was developed which is "Making Water Everybody's Business", (Cosgrove and Rijsberman 2000). It develop a consensus for gaining universal access to water and sanitation by 2025, which led the UN member states to adopt (on 18th September, 2000) water and sanitation as part of the MDGs. The goal was to ensure that the proportion of people living without sustainable access to safe drinking water and basic sanitation are reduced to halve by the year 2015. 'Water for Life' a United Nations International Decade for Action 2005 – 2015 was also lunched at the 2005 World Water Day followed by an International Year of Sanitation in 2008. All these unequivocally outline the global need for adequate and efficient clean water and waste water governance.

Table 1 indicates that nearly a billion people globally will still lack safe drinking water and more than that lacking sanitation at the end of MDGs in urban areas. With Nigeria being one quarter of Sub-Saharan Africa population, more than 70 million citizens is thus in need of water and sanitation services presently and effective Governance of water and waste water is the only panacea to these ugly incidence. Lipinska, (2012) went further to estimate that over 90% projected population growth will be in developing countries by the year 2050 and the regions are already water scarce with increase competition among water users to gain access to limited water supply.

Table 1: *Urban demands for access to safe water and sanitation by 2015*

Eastern Asia & Pacific	290,000,000	330,000,000
Sub-Saharan Africa	175,000,000	178,000,000
South Asia	243,000,000	263,000,000
South-Eastern Asia	115,000,000	208,000,000
Latin America and Caribbean	121,000,000	132,000,000
Former Soviet Union	27,000,000	24,000,000

***Source**: UN Millennium Project Task Force on Water & Sanitation, Interim Report, 2015*

The quality of life for a community both urban and rural is directly or indirectly affected by the availability or lack of access to water and sanitation for their daily needs "First, we have to have water simply to exist because we can only survive for short periods of time without drinking it" (Shaw 2005). Water is the common factor to the other four of the five basic human needs; water, food, health, shelter and peace. But of all the different uses of water, its use for consumption and sanitation activities are of higher social and economic relevance, ((Anand 2007 and Gbadamosi 2012). Water and waste water infrastructure assets form a large portion of all cost of public utility in any given city, (Cardoso et al 2012). Goldman (2008) estimated the size global water sector market to be above USD 425 billion with about 4-6% annual growth rate, he also stated that it will in the nearest future be compared only to the petroleum industry. This sector however varies from one country to the other depending on each country's population, geographical size, reputational frame work, business model adopted and stakeholders involved, (Abbott and Cohen, 2009 and JMP, 2012). This means Nigeria most developed sustainable governance system that she can effectively govern.

The Nigerian Water and Waste Water Industry: Key Issues

In addition to naturally being blessed with much water resources, the country invested significantly on water resources during the oil boom of 1970s and early 1980s especially in the construction of large multipurpose dams meant for drinking water supply, irrigation, flood

control and hydropower. Since then nothing much has been added despite double in population, operation and maintenance of these aging infrastructures has also been very poor resulting to a higher percentage of the population without access to clean water.

While water supply and waste water management problems are not unique to Nigeria but common to most developing countries; presently Nigeria is one of the most stressed in terms of water accessibility per person due to rapid urbanization and population growth. The growing pressure on water resources globally might see water as a major cause of conflict internationally and even nationally in most part of the world in the future (Lukenga, 2015).

The planning, development and delivery in the water and waste water sector in the country is generally dominated by the public sector with unnoticeable involvement of the private sector except in private Boreholes mostly drilled in residential areas for private sales. The bulk of planning, funding and major projects are undertaken by the federal government with a top-down approach, thus dictating the pace of sector development. But in smaller water and waste water projects, each agency or government level adopts its own management style to achieve its objectives with a very weak coordination for all the projects.

The first policy enactment on Nigerian water sector was the Water act 101 of 1993 followed by the National Water Resources Master Plan of 1995, the Water Resources Management Reform Programme of 1997, the National Water Supply and Sanitation Policy (2000) and finally the National Water Policy 2004. A review of the NWRMP (1995) commences since 2012 but is still ongoing. This policy are intended to regulate the Nigerian water and waste water sectors covering Legal and Regulatory Framework, Institutional Framework and Participatory Approach, Water Resources Infrastructure, Information and Water Resources Database, Assets and Assets Management, International Waters, Water Resources Economics and Financing and Environment and Resource Sustainability.

The poor water and waste water coverage in the country over the years is also blamed on lack of transparency in the implementation of water and waste water projects. Water governance is spread across different political boundaries, organisations and agencies in Nigeria making effective regulation, monitoring and oversight often difficult with many outlets of corruption to exploits. (Jacobson and Tropp, 2010).Adequate monitoring and maintenance of water and waste water infrastructure has also not been effective majorly due to inadequate funding. Corruption in the water sector keeps people thirsty and vulnerable to waterborne diseases, making families struggle for survival to escape poverty. Unfortunately, the less there is water availability, the higher the risk of corruption, (TI 2008) and (Lukenga, 2015).

Sustainability/Integrated Water Resources Management

Water and waste water management cut across many interest, stakeholders and businesses, hence there is the need for sustainable water management because “water is a renewable but finite natural resource” (Samuels *et al,* 2006). Its sourcing, supply and disposal is of fundamental to the economy and sustainability of nation and the quality of life of its citizen and business and the economics of how to sustainably manage the water cycle.

Harvey and Reed, (2003) defines sustainability in the water sector as that in which the water sources are naturally replenished after exploitation, facilities adequately maintain to ensure reliable and adequate water supply to all users over a long period of time in a cost effective manner that can be replicated. Water saving should become a priority to all people and “sustainable water policy promotes the formation of a water-saving culture”, (Lipinska 2012).

Because the environment is under pressure from many developmental spares like increase housing, population growth, transport systems etc affecting climate change; (Samuels *et al* 2006) outline issues that need to be considered in delivering sustainable water managements

in UK which include raising public awareness on impact of water use on the environment and ways of sustainable management.

To find the best answers and institutional models that are best and appropriate for addressing these and many other water sustainability issues has not been easy. There is now a better global focus on water governance, IWRM, participatory approaches and partnership, emphasis on ecosystem conservation and the consideration on cultural, social and economic of the water industry with adequate stakeholder participation.(Lipinska, 2012). At United Nations convention on Environment and Development held at Rio de Janeiro in 1992, and also at World Summit on Sustainable Development held at Johannesburg in the year 2002; the global water institutions developed a water used policy for Sustainable Development (SD) through Integrated Water Resources Management (IWRM) and Integrated Watershed Management (IWM) which has been adopted by many countries. Table 2 below shows characteristics of water and waste water management systems within a sustainable sanitation framework. In Africa and Nigeria in particular, the use of the word 'sustainability' is found repeatedly in many government policy and documents in the water sector but most agencies are not committed to its concept and inclusion in developmental planning and implementation of programmes.

Table 2: *Characteristics of water and waste water management systems in a sustainable sanitation framework*

Items	Characteristics
Water Resources	Extraction of fresh water from protected areas; reuse from treated water
Water Quality	Treatment of sufficient quality and quantity; novel and decentralized facilities
	Meeting health risk requirements
Treatment objectives	
Water Distribution	Piping system with chlorine residual; bottled drinking water
Generation of sewage	Toilets, kitchen, bathrooms; separation at source
Collection of waste water	Centralised system for sewer networking: Combine or separate system; on-site decentralized waste water treatment requires no sewer network
Centralized waste water treatment	Removal of pollutants: solids, organics, nutrients; reused of effluent and sludge
Advanced treatment	Removal of micro-pollutant, eco-hazard; reuse of effluent and sludge
Sludge management	Sludge conditioning and disposal, reuse
Financial Mechanism	Providing facilities based on the capacity of the general public and industries
Capital operating cost	Emphasis on cost-benefit analysis with reuse and recycling as requirements
Socio-cultural management	Clear policy on pollution and water sustainability, human resource

Source: *Ujang, Z and Henze M (2006)*

RESEARCH METHODOLOGIES

Qualitative method of research was adopted for this study in a bid to solving a qualitative problem (Biggam,2011)and has analysed various water and sanitation governance models using the concept of Strengths, Weaknesses, Opportunity and Threats (SWOT) analysis. This involved searching for documents and information by investigation and reviewing of similar articles and literature in order to reveal the efficiency or otherwise of the Nigerian water and waste water management. Different literature and information sources were used for facts finding include peer reviewed journals, conference proceedings, government publications, newspaper articles, water and waste water reports, books and other international organisations and bodies publications involved in water and sanitation issues such as the UN, WHO and UNICEF. Reviewing these literatures has exposed the efficiency, governance, procurement and infrastructural positions and challenges facing the water sector in Nigeria. Also, surveys and interview has been carried out using data collection instruments such as psychometrics and document analysis from records of water and sanitation activities available Rugg (2007).

There were two methods of approach for data collection used for this research work: Primary data/responses obtained from face to face interviews, questionnaires and personal observation carried out on key Federal government players within the water and sanitation industries and

Secondary data, information and records obtained from Journals, Magazines, Books, related published articles, documentaries and policy documents from water and sanitation related.

RESULTS AND DISCUSSIONS

The study examines the challenges facing the Nigerian Water and Waste Water industry and there after categorized the overarching issues critical to effective water and waste water management and improve performance in Nigeria in to four, they are; Water and Waste water Governance and efficiency, Infrastructure and Procurement, Finance and Financing systems and finally Investment gaps and opportunities analyzing only the top four discovered to be the most critical in each category.

General profile of respondents

A total of 50 questionnaires were distributed however, completed and returned questionnaires were 42 indicating 84% success rates; this figure is very good and reliable sample as suggested by Dania et al (2007) in which 52% response was accepted as valid. All respondents selected are within the senior and management level of responsibility with over 70% having more than 10 years' experience working in the Nigerian Water sector. The questionnaire also requested to know from respondents the area of participation in the water and waste water industry based on planning, construction/construction supervision, procurement, advisory and others as depicted on table 3 below;

Table 3: *Respondents profile of water industry participation*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Planning	22	52.4	52.4	52.4
	Construction	10	23.8	23.8	76.2
	Procurement	6	14.3	14.3	90.5
	Advisory	3	7.1	7.1	97.6
	Others	1	2.4	2.4	100.0
	Total	42	100.0	100.0	

As indicated on table 3 planning accounts for 52.4% of respondents, construction account for 23.8%, procurement 14.3% and advisory 7.1% while others accounts for 2.4%. This should be because most of the actual construction works are contracted to private water contractors while the government concerns itself with the governance process despite the random sampling used in sharing the questionnaire amongst the water industry actors.

Challenges to Nigerian water and waste water sector

One of the objectives of this research work is to discover the current challenges facing the Nigerian Water and Waste water industry. Twenty of the challenges were discovered in literature and from the descriptive analysis, top ten major challenges from respondents are ranked 1-10 are further analyzed on table 4 based on the respondent's three major aspects of involvement viz: Planning, Construction and Procurement.

Table 4: Challenges to the Nigerian Water Sector Work Responsibility Analysis

Variable	Planners		Construction		Procurement		General	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Power Supply	1.12	1	1.62	3	1.42	4	1.55	1
Inadequate Funds	2.05	8	1.97	5	1.32	2	1.64	2
Lack of maintenance	1.40	3	1.36	2	2.36	9	1.88	3
Lack of Political commitment	1.98	7	1.88	4	2.00	7	2.05	4
Lack of Manpower and skill	1.38	2	1.26	1	1.52	5	2.10	5
Corruption	1.64	4	2.75	9	1.33	3	2.10	6
Use of Non-professionals	1.88	6	3.50	8	2.00	7	2.10	7
Defiant Regulations	2.05	8	2.48	7	2.10	8	2.16	8
Non implementation of Budget	1.76	5	2.07	6	1.24	1	2.17	9
No Delineation of Responsibility	3.02	10	3.83	10	1.74	6	2.34	10

1 = Very challenging 5 = Not challenging

Planners score indicates that the 3 most important challenges to the water sector in Nigeria are Power supply, Lack of Manpower and lack of infrastructure maintenance with the score of 1.12, 1.38 and 1.40 respectively. This agrees the general mean ranking and with Chukwujekwu, 2000 that the economic growth of a nation is traceable largely to its power supply. The other two highest ranked challenges are also amongst the top five general ranking.

The opinion of respondents involved in construction activities shows that Lack of manpower, Maintenance and Power supply in that order with mean value of 1.26, 1.36 and 1.62 respectively are the major challenges. The three also falls within the top five of general respondents indicating their negative impact on the Nigerian Water sector. Construction companies need skilled manpower to function effectively and deliver quality infrastructure so also the need to maintain such infrastructure to prolong its life cycle.

In the view of Procurement officers, the three most important challenges facing the Nigerian water sector are: Inadequate funds, none implementation of budget and Corruption with the score of 1.24, 1.32 and 1.33. Ironically none implementation of budget which is the tenth challenge on this analysis is the second for procurement officers and corruption which is sixth is the third. This is not unconnected with the fact that procurement relies solely on the availability of funds.

The general opinion of respondents is that power is the major challenge to the development and efficient provision of water and waste water services to the Nigerian public, this is also the view of planners with a mean value of 1.12. Respondents involved in construction activities ranked it 2nd while it is the 4th according to procurement officers. In summary, although all the respondents work in the Nigerian water and waste water sector, Planners involved in the design of water infrastructure acknowledge lack of sustainable energy source in Nigeria as the greatest challenge, Construction workers went for lack of manpower and skill while procurement officers are of the view that none implementation of the country's fiscal responsibility act.

Water and waste water governance and efficiency

The following discuss the major aspects of the Nigerian water and waste water sectors as score by all respondents to come out with results and overarching issues critical to effective water and waste water management and improve performance in Nigeria.

Table 6 below summarizes descriptive analysis results of questions asked to acquire information regarding water and waste water status, governance, procurement and efficiency in Nigeria.

Table 5: Respondents view on water and waste water governance and efficiency

Variables	Mean	Rank
I am satisfy with current water and waste water governance in Nigeria	1.79	1
Nigeria has met MDG's goals on Water and waste water services	2.05	2
Publicly own water and waste water projects are better managed in Nigeria	2.05	2
Project beneficiaries decide project type and location	2.07	3
The current level of private sector participation in water Waste Water Sector is very encouraging	2.21	4
Much part of your expenditure goes to maintenance of project	2.34	5
Customers promptly pay for your services	2.38	6
Revenue from services could account for the cost of service delivery	2.38	7
The level of 2014 budget implantation is above average	2.40	8
There is a strong political commitment towards water and waste water management in Nigeria	2.41	9
There are regular tracking audits of projects after completion to ensure value-for-money	2.48	9
Small-scale independent water providers are monitored to serve unreached areas	2.48	10
Project sustainability is always considered in my organisations project design and implementation	3.05	11
There is adequate gender balance in water and waste water sectors in Nigeria	3.21	12
Decentralised water sector management with States Government playing key role is better	3.38	13
There is adequate monitoring and evaluation of water and waste water projects in Nigeria	3.40	14

Valid Number of Respondents = 42 1 = Strongly Disagree 5 = Strongly Agreed

From table 4.5 above, less than the mean (about 2.05) agreed that Nigeria has met the MGDs target on water and sanitation. From our literature review the UN has classified Nigeria as having met the target on water but not in sanitation. In 2002, the African Ministerial Conference on Water estimated that over $10 billion was required to meet the MDGs target on water supply; However, it is very clear that this funding was not met resulting in significant investment gap in Nigeria also making respondents not to be satisfy with the current water governance system as indicated by the mean score of 1.79. World Bank, 2007 stated that water management problems mostly stem out of overlapping and unclear functions of public agencies, I will agree with them and concur with Agberemi (2003) of the need to decentralized the water and water governance structure to give more control and management decisions to the states and local council due to the different water sources, topographical peculiarities and large population of the country as proposed on figure 1 below.

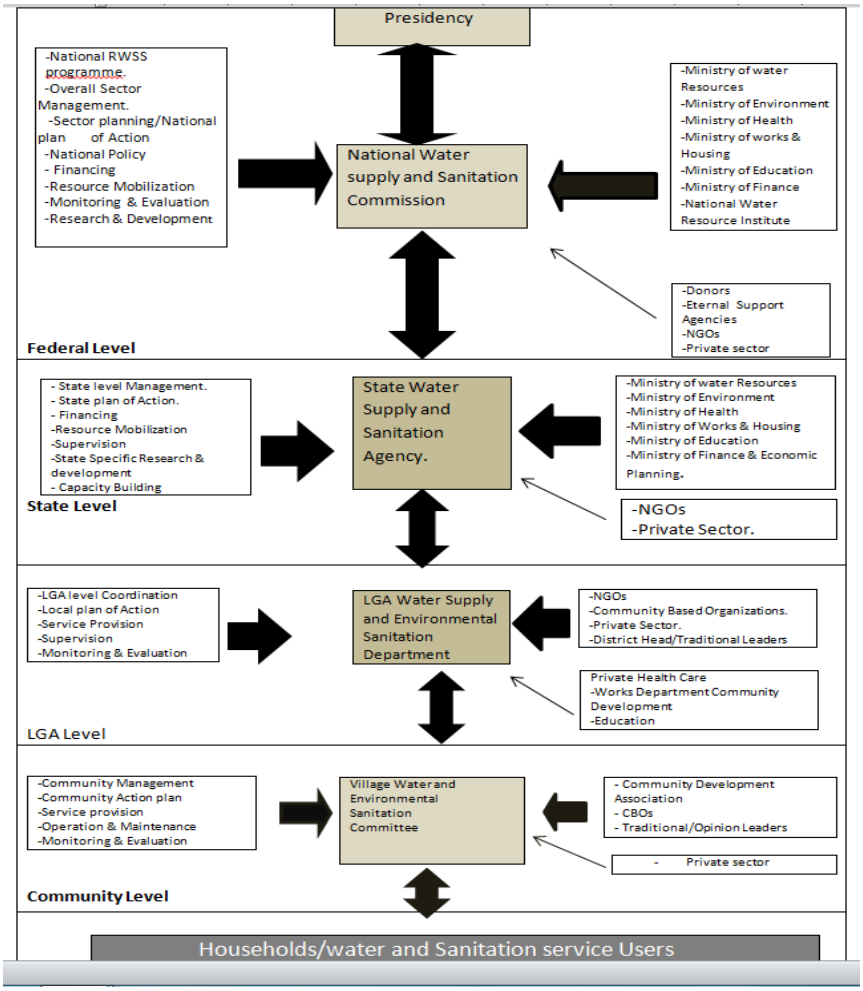

Fig 1: *Proposed Governance Model for the Nigerian Water and Waste Water Sector*

From the analysis on Table 6; many of the respondents agrees that most decision on water and waste water project location is decided by the political class and/or government as less than the average mean of 2.07 indicates that the end user have less voice on project execution. Gbedemah (2009) illustrate how participatory approach by NGOs in Ghana is regarded as the third sector on project procurement which is lacking in Nigeria. End users only may not be able to decide type and location of water and waste water infrastructure in Nigeria but effective infrastructure procurement should involve the combine commitment of the government, Designers, Civil society and end users, thus "Making Water Everybody's Business", (Cosgrove and Rijsberman 2000) to ensure all voice are heard .

The mean value of 2.05 for Public service provider suggest that the Private sector could play an important role in the water sector in Nigeria if better organisation, policies and regulatory frameworks are put in place with creative incentives and structures that will guarantee its profit margin on their investment. There should also be a broad based consensus, capacity building, a well-defined financial autonomy and obligations of all parties in the contracts (AfDB, 2005) and the choice of a PPP model that could suit the country's peculiarity (Akintoye and Renukappa, 2015). An autonomous body could also be set up to mediate between private investors and government with also the aim of protecting customers of the service that is delivered. Other areas of concern for water sector financing in Nigeria from the analysis above are that government finance the water sector in Nigeria (with 2.34 score), customer payment of services cannot account for the cost of service delivery (2.38), Federal government budget for the industry is not being fully implemented (2.38) and there is no value for money tracking for the water industry in Nigeria (2.41).

An investment gap brought out by this analysis with mean of 2.34 is the lack of Planned Maintenance of water and waste water infrastructure in Nigeria.(Gbadamosi ,2012 and Lukenga, 2015) affirm that "however small or however well designed, all water treatment works require regular attention and maintenance".

CONCLUSIONS

This research was able the discover Nigerians inability to expands its citizen access to potable water and effective management of waste water to government apathy towards the water sector, the dearth of laws, regulations and legal frameworks and their implementation, insufficient funds and funds misappropriation, corruption and lack of transparency in implementation of water projects, inadequate power supply to run the few existing infrastructure and none incorporation of all stakeholders in the planning, design, construction, operation and maintenance of projects. There is the need to urgently address these challenges in order to lay a solid foundation for the soon coming Sustainable Development Goals (SDGs) beginning in 2016. This can be achieved through participatory approach to water governance by all stakeholders, strong political commitment, increase financing and private sector involvement, transparent and accountable procurement process and planned maintenance of infrastructure. Further study could be developed on best alternatives approach for private sector participation that is best for the country peculiarity.

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Energy Balancing in Buildings as a Sustainability Design Strategy in Nigeria

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ABSTRACT

The paper presents findings of Energy modeling of the wall and window components of the PIND office Building Warri. The study demonstrate how building envelop components assembly may achieve energy balance through electronic energy modeling. The paper illustrated how this strategy was used in the design process to achieve energy balance in the Architectural Designs of the Chevron – PIND office complex. Evidence suggests that, in Nigeria, Energy Balancing has not been sufficiently explored as a means of achieving Energy Efficiency in buildings. Architects, in Nigeria, are currently not required to design to energy standards. This has hampered the up-take of Energy Balancing as a sustainable design technique. This paper explores how Passive House Institute Standards has used in the Energy Balancing of the Chevron PIND office complex, Warri. The study method includes, Focus Group Discussions, the review of literature and Case Study of the Chevron PIND office complex. The significance of this study is that the strategy would enable better energy balance, less CO_2 emissions by the Nigerian building stock. The main-streaming of PHI standards or similar would be an effective climate change mitigation strategy for Nigeria - in line with the United Nations Local Agenda 21. The findings highlight the significant contributions of the latent cooling and sensible cooling loads to the Total Energy Demand and the Primary Energy Demand of buildings in Nigeria. The study findings also indicate that building costs in Nigeria are limited to cost of Labour and materials; hardly any consideration is given to the environmental and socio-cultural impact. The results also suggest the achievement of Energy Balance of the Wall and Window elements is significant to the total energy demand and also with GHG emissions. Quite often, the public is unaware of the dangers of non-environmental sustainable buildings. The deliverables are intended to form part of a conceptual Energy Performance Framework to which Architects are expected to design to by law.

Keywords: building, energy, efficiency, balancing, simulation, sustainability

INTRODUCTION

In almost all Western Countries and increasing developing countries (that signed up to the 1992 Rio Climate Change Agreement) architects and other construction professionals are now expected to design to pre-determined statutory energy performance standards. Energy modeling has become part of the design process. This technique is the quickest and most cost effective of achieve Building Energy Balance early in the design process.

Energy efficient buildings are those which consume less energy while maintaining or even improving the comfort conditions for their occupants compared to standard buildings. Energy efficient buildings result not only in less environmental impact but are also economically sustainable and resilient. The development of energy efficiency standards is likely to ensure that Nigeria has more access to electricity at lower cost (Monteyne H & Gyoh L 2013)

The Building Energy Efficiency Guideline for Nigeria was commissioned by the Federal Ministry of Lands, Housing and Urban Developement, Abuja Nigeria with support from Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH, UN Habitat and the European Union under the Nigerian Energy Support Programme (NESP). It aims to give practical advice to professionals in Nigeria on how to design, construct and operate more Energy Efficient Buildings. The guide also aims to educate the general public about energy efficiency measures and help clients when specifying buildings to ensure that they obtain a "green" building. The development of the Building Energy Efficiency guidance has become necessary as energy used in residential buildings in Nigeria account for 78% of the total

Gyoh, L. & Abdulkarim, M. (2016). Energy Balancing in Buildings as a Sustainability Design Strategy in Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 449-458

national electricity energy consumption, whilst approximately, 55% of the population has no access to electricity supplies (GIZ August 2015). A World Bank study suggests that approximated 40% of global Energy Demand may be shaved off by building energy efficient improvement alone (World Bank 2012).

The building sector accounts for the majority of electricity consumption in Nigeria and will inevitably increase significantly in absolute terms in the coming years driven by a rapidly increasing population, migration from low energy consuming rural dwellings to urban centres, and improvements in living standards. Set against a chronic shortage of electrical generation and transmission capacity, energy efficiency measures represent the cheapest way of improving the state of energy supply in Nigeria, now and in the future as the grid plays catch-up with demand. This may be achieved by exploiting Environmental Assessment pathways such as LEED, BREEAM, Green Star and Passive House, to mention a few.

Significance of Passive House

Why Passive House

Passive House focuses on energy, indoor air quality and comfort; It performs exceptionally well in this areas (Monteyne and Gyoh 2013). Passive House as compared to other Environmental Assessment systems has a narrow but rigorous method. It is simple, flexible and easily adaptable to the local environmental situation in Nigeria and elsewhere.

The benefits of the Passive House Institute (PHI) methods are that, the 'Passive House Performance Standards' are sensitive to local environment and climatic conditions. The performance standards factor in the local Latent Cooling Loads, Sensible Cooling Loads and Heat load demands.

Passive House Standards

Basically, Passive House Institute Standards is one in which comfort in interior spaces can be achieved without conventional cooling or heating systems. The standards are built round the 'Fabric First' Concept, based on five fundamental building blocks – namely:

i. Thermal Insulation
ii. Thermal-Bridge-Free Construction
iii. High Performance Window and Doors
iv. Airtight Construction (Moisture Control)
v. Controlled Mechanical Ventilation with Energy Recovery Ventilation (ERV)

Passive House is a building standard, which is energy efficient, comfortable, economic and environmentally friendly simultaneously. Passive House is not a brand, it is a building concept which is open to all and which has proved itself and constantly improving (PHI 2013). According to the Passive House Institute of Ireland, Passive House is the leading standard in energy saving in buildings worldwide. The energy saving for heating amounts to over 75% in comparison with the legally prescribed building standards (Bere 2013). The heating costs are very small – high energy prices make no differences to residents of Passive House in Germany (Vallentin R & Gonzalo R 2013)

According to the Passive House Academy PHPP official manual, the key Passive House Certification Criteria are as follows:

i. Heating Energy Demand (QH) $\leq$ 15 kWh/m^2.a
ii. Cooling Energy + Allowing for humidity control - Dry Degree Hours (DDH) $\leq$ 15kWh/m^2.a + DDH
iii. Building Cooling Load (PC) $\leq$ 10 w/m^2
iv. Building Heating Load (PH) $\leq$ 10 w/m^2
v. Primary Energy Demand (PE) $\leq$ 120 kWh.m^2.a

vi. Building Airtightness (n50) ≤ 0.6/h Air Changes per Hour (ACH)
vii. Summer overheating frequency < 10%

The Passive House recommended U-value for opaque elements ≤ 0.15w/m^2.k. This goes for the walls, floors, roofs. However, the U-value installed for windows ≤ 0.85w/m^2.k

Comparison of LEED and Passive House

Table 1: Comparison of LEED and Passive House

LEED	*Location & Transport*	*Sustainable Sites*	*Water Efficiency*	*Energy & Atmosphere*	*Material & Resources*	*Indoor Environmental Quality*	*Innovation*	*Regional Priority*
Passive House (PH)				PH - Energy Standards		PH- Indoor Air Quality & comfort		

LEED and Passive House are completely different approaches to sustainable building. LEED has been an incredible market transformation tool and has been seismic in raising awareness of sustainable building in North America and elsewhere. However, Passive House, on the other hand, is more narrowly focused on energy, indoor air quality and comfort, it performs exceptionally well in those areas – as illustrated in table 1. Passive House is still niche in North America, but is gaining traction and growing rapidly world-wide. Passive House performance is well proven globally, is backed by over 25 years of building physics and is achieved using the PHPP Energy Balancing verification tool (Bere, J. 2013)

METHODOLOGY

This paper emerges out of the preliminary findings of a wider study carried out by the authors at the Ahmadu Bello University, School of Architecture, Zaria, Nigeria. The study adopted mixed method research design approach, and in which qualitative method were applied in the interpretation and analysis of data on the perceptions and attitudes of participants to the early use of energy balancing methods in the design process and the potential benefits. A purposive sampling technique was adopted in order to identify the typical instances with relevant rather than aim for proportional representation (Castillo 2009). The empirical evidence was derived from the Case study experience of a Passive House Energy Efficient project design and construction of the Chevron PIND ATED Energy Efficient Office Building complex, Warri, Delta State, Nigeria. The study method also includes Focus Group Discussion, In-depth Interviews with design consultants, specialist contractors, user groups and the client organization.

Energy Efficient Building

The procurement of Energy Efficient Building (EEB) starts with the right design approach. It starts firstly, by considering the microclimate conditions of the site, orientation and shaping the building form. Secondly, by a conscious selection of building materials and envelope systems aimed at minimise building thermal transmissions – by shading, insulation, natural ventilation and thermal bridge detailing. Thirdly, active systems may be selected on the basis of high efficiency (e.g. high efficient ventilation and lighting systems) to enable a reduction of building cooling loads in hot and humid climate (e.g. dehumidifiers)

Energy Balance

Passive House is a building standard, which is energy efficiency, comfortable, economic and environmentally friendly at the same time. The Passive House Institute (2013) argues that, It is the leading standard in energy saving in building world-wide. Passive House Energy Balance refers to the Energy Gains versus Energy Losses in relation to comfort environmental conditions.

Space Cooling Demand

Qc = Space cooling demand (kWh/year)

Qc = QT + QV – Ƞ (QS + Qi)

QT = Transmission losses

QV = Ventilation losses

QS = Solar gains

Qi = Internal gains

Ƞ = Correction factor

qc = Specific space cooling demand (kWh/m^2.year)

ATFA = Total Floor Area (m^2)

qc = Qc/ATFA

The Passive House Criterion qH ≤ 15kWh/m^2.a + DDA

The Dry Degree Hours in Warri (DDA) = 54 kWh/year

Transmission Losses (Transmission Losses (QT))

QT = A x U x ft x Gt

A = Area of Wall

U = U-Value of Wall

ft = Temperature correction factor (unit less) usually = 1 above ground

Gt = Cooling degree hours (∑ΔT)

The Transmission Losses QT is equal to the product of the total wall surface area, the U-Value of the wall and the temperature difference (ΔT). The U-Value of the heterogeneous wall assembly was calculated by 'building-up' from the respective heat transfer coefficients (λ – values) of the individual components that constitute the wall assembly.

U-Value = 1/RTotal = 1/ Rsi + d1/λ1 + d2/λ2 + d3/λ3 + …..+ dn/λn + Rs**e**

RTotal = Total Resistivity

Rsi = Internal Surface Film Thermal Resistance

Rse = External Surface Film Thermal Resistance

Wall Specification for the PIND Passive House Warri Project

Hydraform compressed earth bricks where used for the external wall of the Passive House PIND office Warri. Hydraform compressed earth blocks has a Heat Transfer Coefficient of λ = 1.0w/m^2K – much better than cement blocks. The Hydraform block work is 220mm thick, the sand cement plaster on the internal surface is 25mm, whilst the internal insulation is 50mm thick and the internal plasterboad finish is 25mm thick.

The wall assembly specification for the office complex are summaries in the table 1 and table 2.

Table 1: Lamda and delta values for wall PIND office wall assembly

Item	Hydraform Blocks	Sand Cement Plaster	Foam Insulation	Plaster board Finish
λ	1.0	1.4	0.03	0.35
d	220mm	25mm	50mm	25mm

Table 2: Surface film thermal resistance- for Internal and External Surfaces of Office Complex

Item	Surface Air Film Resistance (m2k/W)
Rsi (internal surface)	0.01
Rse (External surface)	0.04

RTotal = Rsi + 0.220/1 + 0.025/1.4 +0.050/0.03 + 0.025/0.35 + Rse

RTotal = 0.01 +0.220 + 0.0178 + 1.667 + 0.0714 + 0.04 = 2.02 m^2k/W

Insulated Wall U-Value = 1/RTotal = 1/ 2.02 = 0.49 W/m^2K.a

Non-Insulated Wall U-Value = 1/0.2878 = 3.47 W/m^2K.a (East and West Facades)

From the above results it can be seen that the heat transmission of the Non-insulated wall is seven (7) times more than the heat transmission of the insulated wall. This translates to a significant reduction of the building cooling load and energy costs.

Wall Area = 154m^2 (East and West Façade)
$\Delta T = \sum(Tse - Tsi) \approx 10$
QT = A x U x ft x ΔT
QT = 154 x 0.49 x 1 x 10 = 754.6 kWh/m^2 (insulated wall)
QT = 154 x 3.47 x 1 x 10 = 5343.8 kWh/m^2 (non insulated East and West Façade)

The heat transmission of the non- insulated wall is approximately seven times more than that of the Insulated hydraform wall. This is an indication of the energy load reduction achieved in the PIND Passive House Warri building by specifying insulation of East and West facing walls as well as the roof cladding of the building.

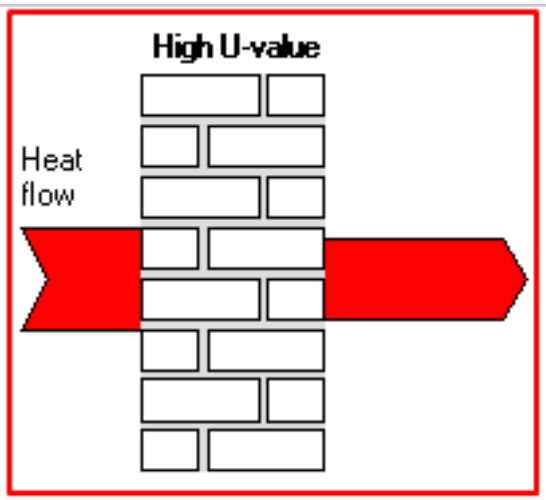


Figure 1: Uninsulated Wall

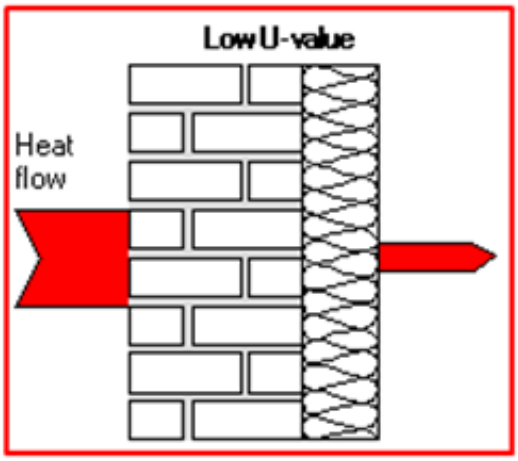


Figure 2: 50mm Insulated Wall

The calculation results indicate that the building cooling load reduces significantly by the introduction of 50mm insulation in the east and west facades of the building. Deep overhangs where provided in the south elevation to prevent overheating thereby further reducing the buildings energy loads.

PHPP Computer Simulation Results

The Passive House Planning Package Simulation results show that 50mm of insulation reduced the heat transferred through the wall by 85% - as indicated by the graph in figure 3.

The calculation results also indicate a seven (7) fold reduction in the wall thermal transmission from a U-value of 3.47w/m^2.K to 0.49w/m^2.K. This translates to massive cooling load energy savings throughout the buildings life cycle

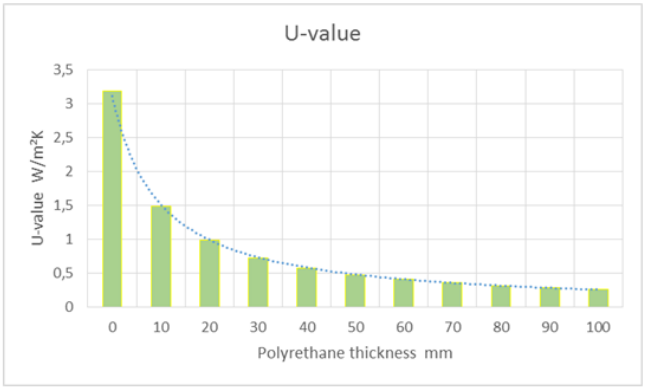


Figure 3: PHPP Graph showing the effect on insulation thickness on thermal transmission

The notable benefit was experience in the first 10mm of insulation up to 50mm. After 50mm, the marginal utility benefit drop as the insulation thickness increased beyond 50mm up to 100mm in Warri climate conditions.

Chevron PIND Energy Efficient Office -Building Project Warri

Chevron PIND office project is an Energy Efficient office complex designed by Yorkshire Consult and project managed by Sustainable Building Concept.

The project was designed to Passive House Energy Standards. The maximum Cooling Demand was ≤ 15 kWh/m^2. year, whilst the Latent Cooling demand was ≤ 54 kWh/m^2.year. Simulation results based on Warri climate data suggest the Specific Energy Demand as ≤ 69 kWh/m^2.year for Latent and Sensible Cooling. The design team allowed 6 kWh/m^2.a for energy efficient lighting and office equipment within the energy balancing strategy. The Total Energy Demand (PE) ≤ 120 kWh/m^2.a

Roof Component Assembly

Light colour roof-cladding material was used for the roof covering. The roof space was ventilated and 50mm spray insulation introduced at the ceiling level. The light coloured roof cladding increased reflection of direct solar radiation. This reduced heat absorption and surface film heat resistance (Rsi and Rse) of the roof. The desired U-value was determined by calculations, specification and iterative simulation of the roof element assembly.

Wall Component Assembly

The wall construction was of Hydraform earth brick construction with 50mm spray insulation. The inside wall is of stud timber construction. The external walls are shaded by large overhangs to reduce exposure to excessive solar radiation. The internal wall is finished with gypsum plaster board. The repeated thermal bridging effect of the stud walls was simulated and designed out by introducing OSB board sheeting. The Psi Ψ – value was calculated and design to Ψ = 0.01w/m^{2}K (this is equivalent to near zero thermal bridging).

Window Component Assembly

The window Energy Balance was simulated in Passive House Planning Package (PHPP). The window U-value is 1.1w/m^{2}K; its U-value installed is 1.3w/m2.K; whilst the Psi Ψ – value installed was Ψ = 0.05w/m^{2}K. The thermal resistivity (R) R = 0,7692m^{2}K/w. The window glazing specification, the Solar Heat Gain Coefficient (SHGC = 0.25), the g-value of 25%. The SHGS is a measure of solar energy allowed through the window glazing.

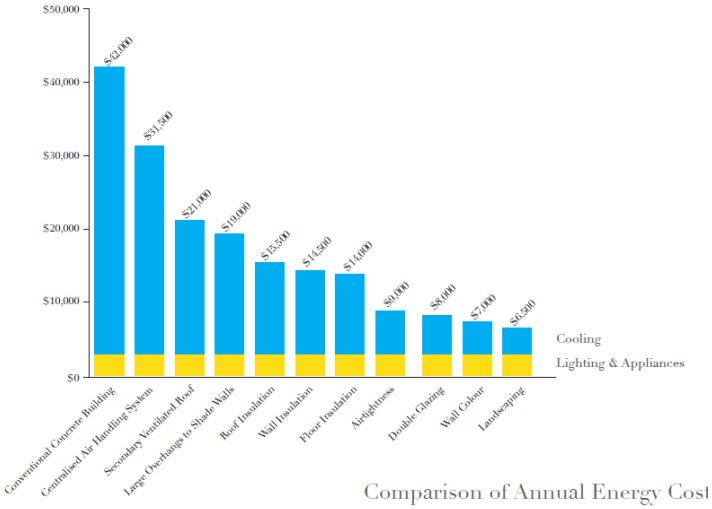
Energy Strategy

Building Physic formed the core strategy of the energy efficient design of the Warri office project. Renewable Energy Technology systems were also applied as follows:

i. Bio digesters where installed to the toilets and piped to provide cooking gas in the canteen area (see appendix 1)
ii. Solar photovoltaic panels provided most of the electricity required for the Energy Recovery Ventilation (ERV) system (0.45Wh/m^3) with dehumidification functions to address the higher humidity levels of Warri (60 to 80% RH). The ERV ensures a constant internal environment condition of between 30-60% RH, not exceeding 12.5g/m^3 and (20 – 26^{o}C)
iii. The Airtight test was 0.6 ACH (Air Changes per Hour)

The ERV system was provided to improve the air quality in the office complex. The ERV system brings in fresh air intake from the outside, filters the air and supplies it to the office spaces. Energy Recovery take place through a counter flow process in the ERV system. The intake air is cooled down from the relatively cooler temperature of the exhaust air (Intake Air ≈ 30^{o}C whilst the Exhaust Air ≈ 20^{o}C). The design provides supply of fresh air to the office spaces and extracts in the wet rooms, stores and machine room via the transition zones.

Figure 4: Summary of the Impact of individual Strategy to Energy Costs – PHPP Simulation, PIND Office Complex, Warri



Window Energy Balance – Chevron- PIND Office Building Warri

The windows at the Chevron PIND office were balanced to optimize the window-element energy performance of the office complex. This was achieved by appropriate design and specification to pre-determined Passive House standards.

The designs where simulated in the PHPP Electronic environment. This strategy was able to guide against overheating due to excessive solar gains – as well as transmission losses through the window element, thereby minimizing thermal transfers. The solar gains was calculated and optimised as follows:

Qs = r x g x Aw x G

Qs (Solar Heat Gains) = Reduction Factor (Unit less) x Solar Heat Gain Coefficient g-value
(Unit less) x Gross Area of the Window (m^2) x Global Irradiation = kWh/m^2.yr

However, the reduction factor ‘r’ is determined by the four individual elements

i. Shading on the window (from external elements) reduces the sunlight falling on the window (the varies with the window design)
ii. Dirt on the glass itself blocks some solar radiation from penetrating the glass (0.95 is used as a default – assuming PHPP simulation figures)
iii. Non-perpendicular Radiation given that the sun moves through the sky (east-to-west each day, higher and lover in the sky each season) (0.85 default - assuming PHPP – simulation figures)
iv. The proportion of the window which is glass (the frame eliminates a certain portion since it is opaque)

Once the solar energy strikes the face of the glass, the amount of energy that passes through to the interior is determined by the Solar Heat Gain Coefficient (SHGC). The required SHGC can be provided by the window manufacturer (within reason) For the PIND Warri office project, Metallum the Lagos based window manufacturer was able to provide the full window specification details

The typical size for most of the windows (WDG-1200) has a typical dimension of 1200x1500mm with a frame thickness of 25mm.

i. g-value of the glass (SGHC = 25%) = 0.25
ii. U-Value of glass Ug = 1.1w/m^2K
iii. U-Value of frame Uf = 2.8w/m^2K
iv. Ψ spaces = 0.02w/m^2K
v. Ψ installed = 0.03w/m^2K
vi. VLT = 40%
vii. G (ΔT) = 10 kKh

The solar gains was calculated as follows

Qs = r x g x Aw x G
But r = (Reduction factor) = (1) Shading x (2) Dirt x (3) Non perpendicular incident radiation and (4) Glazing %
r (reduction factor) = 0.95 x 0.85 x 0.85 x 0.92 = 0.63
Qs = 0.63 x 0.25 x 1.8 x 10 = 2.835kWh/year

A separate calculation was made to optimize the performance of each window type taking into consideration the orientation of individual windows. This was achieved by calculating the U-values of the windows-installed in their respective orientations. The U-value is the measure of the thermal transmission. The global irradiation 'G' is site-orientation dependent and usually highest in the south facing equator – i.e. in the Northern hemisphere

i. Area of glazing = A_{glass}
ii. Area of frame = A_{frame}
iii. Length of Glazing = L_{glass}
iv. Length of Window = $L_{installation}$
v. Area of Window = A_{window}
vi. Global irradiation = G

U window-installed = (Ug x A glass) + (Uf x A frames) + (Ψ spacer x L glass) + (Ψ install x L install)/A window
U window-installed = (1.67 x 1.1) + (2.8 x 0.13) + (0.02 x 5.2) + (0.03 x 5.4)/1.8 = 2.467/1.8
U window-installed = 1.37 w/m^2K

The study demonstrates how the Psi Ψ – value of the spacers and of the window installed can have a major impact of the Energy Balance of a window. It is not always possible for

buildings to have their shorter sides oriented in the East West direction. One of the major determinants of building-orientation is the location of the access road. The window specifications in terms of its energy transmission properties and the solar heat gain coefficient (SHGC) may be used as design strategies to reduce excessive heat gains. The U-values of the window glazing and frame both have effects on the window performance.

The U-value of the window glassing is 1.1w/m^2K. However, the U-value of the window installed is 1.37w/m^2K. The drop in performance is due to the Psi Ψ values of the spacer and the Psi Ψ value of the window installed. The Psi value is a measure of the thermal bridging in w/m^2K.

CONCLUSION

It is not always possible to optimize building energy performance using passive means such as building orientation and cross ventilation alone. Significant development has been made in the area of Energy Balancing of buildings using the principles of Building Physics. On-going studies world-wide are continuing to make remarkable progress in building physics using various environmental simulation packages. Passive House, LEED, BREEAM, Green Star, and Energy Plus are some of the systems that have emanated from these studies.

The study highlights how energy balance may be achieved through the design and specification of the Window and Wall elements. The paper also shares the experience of the Chevron PIND Energy Efficient Office complex designed and built to Passive House performance standards.

The window component plays a significant role in the energy balancing of building. The energy transmission through windows could be balanced through appropriate design and specification of the window component. The critical elements that determine the performance of the window component include the U-value of the glazing, window frame and the U-value installed. The Psi value Ψ of the spacers and the Psi Ψ value of the windows installed are both crucial to the performance of the window element. These variables can all be influenced by the architects designs and specification of the window element.

RECOMMENDATIONS

Energy Balancing

Architects and Building Services Engineers should consider the use of Building Physics as a strategy in improving building performance through the balancing of individual building components

Wall Component

Architects and M&E consultants should aim at designing to some voluntary energy standard where mandatory standards do not exist. Designers should endeavor to keep the U-Value of the external wall assembly build-up to below 2w/m^2K. Insulation may be used in the east and or west elevation to cut out excessive thermal transmission. Insulation may also be applied in the roof space in addition to its ventilation. Insulation thicknesses seem to have a more significant impact in thermal transmission reduction up to 50mm. The above strategies where applied to the Chevron PIND office complex in Warri; results for PHPP Energy models indicated a 75% reduction of the buildings cooling loads – as compared to a business as usual scenario.

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Appendix 1: Summary of Strategy, Percentage Cost and Energy Consumption – PHI, PIND Office Complex Warri

Item	**Strategy**	**Percentage % of Construction Costs**	**Total Energy Consumption kWh/m2.a**
	Business As Usual – conventional total energy consumption cement sand screed and plaster wall assembly		750
1	BAU wall assembly	44	750
2	Dehumidification (ERV System)	14	545
3	Secondary Ventilation of Roof	9	350
4	Large overhangs to protect external walls	5	315
5	Insulated ceiling 50mm spray insulation	6	240
6	Insulated 220mm Earth brick external walls with timber stud wall and 50mm spray insulation	6	220
7	Airtightness	2	115
8	Double Glazed windows with low-e	4	100
9	Roof insulation 50mm spray insulation and light coloured cladding to reduce absorption		85
10	Landscape to reduce thermal gains	5%	70

A Comparative Analysis of Sustainable Building Material: A Focus on Perceived Qualities of Timber versus Concrete in Nigeria

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ABSTRACT

This paper presents a comparative analysis of quality perception between timber and concrete with a focus on sustainability. The objectives of the study were to determine the environmental potentials, availability and level of adoption of these materials in building construction. It also sought to evaluate the perceived quality of the timber and concrete from Nigerians perspective. With a thorough literature analysis, the global understanding of sustainability potentials of the materials was established in term of CO_2 emission and storage, fossil fuel release into the atmosphere, thermal conductivity, energy consumption, and affordability amongst others. Structured questionnaires were used to collect relevant data from ninety six (96) building owners at Oluyole Local Government Area, Ibadan, Nigeria on their perception of the quality of these materials. Descriptive statistical analyses and analysis of variance were carried out using statistical software. Findings revealed that timber offers more sustainability potentials even as the integrity of concrete is currently under scrutiny. However, the level of adoption of timber in building construction in Nigeria is relatively low due to inadequate technological deployment required for its processing. The study recommends a collaborative effort among stakeholders geared towards developing timber-based structures in Nigeria.

Keywords: Building materials, Concrete, Perception, Sustainability, Timber

INTRODUCTION

Building construction is increasing daily worldwide due to accelerating population growth and the need for people to be well sheltered. With the advancement in technology, building materials have been developed to provide better living condition for the man in terms of safety, health, economy and functionality of built form. Meanwhile, climate change emerged as one of the most significant issues facing mankind in the 21st century. Environmental sustainability and energy efficiency are the focus of growing concern on human activity as well as contemporary life. Effort towards reducing greenhouse gas emissions, most especially CO2 is currently getting top priority across the globe (IPPC, 2007).

It has been ascertained that human activities can induce detrimental effect on the world we live (IPPC, 1996; IPPC, 2001). Building construction and operation largely responsible for one third of greenhouse gas (GHG) emission with building related activities also consuming 40% of energy use globally(UNEP, 2009; Robertson *et al*., 2012). According to the report of International Energy Agency (IEA, 2007), 70% of electricity use in developed countries were accredited to building sector alone. The detailed energy consumption as reported by International Energy Agency (IEA) shows that Commercial sector takes 9% energy, Industry 29%, Residential 27%, Transport, 30% while other sectors captures 5% (IEA, 2007;Chen, 2010; Parameshwaran *et al*., 2012)

In most of the developing countries, energy generation is mostly through fossil fuel combustion processes. Consequently, these activities result in the emission of greenhouse gases such as carbon dioxide, methane, sulphur dioxide, among others into the environment resulting in ozone layer depletion aftermath of which is global warming and climate change (Penner *et al*., 1989; UNEP, 2007; Abimaje and Baba, 2014). In another perspective, the growing challenges of affordable housing and environmental sustainability led to increased

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concern for alternative material in developing country. For instance, Nigeria's population has recently been estimated at about 180 million, with population growth rate of 2.55%, GDP growth of 6.81% and 3.5% annual urbanization rate (UN, 2015), therefore need of affordable homes for the citizenry. Most conventional building materials which are often imported into the country with gross foreign exchange resulting to escalating cost, hence the need for adoption of locally available building materials which are affordable for the populace. This alternative method of construction geared towards sustainability and affordability is highly essential in order to cater for the housing needs of the average Nigerians (Adedeji, 2007).

It has been established that a sustainable building material must be affordable, durable, environmental friendly and flexible in usage (Okereke, 2006; Chen, 2010; Schmidt & Griffin, 2012; Abimaje and Baba, 2014). Research activities are now been sponsored, supported and carried out by government, organizations and academia in an effort at analyzing, quantifying and comparing environmental impact of building materials and design with alternatives been sort in natural products. However, little research effort has been directed towards quantitatively determining the level of awareness and perception of populace on the sustainability potentials of building materials especially in Nigeria. Although, building materials specifications ideally comes from the building consultants (especially architects), this cannot be without the input and agreement with the client. Evidently, public perception of qualities of a building material could to a great extent influence their choices. According to Florez *et al.*(2010) market demand is a critical factor to be considered in realizing sustainability goals since inappropriate materials choices may hinder the desired sustainability objectives.

This research work sets out to examine the perceived sustainability potentials of timber and concrete in the study area, in view of this, the study will attempt to answer the following questions; what is the level of usage of timber and concrete in the study area?; what is the level of availability of the materials? and what is the perception of sustainability qualities of timber and concrete? The hypothesis of this research is thus; *Ho*: Building owners will not differ significantly on their perception of sustainability qualities of timber versus concrete in the study area. *Ha*: Building owners differ significantly on their perception of sustainability qualities of timber versus concrete in the study area.

This study aim at examining perception of sustainability potentials of timber and concrete comparatively with the view of suggesting strategies for achieving sustainability goals in Nigeria. The objectives were thus to determine the sustainability potentials of timber and concrete from global perceptive, examine the level of adoption and availability the materials in Nigeria and carry out a comparative analysis of Nigerian's perception on the qualities and sustainability potentials of these building materials. This article begins with a literature review by comparing the sustainability potentials of timber and concrete in terms of carbon dioxide released and storage, fossil fuel release into the atmosphere, thermal conductivity amongst others. Then, the result of the empirical survey was discussed. The article concludes by summarizing the benefits of developing sustainable building materials in Nigeria and required actions to achieve these benefits.

LITERATURE REVIEW

Nature and adoption of Timber and Concrete in Building Construction

For many centuries, wood has been used by man in building construction. The ancient timber structure of the Chinese dated back to 7000years ago (Liv, 2002). Timber was the most predominantly used building material until the second half of the 19th century (Douglas, 1995). Today, advocates of timber as a building material opined that the material is attractive while its opponents argued that its unreliable strength and weak fire resistance are the most

critical disadvantages. However, the use of wood in construction of buildings has been limited due to life-safety concern and structural quality as well as the perceived poor fire control quality which has led to restriction of wood as a structural material in building codes. Andreas (2005) argued that architects and clients are limited not by the material, but by their low understanding of its potentials and method of adaptation in building construction.

Much recently, new innovations and technology advancement in wood production, experimentation and test has revealed that wood products could be adopted as a structural material for storey buildings such as high rise family dwelling units (FPI innovations, 2010; Schmidt & Griffin, 2012; Mohammed *et al.,* 2015). Timber has been innovatively developed into varieties of products especially in the developed countries with the introduction of engineered wood such as Cross laminated timber, Glue-laminated timber, Laminated Veneer lumber, structural composite lumber amongst others. For instance, Cross Laminated Timber (CLT) was developed in Austria and Germany and has been predominantly used in Europe both in residential and non-residential building (Chen, 2010; Schmidt & Griffin, 2012; Mohammed *et al.,* 2015). The product has gained popularity in Europe as structural building element for multifamily high rise building up to eight floors with proposal underway for seventeen storied CLT made building (Gagnon & Pirvu, 2011).

The perceived weak fire resistance of wood structures is one of the limiting factors affecting its usage in building construction. Notably is the great Chicago fire of 1871 and the 1906 San Francisco earthquake in which large portion of the cities were wiped away by fire (Schmidt & Griffin, 2012). Gagnon & Pirvu (2011) asserted that Cross laminated timber CLT has been tested and proven to have a 0.67mm per min fire resistance. Another primary limitation in timber is the distance its able to span. Today, new engineered wood products (such as CLT) are used as a major structural material for taller and larger building types (See Fig. 1 & 2) even than what code currently permits.

Fig. 1: Seven-story CLT house tested at E-Defense Laboratory in Miki (Source; Mohammad et al., 2015)

Fig. 2: Eight-Story Building under Construction Protected with a Tent in Sweden (Source; Mohammad et al., 2015)

Acoustical performance of wood products is another challenge. However, with the introduction of wall covering, acoustical insulators and sleeper studs, the sound control is highly enhanced. Other important factors for the choice of a structural system include the construction costs, building codes, and seismic performance. FPInnovations (2011) comparative study on CLT's cost against other materials such as concrete, steel, masonry revealed that CLT has a quicker construction time and lesser foundation costs. The repetitive system and modular components are responsible for the shorten construction time and much less labour. Also, when compared with Post-tensioned concrete, CLT has a faster assembly time up to 50% lesser construction duration (Crespell & Gagnon 2010).

Concrete is a building material prepared out of cement together with other different cementatious materials, for example, fly ash, slag content, coarse aggregate (for the most part rock, limestone, or stone), fine aggregate (stream sand), water, and compound admixtures (Srinivasa *et al*., 2013). The discovery of concrete as a construction material remains a landmark innovation in the field of science and engineering. Although, Concrete is known for its low tensile, this actually limited its prior years of development. Today, the adaptability of concrete has extensively expanded (Zongjin, 2011). The introduction of steel reinforcement to solid mix makes up for the tractable tensile shortcoming of concrete. The consolidated blend of both cement and steel support is called reinforced concrete and is the second era of concrete after the unreinforced mass concrete. Thus, reinforced concrete is a man-made material gotten from the mixture of cement, aggregate (smooth and coarse) and water, more importantly the imbedded steel rods which boost its tensile strength.

Today, reinforced concrete stand out as the most essential material utilized as part of the structural elements in construction around the world. It is an excellent composite material gotten through the capacity of both concrete and steel to give correlative backing to one another, making up for the shortcomings in the properties of each material (Arya, 2009; Ede and Agbede, 2015). In another perspective, the excellent fire resistance performance of concrete is another property that has propelled its usage, concrete has the ability to restrict the spread of fire within a compartment as well as support the structure from failure despite exposure to serious fire. Srinivasa *et al.* (2006) studied of the impacts of raised temperatures from 500C to 2500C on the compressive quality of High Standard Concrete (HSC) made with both standard Ordinary Portland bond (OPC) and Portland pozzolana concrete (PPC). The report revealed that HSC made with Portland pozzolana cement performed better by holding the compressive strength contrast to Portland made concrete

Environmental/Sustainability potentials of Timber versus Concrete

The 1987 report of the World Commission on Environment heralded the popularized statement "Our Common Future'', in a quest for a possible solution to environmental challenges through the concept of sustainable development. Fundamentally, sustainable development signifies ''meeting the needs of the present without compromising the ability of the future generations to meet their own needs'' (WCED, 1987; Cunninghan, 1992; Gustavsson *et al*., 2005). It also means the consumption of resources available to the current generation without depriving the future generation of resources for their effective living. Sustainable building material is thus an important theme within this broad ideology of preventing our world from human activities that has detrimental impact on the environment.

Over several decades, concrete has become the most predominantly used building material, however recent inquires has made the integrity of the material to be subjected to further scrutiny. Findings revealed that cement manufacturing only is responsible for (5%) of annual anthropogenic CO2 production worldwide even as over 2 billion tone quantities is been produced annually (IPPC, 1996). On the contrary, forest products have potential of reducing

emissions as well as increase the absorption of carbon dioxide in the atmosphere and storing it. Wood products are natural, exceedingly renewable and lighter, could reduce discharge of greenhouse gas and ecologically preferred over CO2 concentrated materials such as concrete, aluminium or steel (Schlamadinger and Marland, 1996).The qualities of timber as a building material include availability, aesthetic qualities, constructability and adaptability, environmental sustainability, reusability, flexibility, waterless construction, and comparative cost effectiveness (Gregory, 1984; Whitelaw, 1990 and Nolan, 1994).

Global discuss on sustainability emphasizes the comparative analysis of building materials in terms of quality of CO2 released by the material into the atmosphere, absorption and storage of CO2, amount of fossil fuel required in the materials production, amount of fossil fuel released into atmosphere, thermal conductivity etc. Ferguson et al.,(1996) and John(2003) studies on environmental impact of common building material revealed that fossil fuel required to manufacture rough sawn timber is 750 MJ/m3, concrete uses 4800 MJ/ m3, steel uses 266000 MJ/m3, and aluminum make use of 1,100,000 MJ/m3 of fossil fuel. Obviously, timber uses lesser fossil fuel in production than concrete, steel or aluminum making it more environmental friendly than most other materials. Similarly of all the material mentioned above, only rough sawn timber stores carbon dioxide (up to 250kg/m^3), concrete, steel and aluminum cannot withhold any amount of CO2. Not only does timber stores the highest quantity, it also releases the least amount of CO2 during production. Rough sawn timber releases 30 Kg/t of carbon dioxide, while steel and aluminum release 700Kg/t, and 8700 Kg/t respectively (Ferguson *et al.*, 1996).

For thermal conductivity of building materials, timber possess better heat resistance when compared to concrete, wood conductivity rate is 0.05-0.0.15 J/m-Ik-I, concrete 1.4-2.9 J/m-IK-I and steel 19.0-21.0J/m-I k-I, whereas fired clay has 1.0 J/m-IK-I, limestone gravel 0.6 J/m-I k-I, cement board 0.6 J/m-Ik-I and stone 1.5- 3.0 J/m-IK-I (John, 2003). Obviously, timber buildings will need lesser artificial insulation inside to maintain the interior temperature. Chen (2010); Schmidt & Griffin (2012); Ede & Okundaye (2014) also asserted that timber is environmental friendly since it requires lowest embodied energy when compared to other building material such as concrete. Although, a great effort had been put into experimental research on building materials development, little effort has been directed towards public awareness on sustainability potentials of building materials. Often, information on new innovation as well as opportunities offered by new building products takes a longer period to reach building consultants and prospective clients. According to Ljungberg (2007) sustainability goals should not only consider the environmental aspects, economic impact and customer needs but also the market demands. In the quest for sustainability, effort should be directed towards public awareness of opportunities and environmental demerits of building materials so that prospective clients and consultants could make best choices for collective benefit of our environment.

Development and Usage of Timber and Concrete in Nigeria

Over the years, Nigerians have used sandcrete blocks and concrete in building construction more than any other building material. In Nigeria today, the escalating cost of cement, steels and other components of reinforced concrete has made housing affordability a serious challenge. Often, the quality of concrete is compromised in a bid to save construction cost which frequently results into incessant cases of building collapses (Ede & Okundaye, 2014). Adoption of concrete as a building material requires strict adherence to specifications especially in areas of properties prerequisite, sizes, proportion/ mixing ratio as well as quality control measures. As noted by Pansuk (2011), any deviation in the specification, for example, the aggregate size has a significant effect on the overall quality, durability and compressive

strength of the concrete. Exposure of concrete structure to excessive load also poses a threat to it.

Ede and Odunkaye (2014) noted that timber is abundantly available in Nigeria; notwithstanding, timber usage has been limited to few building components, temporary structure and construction of buildings in riverine areas. The Raw Materials Research and Development Council of Nigeria (RMRDC) (1998) asserted that workability and durability potentials of timber had made it the mostly used material for roof carcass and ceiling noggins. Also a yellowish hardwood known as Opepe (*Nauclea diderrichii*) is also commonly used in doors and windows due to its hardness and ability to resist insect attacks. Adesogun (2013) opined that housing shortage and urban challenges associate with building affordability could be solved with the construction of wood based structures since the product is readily available in Nigeria. With the advancement in timber production and widely proponents for timber based structure, it is important to know the level of usage, availability and perception of citizenry about these two mostly used building materials in Nigeria. The details of the empirical research are therefore enumerated in the next sections of this research paper.

RESEARCH METHODOLOGY

Study area

The study was conducted in Ibadan, Nigeria. Ibadan is the capital of Oyo state in southwest Nigeria. The city lies approximately between latitude $7^{o}23'$ to $7^{o}55'$ North of the Equator and longitude $3^{o}5'$ to $4^{o}36'$East of the Greenwich Meridian at 145 km north of Lagos. Ibadan has Eleven (11) local government areas out of which Oluyole local government area was selected for this study since its one of the most populated and urbanized area within the state. Oluyole local government area covers an area of 629km2 with a population of 202, 726 by 2006 census (NPC, 2006). Three residential neighbourhoods namely; Ashipa/ Olosan Area, New-garage Area and Podo Area were selected within the local government area because these areas were newly developed with most buildings recently completed. Hence, most participants of this survey have the latest opinion on building materials quality.

Instrument

The research approach involves a cross-sectional survey through quantitative research targeted at examining the level of availability, usage and perceived quality of concrete and timber in building construction in Nigeria. Questionnaires administration was used as a data collection instrument. The questionnaire has three sections: Section A contains the general information about the respondents, while Section B draws the information on availability and level of material usage in building parts. Section C draws the respondent's perception of the qualities of these two materials in terms of cost, maintenance, environmental impact, fire resistance, thermal comfort, acoustics, reusable potentials, aesthetic and strength/durability. The instrument measured the availability of material on a Five-point-Likert type scale of; Strongly agreed- 5, Agreed- 4, Neutral - 3, Disagreed - 2, and Strongly disagreed – 1 whereas Two-point scale; Timber- 2 and Concrete-1 was used to determine adoption of the materials in buildings as well as the comparatively measure the respondent's perceived sustainability qualities. The research data were collected between October and November 2015 through the assistant of students on industrial training that administered, collected and collated the questionnaires.

Sample size

The targeted populations are the building owners of the residential neighbourhood. Building owners were selected as participant for this study since they have a predominant influence on building material choices especially for residential building projects in Nigeria. According to Glavic & Lukman (2007), for a product to be sustainable, it must be affirmed to be socially

and innovatively rewarding for all stakeholders both on short and long term bases. Previous study by Castro-Lacouture *et al.* (2009) considered market preference using customer's perception instrument on sustainable products to assess customer's attitude. Hence, building owners were judged to be suitable for this study since they satisfied the conditions to be classified as stakeholders as well as customers for sustainable building materials. Samples of 120 households were drawn from 1200 residential buildings identified within the study area. A systematic sampling method was adopted by randomly selecting 1 out of every 10 buildings. A total of One hundred and twenty questionnaires were administered within the study area with 40 questionnaires been administered at each of the three selected areas. Of all questionnaires administered, a total of ninety six (96) sets of questionnaires were retrieved from the three areas which represent 80% of total questionnaires administered. In all, thirty three (33) questionnaires were returned from Ashipa area, thirty one (31) from Podo area while thirty two (32) questionnaires were returned from New-garage area.

Data Analysis

The data extract from the survey were analysis through Statistical package for Social science (SPSS 17.0). Descriptive statistics were presented with frequency distribution charts while analysis of variance (ANOVA) was used to test the hypothesis.

RESULTS AND DISCUSSIONS

Socio- Economic Characteristics of Respondents

Table 1: Analysis of Socio-Economic Characteristics of Respondents

Social-Economic characteristics	No of respondents	Percentage (%)
Age of Respondents		
18-30 YEARS	11	11.5
31-45 YEARS	20	20.8
45-60 YEARS	37	38.5
61 AND ABOVE	28	29.2
Sex		
Male	56	58.3
Female	40	41.6
Educational Status		
No Formal education	12	12.5
Primary Education	18	18.8
Secondary Education	37	38.5
Tertiary education	29	30.2
Employment Status		
Retired	9	9.4
public sector workers	24	25.0
private sector workers	48	50.0
Unemployed	15	15.6
Average Monthly Income		
below #38,000(lower income)	18	18.7
#38,000-#144,999 (middle income)	48	50.0
145,000 and above (high income)	38	39.6
Age of Buildings		
1-5 years	12	12.5
6-10 years	43	44.8
11-20 years	24	25.0
Above 20 years	17	17.7

Source: Author's Fieldwork, 2015

Table 1 above shows the socio-economic characteristics of the respondents. 11.5% of the respondents have their ages ranging between 18-30years, 20.8% are between 31-45 years of age, 38.5% (45-60 years) while 29.2% are 61 years and above. Evidently a significant number of the respondents are above 45 years old. Also, the table revealed that 58.4% of the

respondents are male, whereas 41.6% are female. On educational status, the highest percentage of the respondents have up to secondary education, this represents 38.5% even as 30.2% and 18.7% have their education up to tertiary and primary school level respectively. However, 12.5% have no formal education. Since a good number of the respondents have formal education, it was easier for them to understand the sustainability qualities in the products under study and respond to the questionnaires effectively, hence the result of this research are highly reliable.

The table also shows the employment status of the respondents with 50.0% been private sector workers (such as traders, artisans or private sectors employees), the public sector workers are 25.0%, unemployed 15.6% and retired are 9.4% of respondents. Furthermore, most of the respondents are middle income earners representing 50.0% of the respondents, followed by high income earners who are 39.6% while low income earners are 18.7% of the respondents. The age of the buildings of respondents differs as follows; 12.5% of the buildings were constructed in the last 5 years, 44.8% within the last 6-10 years, 25.0% (11-20 years) and 17.7% were above 20 years. This indicates that the higher percentage of the respondents have their buildings constructed within the last 10 years, apparently, most of the building are relatively new. Thus, this empirical survey represents a relatively current insight on this study's objectives.

Adoption on Timber and Concrete in Building Parts

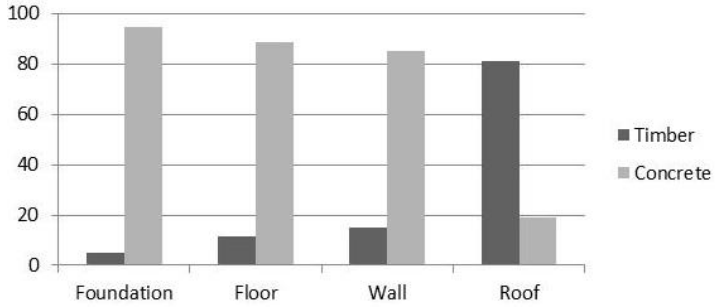


Figure 1: Analysis of level of adoption of timber and concrete

Figure 1 above shows the part of the building where timber or concrete is mostly used. The result indicates that 1.8% of the respondents used timber for their building foundation, whereas 98.2% used concrete for their foundation. For the floor, 11.5% used timber while 88.5% used Concrete. Also, 15.0% of the respondents used timber as their walling material, while 85.0% used concrete/sandcrete blocks for their walls. The roofing elements differ as follows; 81.2% used timber for their roof even as 18.8% have concrete slab on their roof. The above analysis revealed that timber is mostly used for roof carcass in the study area, whereas concrete is predominantly used for the foundation, floor slab and walls. This supports the report of the Raw Materials Research and Development Council of Nigeria, RMRDC, (1998) that timber is mostly used material for roof carcass and ceiling noggins in Nigeria.

Availability of Concrete and Timber in Respondent's Area

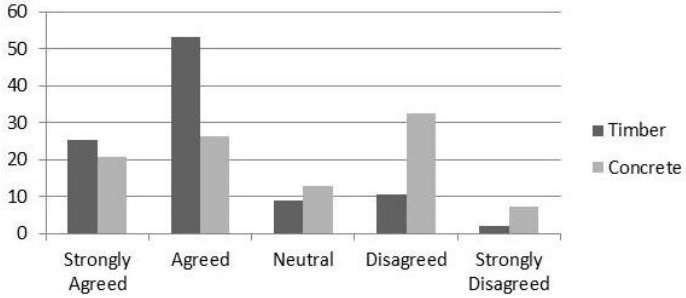
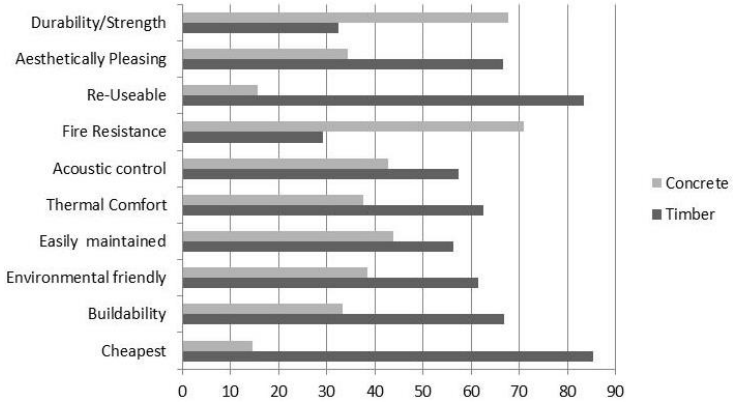


Figure 2: Availability of Concrete and Timber Material

The result shown in Figure 2 above reveals that 25.2% strongly agreed that timber is readily available, 53.2% also agreed that the material is sufficiently available, 9% were neutral, 10.5% disagreed that timber is sufficiently available in addition to 2.1% who strongly disagreed. This result affirmed the position of Adesogun (2013) that timber is abundantly available in south-western part of the Nigeria. As for availability of concrete, 20.9% of the respondents strongly agreed that concrete is sufficiently available, 26.2% agreed whereas 13% were neutral. On a contrary, 32.5% disagreed that concrete is readily available in their locality at the same time 7.4% strongly disagreed that concrete is sufficiently available.

Comparative analysis of perception on Qualities and Sustainability potentials of Concrete and Timber

Figure 3: Comparing Perceived Qualities and sustainability potentials of Concrete and Timber



The respondents were asked to compare timber and concrete by indicating which of the two materials is the cheapest, easier to construct, most environmental friendly etc. based on their opinion. The chart above (Fig 3) show the respondent's assessment as follows; comparing the affordability of timber and concrete, the analysis shows that 85.4% opined that timber is cheaper than concrete while 14.6% believed that concrete is cheaper. As regarding buildability, 66.7% viewed timber as a material that requires lesser time to construct whereas 33.4% stated that concrete structure is easier to construct. The respondents were also asked to choose the most environmental friendly material out of timber and concrete, the result shows that 61.5% indicated that timber is most environmentally friendly while others (38.5%) choose concrete as a more environmentally friendly material. Hence, we can deduce that most people are aware that timber offers better environmental conditions and sustainable characteristics.

Ease of maintenance was also examined with the result showing that 56.2% perceived timber to be easier to maintain, whereas 43.8% opined that concrete is easier to maintain. The thermal comfort quality assessment shows 62.5% in favour of timber and 37.5% for concrete. The respondents also assessed the material based on their knowledge of its acoustic quality with 57.3% indicating that timber controls sound better whereas 42.7% opined that concrete has better acoustic quality than timber.

The fire resistance quality of these materials were also assessed and the respondents differs as follows; 29.3% opined that timber has high fire resistance quality while 70.8% indicated that concrete resist fire better than timber. Comparing the aesthetic and visual quality of the two materials, the outcome shows that 66.6% agreed that timber is more aesthetically pleasing, whereas 34.4% indicated that concrete-based buildings are more aesthetically pleasing. The analysis also revealed that 32.3% of the respondents believed that timber is more durable while 67.7% opined that concrete has more strength and durability potential than timber. The analysis above reveals that most people are aware of qualities of timber as a building

material, notwithstanding the perceived poor fire resistance quality and durability have been the duo hindrance affecting its usage. This validates the opinion of Ede *el at*. (2014) that in developing nations, timber is yet to attain its full potentials in building construction due to doubtful good structural quality among the people. Inadequate technology and skill has primarily hindered timber from realizing its full potentials in areas of durability and reliability in developing countries (Kohler, 2007; Ede *et al.*, 2014) whereas an appreciable knowledge and awareness has enhanced development of timber-based structures in developed countries (Fewell, 1997). Consequently, if the latest technological advancement is appropriately harnessed; the material could be better adopted as commonly used building material in Nigeria. It is therefore imperative that technology be deplored towards better processing and improved quality of timber products.

Perception of sustainability qualities of timber and concrete across the three selected areas

A one-way analysis of variance was applied to mean scores on perceived sustainability potentials across the three study areas. Hypotheses were tested at 0.05 level of significance (i.e. Significant if P< 0.05). The table 2 (See appendix) shows the significance values of 0.833, 0.179, 0.700, 0.547, 0.503, 0.379, 0.059, 0.574, 0.766 and 0.144 for the perception of durability/strength, aesthetics, re-usability, fire resistance, acoustic control, thermal comfort, ease of maintenance, environmental friendliness, ease of construction and affordability respectively across the three study areas. This result revealed that significance values for all the variables are higher than 0.05 significant levels implying that there are no significant difference in the means of perceived qualities of these materials (i.e. all P >0.05). Hence, we can accept the null hypothesis that building owners will not differ significantly on their perception of sustainability qualities of timber versus concrete in the study area.

CONCLUSION AND RECOMMENDATIONS

Recent global concern for reduction of CO2 and other greenhouse gases requires a thorough study into sustainability potentials of the building materials. Building materials, construction processes and building operations have an impact on the quality of life. In this study, building owner's perception on sustainability potentials of timber and concrete is explicitly compared. The study reveals that timber is perceived to offer more sustainability potentials than concrete. Timber is thus recommended as an alternative material in place concrete due to its sustainability quality, flexibility, affordability, visual quality amongst others. This paper urges that timber processing and products should be developed in Nigeria through a collaborative effort of public and private sectors. The country could also take some lessons from developed nations on application of Cross Laminated Timber especially for multi-storey residential apartments. In the quest for a better environment, effort should be directed towards developing sustainable building materials while complimentary effort should also be geared towards public orientation on sustainability qualities of building materials both for the consultants and prospective clients. Mass production of timber will immensely boost up the level of housing affordability, job generation and ultimately improve environmental sustainability.

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APPENDIX

Table 2: Analysis of Variance on Qualities and Sustainability Perception of Timber and Concrete across the study area

		Sum of Squares	Df	Mean Square	F	Sig.
Strength	Between Groups	.076	2	.038	.183	.833
	Within Groups	19.330	93	.208		
	Total	19.406	95			
Aesthetics	Between Groups	.841	2	.421	1.753	.179
	Within Groups	22.315	93	.240		
	Total	23.156	95			
Reusability	Between Groups	.062	2	.031	.358	.700
	Within Groups	8.094	93	.087		
	Total	8.156	95			
Fire resistance	Between Groups	.189	2	.094	.608	.547
	Within Groups	14.436	93	.155		
	Total	14.625	95			
Acoustic	Between Groups	.349	2	.174	.693	.503
	Within Groups	23.391	93	.252		
	Total	23.740	95			
Thermal comfort	Between Groups	.470	2	.235	1.004	.370
	Within Groups	21.770	93	.234		
	Total	22.240	95			
Easily maintained	Between Groups	1.398	2	.699	2.924	.059
	Within Groups	22.227	93	.239		
	Total	23.625	95			
Environmental friendly	Between Groups	.274	2	.137	.558	.574
	Within Groups	22.882	93	.246		
	Total	23.156	95			
Build ability	Between Groups	.137	2	.068	.267	.766
	Within Groups	23.770	93	.256		
	Total	23.906	95			
Affordability	Between Groups	.479	2	.239	1.978	.144
	Within Groups	11.261	93	.121		
	Total	11.740	95			

Why Sustainable Infrastructure Development and Provision Continues to Defy Africa

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ABSTRACT

Sustainability is used here in the original deployment of the word in development literature to denote infrastructure projects that outlast multilateral and unilateral financial and technical assistance. Such infrastructure projects have some unique inbuilt characteristics that reflect the inputs and needs of intended beneficiaries, and for which they would have both financial and technical capacities to sustain. In the latter use of the concept of sustainability, environmental consideration is deeply emphasised, underscoring the apparent contradictions inherent in infrastructure development. If the purpose of infrastructure is to spur growth and development, which are deemed necessary to facilitate and enhance better standards of living, it must be achieved in manners that satisfy the needs of current generations without having to compromise the ability of future generations to fulfil their own needs. The capacity to develop infrastructure in sufficient quantity and quality, and with the speed necessary to deliver them, cannot be taken for granted in Africa, particularly sub-Saharan Africa compared to other regions of the world. This is exemplified, not only by the dearth of growth inducing and life enhancing infrastructure and services, but also, by the inability to maintain and replicate infrastructure and services to areas of dis-amenities. If Africa is to challenge the ever increasing poverty and inter and intra-regional growth inequalities, not only must infrastructure be adequate both in quantity and quality, the necessary delivery and maintenance capabilities must also exist. The literature is replete with debates about the factors constituting a bottleneck to Africa's capacity for sustainable infrastructure development and delivery, spanning technological, institutional, and human and financial capital constraints. The main aim of this papers is to critically evaluate these challenges and determine on the one hand, the extent to which these challenges still hold in the 21st century globalised economy, on the other, derive affective strategies for sustainable infrastructure development, particularly in sub-Saharan Africa. Fulfilling these aims requires a brief general overvif the role of infrastructure in economic development, a critical evaluation of the current state of infrastructure in Africa, particularly the capacity to develop and deliver to the quantity and quality required, leading to mapping a research informed road map for the development and delivery of sustainable infrastructure in sub-Saharan Africa.

Keywords: Sustainability, Infrastructure, Development, Delivery, Africa, Sub-Saharan African

INTRODUCTION

Infrastructure is a nebulous term and variously defined but a common thread running through the various definitions confirms that it consists of physical structures, facilities, and networks that facilitates essential services for society (Chambers, 2007). This definition recognises the shift from the physical, hard, or tangible meanings and understandings of infrastructure to the concepts of soft or intangible infrastructure (Button, 2002; UN-Habitat, 2011). Often when infrastructure was discussed in the past, it was always in respect of tangible assets such as roads, sea ports, airports, railways, water distribution and sanitation systems, electricity, and telecommunications.

Intangible or soft infrastructure on the other hand is exemplified by effective and enabling environments, and underpinned by effective policy and regulatory frameworks - governance mechanisms; systems and procedure; social networks; and transparency and accountability of procurement systems (UN-Habitat, 2011). Although this latter understanding and definition of infrastructure is a welcome development, ***it is nevertheless an enduring fact that capacity defines infrastructure development and provision***. In the wake of numerous failed

Ebohon, O. J. (2016). Why Sustainable Infrastructure Development and Provision Continues to Defy Africa. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 472-482

development projects in the 1970s and early 1980s, where projects often seize to function beyond multilateral and unilateral technical and financial assistance, it was decided that only sustainable projects, meaning projects with the capacity to outlast technical and financial aid will from henceforth be the focus of international development assistance. Fused with the current understanding of the concept of sustainable development, and the role that infrastructure have come to play in explaining possible causes and solutions to global environmental sustainability; it assumed further significance in the global pursuit for sustainable growth and development.

Thus, the broader definition and understanding of infrastructure indicates that tangible or hard infrastructure does not occur in a vacuum of functional systems and institutions; open and transparent governance processes; and a deep knowledge-base (UN-Habitat, 2011). In other words, soft infrastructure constitutes a major building block, not only for new infrastructure to meet new demands but also to maintain existing stocks of infrastructure capital. For example, project preparation, procurement policies and strategies, stakeholder engagement policies and processes, and administrative and operating procedures are all critical factors in infrastructure development and supply. Unfortunately, these aspects of infrastructure development and provision are often taken for granted in most developing economies, particularly Africa (UN-Habitat, 2011; Opong, 2014).

Where these key prerequisites are absent, as they most are in Africa, it comes as little surprise why most efforts devoted to infrastructure development and delivery produce little results. As a result, managing the rapidly unfolding globalisation process to its advantage, and competitively engaging with the rest of the world has become major challenges to Africa. All available evidences show that countries with effective and functional are those able to generate and sustain growth and development, allowing employment and income generating opportunities to be sustained. Infrastructure in sufficient quantity and quality affords the mechanism for deepening socio-economic policies aimed at addressing social problems of poverty and inequality.

Despite the inexorable link between infrastructure and socio-economic development, Africa remains one continent that is continually faced with formidable challenges to meet its infrastructure needs. Several factors have been advanced, over the years, as possible explanations for Africa's inability to fulfil its infrastructure needs. The task of this paper is to critically evaluate the nature of the challenges to sustainable infrastructure development and delivery, determine the extent to which they still hold true in the 21st century global economy, and suggest possible way forward for Africa's infrastructure development. To achieve these aims, a general overview of how infrastructure contributes to economic development is revisited. This is followed by a critical evaluation of the current state of infrastructure in Africa, allowing the nature and enormity of infrastructure challenges to be gauged. Finally, and in relations to the understanding of these challenges, possible measures to arrest infrastructure gaps in the region are discussed.

Sustainable Infrastructure and Economic Development

Infrastructure and socio-economic development are inextricably linked (World Bank, 1994; Aschauer, 1989; Foster and Briceno-Garmendia, 2010; Devarajan, 2010; UN-Habitat, 2011). Adequate and efficient infrastructure is widely considered a necessary prerequisite for economic growth, and apart from providing the underlying foundation for economic growth and development (Sanchez-Robles, 1998; Roller and Waverman, 2001; Calderon and Chong, 2004), it deepens the impact of macroeconomic policies, particularly measures aimed at alleviating poverty and bridging national, regional, and global inequality (Pouliquen, 2000). Core infrastructure such as water and sanitation systems, energy, transportation, and

information and communications technology influence economic growth and development through their impacts on output and productivity (Aschauer, 1998). Some of these impacts are felt through reductions in production and distribution costs, and these are critical to competitiveness. Effective and competitive transport and communication infrastructure facilitate movements of goods and people to markets quickly and cheaply, and in the particular case of perishable produce, it is crucial to output expansion decisions. The benefits to consumers, particularly in developing economies characterized by poverty and growing inequality are enormous. Some of these benefits manifest in lower consumer prices and huge varieties of goods and services, facilitating affordability and choice.

Other areas where infrastructure contributes to economic development is inward investments; business location decisions are decidedly influenced by availability of effective and functional infrastructure and services (Fay and Morrison, 2005; Seethepalli, et. al., 2008). Health infrastructure and services also contribute to economic growth and development variously, not least in ensuring healthy population and workforce, which is relevant to productivity. As aptly demonstrated in the case of Ebola outbreak in West-Africa, the ability of Nigeria to contain the disease quickly, and the inability to do so in Liberia and Sierra Leone owed to relative differences in tangible and intangible health infrastructure. Similarly, the impact of infrastructure on quality of life is well documented, not only does it facilitate meaningful engagement with public spaces, but also facilitate recreation activities, and in the process, helps in promoting and enhancing healthy living and quality of live. This is particularly relevant to bridging spatial inequality and containing urban sprawl, which are largely defined by absence of basic infrastructure and services in such areas of dis-amenities (Grant, 2010). Generally, infrastructure is widely considered a necessary prerequisite to sustainable growth and development.

State of Infrastructure and Attendant Consequences for Development in Africa

Despite the well documented relevance of infrastructure to sustainable growth and development, Africa lags seriously behind other regions of the world in infrastructure development and supply, and this is evidenced by the huge divergence between demand and supply of infrastructure and services (UN, 2011). Of all the infrastructure problems facing Africa, the energy sector is the most severe, particularly electricity. A critical look at sub-Saharan Africa, where Africa's energy problems are most pronounced reveals chronic supply shortages. The enormous size of Africa is illustrated by Figure 1; although larger than the United States, Japan, China, and most of Europe combined, it accounts for only 4% of global electricity generation, and only able to manage 43 percent household electrification rate. This implies that more than 600 million African have no access to electricity (Foster and Briceno-Garmendia, 2010).

ICA further reveals total current power generating capacity for the whole of sub-Saharan to be 68 gigawatts. Of this, 25 percent is out of reach (Foster and Briceno-Garmendia. 2010). Figure 2 compares sub-Saharan Africa's power generating capacity with other developing regions of the world, and the result shows it presides over huge capacity underutilization. As Table 3 further reveals, sub-Saharan's per capita electricity consumption is peaked at 124 kilowatt-hours per year, and declining rapidly. This compares unfavorably with countries Qatar, USA, Thailand, and India. The consequences continues to manifest low productivity and output, with estimates as high as 40 percent and 2 percent lose in productivity and output respectively for the region.

Figure 1 Africa in Global Perspective
Source: http://www.reddit.com/r/gadgets/comments/30e8fg/facebooks_drone_prototype_has_wingspan_greater/

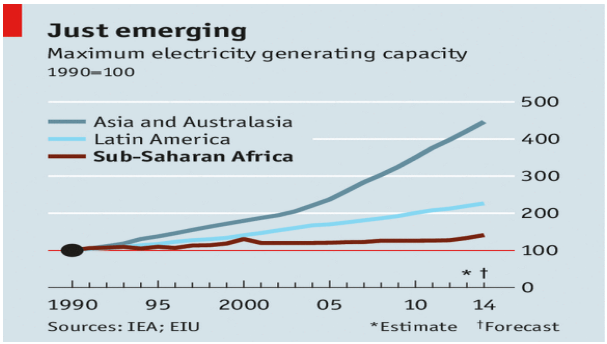

Figure 2 Electricity Generating Capacity for Selected Regions of the World

While other factors are involved, inadequate power supply remains owe to chronic lack of investments and neglect. Given current trends in the power sector, it is forecast that 40 percent of sub-Saharan African countries will still be unable to adequately access electricity by 2050.

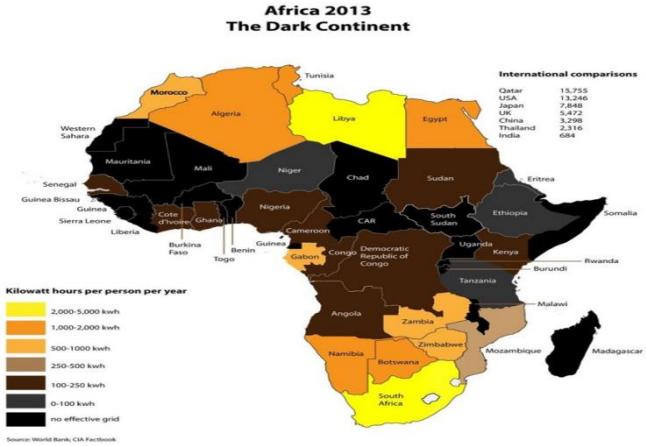

Figure 3

The situation is exactly the same in other areas of energy such as petrol, kerosene, and natural gas where women and children travel long distances searching for energy. Other key economic infrastructure and services are similarly underdeveloped and underperforming. While progress is being made in some sectors such as telecommunication, it is rather very slow. Road and other transport infrastructure is far below the quantity and quality required to propel growth and development. Not only is 53 percent of all roads in Africa unpaved, all-season access roads are available to less than half of the population. This has huge implications for the agricultural sector, which is the mainstay of the economy of the region in

terms of employment and income generating opportunities in terms of expansion and modernization of such an important economic sector.

Another area where inadequate transport infrastructure is mostly felt is road congestion, and this owes to the fact that transport infrastructure has failed to keep pace with the rate of urban expansion. Road congestion is pronounced in most African cities, and restricts efficiency in movements of goods and people, imposing costs and rendering businesses uncompetitive (Kumar and Barrett, 2008). For example, transport congestion on the N1 Freeway between Johannesburg and Pretoria in South Africa costs US$35 million annually (Guatrain, 2012), this can be higher, as is the case with St. Louis in Mauritius where the cost of congestion amounts to 1.3 percent of annual GDP (Curnow and Kermeliotis, 2012). Given the woeful state of Africa's rail infrastructure, road congestion and associated impacts on the economy and the people of the region will remain, unless urgent actions are taken to address the perennial problem.

Water and sanitation infrastructure is another source of constraints on Africa's development; it is estimated that more than 40 billion work hours are forfeited each year in Africa, being productive hours devoted to fetching water (ICA, nd). While the impact is mostly felt by the weak and vulnerable, these being women and children, the more punitive and enduring social costs of forfeited education and life improving opportunities are often ignored. The cost of inadequate water and sanitation infrastructure to Africa is estimated at 5 percent of GDP equivalent (ICA, nd). As Figure 4 shows indicates, it is difficult for sustainable growth to be achieved without adequate water and sanitation infrastructure, particularly in sub-Saharan Africa where 43 out of 48 countries are water stressed.

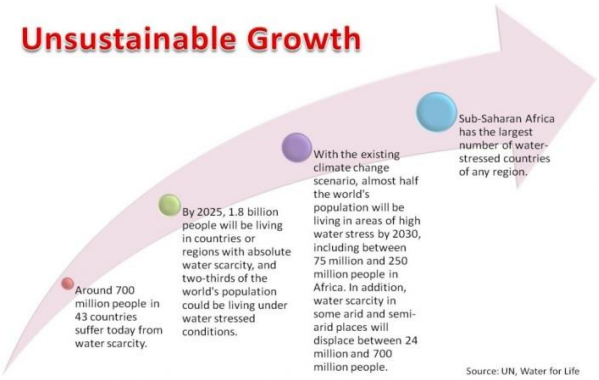

Figure 4

Generally, Africa is seriously challenged in all areas of infrastructure development and provision, severely limiting its capacity to realise the soon to be replaced Millennium Development Goal (MDGs). As Table 1 indicates, infrastructure features prominently in all the target indicators that are necessary to the improvement and reposition of Africa's economy towards sustainable growth and development.

Table 1 Infrastructure Contribution to the Millennium Development Goal

MDGs	1	2	3	4	5	6	8	9
	Poverty	Education	Gender	Mortality	Maternal Health	HIV	Environment	Partnership
Trans. (Local)	+++	++	++	+	+		+	+
Trans (Regional)	+++	+	+	++	+	+	--	+++
Modern Energy	+++	+	+	++	+	+	++	+
Telecoms	++	+	+	+	+	+	+	++
Water (priv. use)	++	++	+	+++	+	+	+++	+
Sanitation	+	+	++	+	+	+	++	+
Water Management	+++		+	+			++	

Source: Willoughby (2004), as cited in UN-Habitat (2011)

The urgency with which Africa needs to address its infrastructure challenges is driven by many factors, not least rapid population growth, urbanisation, inequality, growing unemployment, climate change, and enduring and deepening poverty. The demographic transition of the 20th century witnessed for the first time, urban population living in cities bridged the 50 percent mark. By 2050, more than 90 percent of the global population will be living in cities, given that OECD and Latin American countries have attained this level of urbanization, Asia and Africa, particularly sub-Saharan Africa, as Figure 5 shows, is where this phenomenal transition is widely expected.

Given the facts steering Africa directly in the eye, the need for sustainable infrastructure development and provisions has never been greater and more urgent for many critical and complex interrelated reasons (UN-Habitat, 2011; Estache and Wodon, 2010). Firstly, globalization has drastically reduced the world into a global village where events occurring anywhere in the world are relayed in real time for global consumption. This has galvanizing effects on the hopes and aspirations of young people around the world, upon these hopes and aspirations are the economic and prosperity of nations built. Closely related to this is the scenario where young people in the developing countries are educated and equipped with skills and knowledge for economic prosperity yet no supporting infrastructure offered to anchor their experience of economic prosperity and development. The combination of these factors continues to precipitate brain drain in Africa, sapping it of the very foundation upon which to build current and future prosperity. As this analysis indicates, time is not on the side of Africa, it must seriously address its chronic and endemic infrastructure problems.

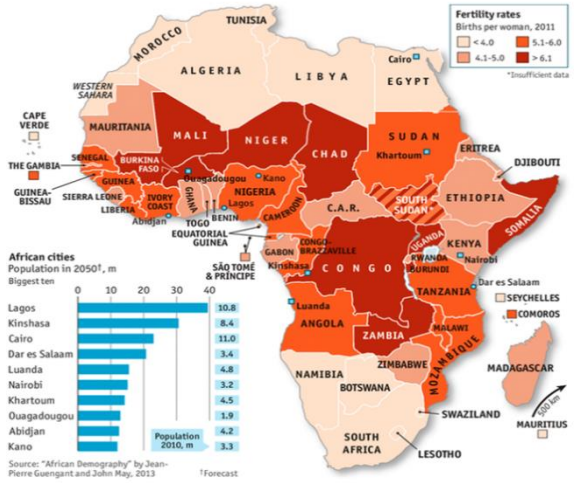

Figure 5

However, Africa is confronted with several constraints, and addressing them requires a clearer understanding their nature, particularly within the context of the rapidly globalising 21st century world economy. It is necessary to unpack the domestic and global dimensions to Africa's infrastructure challenges primarily to inform appropriate and strategic policy response. Otherwise, the capacity to develop, sustains, and deliver infrastructure and services for effective development will continue to defy Africa.

Challenges to Infrastructure Development and Supply in Sub-Saharan Africa

The nature of Africa's infrastructure problems itself is a major challenge. Not only is the dearth of new investments to satisfy growing demand a debilitating constraint, the inability to rehabilitate, upgrade and modernise existing infrastructure services continues to exacerbate the problems. The reason for this is easily articulated; new infrastructure services become prohibitively expensive owing to the dysfunctionality of existing ones. The financial challenge is therefore overwhelming, particularly given the narrow capital base and the

mono-cultural structure of most African economies, government revenue has been dwindling rapidly.

While various annual estimates of investment expenditure Africa requires to bridge its huge infrastructure gaps is estimated at between US$31 to US$91 billion dollars (UN-Habitat, 2011; Konnidaris and Allenstown, 2011), spending estimates in both public and private sectors fall drastically short of actual spending needs across all key infrastructure sectors. Figure 6 shows the huge gaps in infrastructure funding, and most pronounced in the power and water and sanitation sectors.

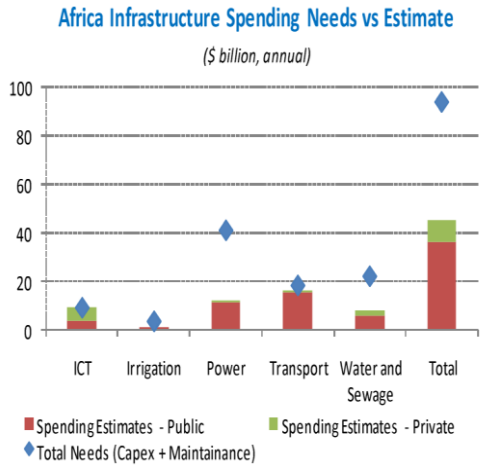

Figure 6

Source: *Africa's Infrastructure: A Time for Transformation, World Bank*

These gaps persist despite the actions by multilateral and unilateral organizations to complement the investment efforts of African governments. Figure 7 clearly shows the various bodies currently participating in Africa's infrastructure delivery, and it is against this background of insufficient investment funds that private capital is being openly canvassed to compliment efforts of governments and funding agencies. This is seen as a realistic proposition for delivery sustainable infrastructure to Africa. The much favored source of private capital remains pension funds and private equity participation in infrastructure development and delivery, with the delivery vehicle being Public Private Partnerships (PPI).

As with other initiatives aimed at mediating Africa's problems, the developed countries are again looked upon to leverage the investments necessary for infrastructure development. A critical look at this strategy reveals, as with many of its predecessors, a series of shortcomings. Firstly, evidence abound that continuing dependence on the developed economies for financial and technical assistance is unsustainable both in the medium and long-term. Secondly, there are grounds to doubt whether the infrastructure types needed in sub-Saharan Africa will attract equity participation from the developed economies. It is on these two grounds that leads to the conclusion that the real issues with Africa's seeming inability to develop the capacity for new infrastructure investments, and the inability to ensure effective and efficient maintenance of existing stocks, has been posed. The important questions to come are whether sub-Saharan Africa's incapacity to produce and deliver sustainable infrastructure are symptoms of intrinsic structural problems whose solutions must precede other forms of interventions.

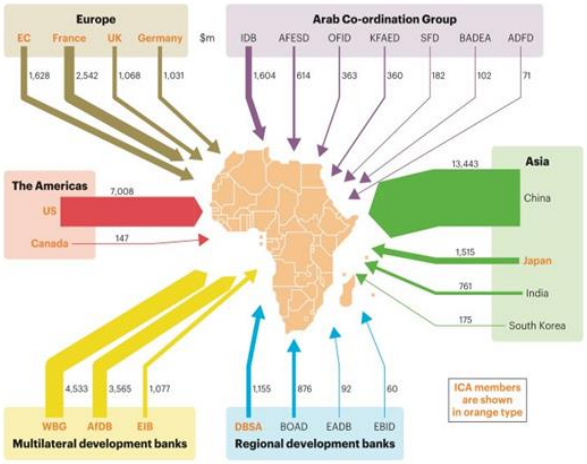

Figure 7
Source: ICA (n.d)

Why are individual countries, trade blocks, and other funding bodies in Figure 7 able to offer development assistance of all types to Africa, and for how long can Africa continue with the '***beggar thy neighbour policies***' state of affairs?

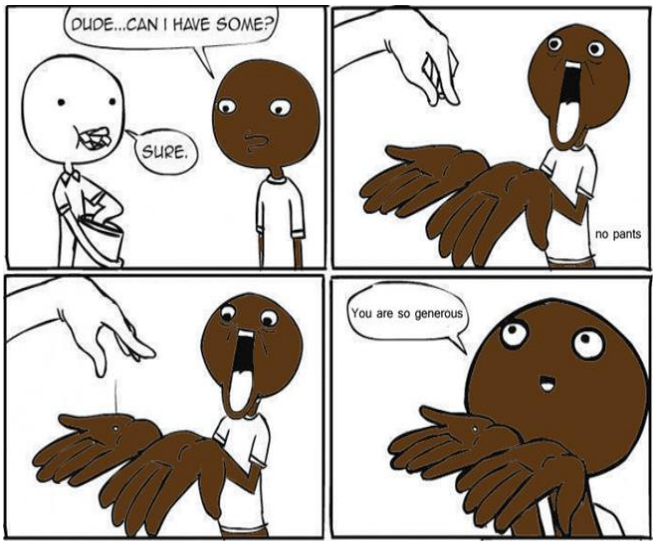

Figure 8 Dependencies on Foreign Aid

For example, does Africa have the management capacity and technical skills in the quantity and quality required to facilitate infrastructure development and delivery, especially given the complexities visiting new emerging procurement arrangements such as the Public-Private Partnership (PPP) strategy?

Is Africa really financially poor, as we are made to believe, or is it the case of lacking appropriate administrative capacity and legal framework, or indeed, the lack of political will to use available institutions and framework to effect sustainable infrastructure delivery and supply? A critical look at Africa's financial sector, what one is confronted with is an underdeveloped financial sector with extremely limited capacity to go beyond offering more than basic banking services. Secondly, effective administrative capacity to allow expansion and diversification of the financial sector, block pervasive leakages, enhance policy formulation and implementation, is what Africa needs to meet its infrastructure financial commitments. For example, the annual capital flight from Africa hovers around US$1.26 – US$ 1.44 trillion dollars a year, and various means are used to facilitate such flows, ranging

from under-pricing of raw materials by extractive multinationals for the purpose of tax avoidance and evasion (Syd, 2011).

While pension fund is the most appropriate source of infrastructure financing, owing to the long term view of investment often adopted, Africa's pension industry is rudimentary and undeveloped. In North America and Europe more than 90 percent of the population are covered by pension fund, in sub-Saharan Africa, only between 5-10 percent of the population are covered by pension funds. For example, while pension funds are the equivalent of 5% of GDP in Nigeria, this compares unfavourable to the UK, Netherlands, and America where pension funds are the equivalent of 131 percent, 170 percent, and 113 percent of GDP respectively. This simply show huge scope for growth, and apart from South Africa, countries such as Namibia and Botswana have US$10 billion and US6 billion in pension funds respectively, representing 80 percent and 42 percent of GDP respectively.

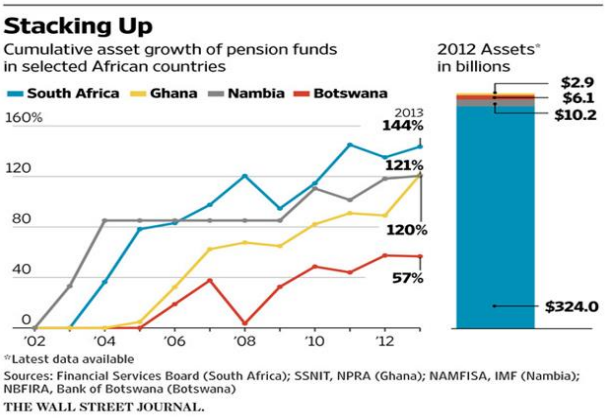

Figure 9 Performances of Pension Funds in Africa

Indeed, it is forecast that sub-Saharan African pension funds will increase to US622 billion by 2020 in assets, and this is expected to grow to US$7.3 trillion by 2050. However, it is important to stress that the criteria used by external fund managers are not essentially different from those used by local fund managers who are equally seeking to maximise returns on clients' investments. In these regards, Africa must overcome several critical challenges, the most critical of them all, is how Africa can enhance its macroeconomic and institutional environments to support infrastructure development and delivery (Estache, 2006). Until this is given the desired consideration, the Africa's capacity to absorb the huge indivisible capital requirements for infrastructure development and delivery will remain the concerns of multilateral, unilateral, and local stakeholders in infrastructure development and delivery (Esteche, 2006; Ebohon and Rwelamila, 2000; Ebohon, 2002).

This presents Africa with a huge dilemma, which is that Africa must first endow itself with basic physical infrastructure and effective institutional arrangements to reassure local and international stakeholders that it possess the essential capacity to absorb the huge and indivisible capital required to transform Africa's infrastructure landscape (Esteche, 2006; Lumbila, 2005). As already indicated, effective institutions and institutional building capacity constitute the soft infrastructure and services that are currently the missing links in Africa' infrastructure development.

Roadmap for Africa's Infrastructure Development

Africa must see multilateral and unilateral infrastructure financial and technical assistance as complementary to concerted local efforts. These efforts must be drilled in effective policy formulation and implementation strategies specifically devised for infrastructure development and delivery. In the 21st century, there are no reasons why effective infrastructure

development and delivery strategies should defy Africa; huge scope exists for adopting and adapting tried and tested policies from successful nations and regions of the world.

Supra-national approach to infrastructure development is an option Africa must seriously consider, this owe to the narrow capital base from which most African economies operate. Additionally, the huge and indivisible capital requirements for infrastructure development and delivery can overwhelm nation states, this is one area where the role of the private sector can be crucial to Africa's infrastructure development. Evidence of this is emerging, though early days yet, giant African companies capable of operating across Africa are being established; the Dangote Cement, MTN mobile communications, ABSA Bank are cases in point.

The need to bring the financial and educational institutions closer to the real economy is overwhelming, and critical to infrastructure capacity building in Africa. Floating long-term infrastructure bonds is one of the many ways attracting local investments to the infrastructure sector, but this will need to be complemented with appropriate policy measures not just to allow user charges but the upward revisions of such charges when there is economic case for doing so. External borrowings and over-reliance on expatriates, particularly in areas of project development and management often attract huge costs to render most capital projects economically unsustainable. Developing regional capacity in infrastructure development and management skills is key to instituting and implementing the necessary reforms to drive infrastructure development in the region.

Similarly, the culture of maintenance must be embraced in Africa, the capacity to maintain existing infrastructure is arguably more important than developing the capacity for new infrastructure and services. The reason for this is clearly evident in the role absorptive capacity plays in facilitating local and international investments. Developing economies with efficient and functional infrastructure and services attract lower risks premium, and likely investment destinations for local and international investors, as this is seen as a demonstration of the absorptive capacity of these economies. Inadequate roads, traffic and ports congestions, poor power are typical manifestations of lack of the necessary absorptive capacity to turn new capital inflow into sustainable infrastructure investments.

Finally, Africa must take steps to depoliticise infrastructure development and provisions, and the need for urgent actions on this front cannot be overemphasised, as it constitutes one of the most formidable bottle-neck to infrastructure development and delivery. Africa is awash with failed and dysfunctional infrastructure that have been procured as a political necessity and thereby wrongly located where they are likely to have the least impact on growth and development. Dams are built on seasonal rivers that should never have been the case but for political necessity, and so are roads constructed where they have minimal effects for political reasons. The paucity of resources available for infrastructure development on the continent is a clear evidence that this practice is unsustainable. If Africa is serious about developing and delivering effective infrastructure capable to reducing its infrastructure gap with the rest of the world, the sector must stop to being the conduit for rent seeking behaviour. The practice of inflating contract prices, outright diversion of infrastructure budgeted sums, awards of infrastructure contracts to none construction industry professionals must seize. This practices have been used to deny Africa the infrastructure it needs for effective and sustainable growth and development.

CONCLUSIONS

To effectively address the growing poverty and inter and intra-regional growth inequalities, Africa must address its infrastructure deficits. Several challenges and constraints have been

identified, and most prominent amongst these are financial and institutional constraints, which must be addressed in order to build the necessary capacity for effective infrastructure delivery. The continuing reliance on multilateral and unilateral institutions for infrastructure provisions and delivery is no longer sustainable; Africa must build its own capacity. However, this requires putting the necessary institutional arrangements in place. In the experiences of other regions with sufficient and functional infrastructure and services, institutional arrangements constitute the soft infrastructure that is the necessary prerequisites to physical infrastructure development and delivery.

Similarly, the need to broaden its capital based, devise appropriate fiscal measures are Africa must broaden its capital base and develop robust fiscal policies to attract local and international investments to Africa's infrastructure sector.

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Mitigating Architecture Design Challenges within the Realms of Sustainability

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ABSTRACT

The philosophy behind sustainable architecture is all about reducing waste, making judicious use of available resources and passive intervention means. This not only means physical waste but minimizing energy loss as well. Sustainable architecture therefore, holds the key to an environmentally positive future. Only by living more economically with our resources can we hope to protect our environment and climate. So, what better way to live more sustainably than by making sure the very structure of our built environment is greener & more sustainable? This is to enable us reduce fossil fuel emissions prevalent especially in large cities, as well as to reduce our carbon footprints and design our individual dwellings/structures not only as a unit, but as a sustainable whole. The paper aims to simplify the meaning of sustainability as it relates to architects in practice and architecture as seen in the case study of the Idea House, Malaysia where passive means were employed as well as careful orientation of the building. This is done through a clear definition of sustainable architecture, highlighting the methods of achieving this and the alternative means to fossil power available the world over. It also discusses the many obstacles that make the cross from conventional building methods to sustainable ones more appealing, some of which include sincerity in government policies, corruption and high cost of initial acquisition, poverty and lack of awareness.

Keywords: Sustainability, fossil fuels, passive strategies, alternative energy

INTRODUCTION

Sustainable architecture holds the key to an environmentally positive future. Only by living more economically with our resources can we hope to protect our environment and climate. So what better way to live more sustainably than by making sure the very structure of our built environment is greener? The philosophy behind sustainable architecture is all about reducing waste. This not only means physical waste but minimizing energy loss as well. By keeping the energy we consume within our buildings for as long as possible, we need less supply in the first place. Using less energy to keep us comfortable means that we can become environmentally responsible and more resource efficient, which are both vital to reducing the effects of climate change. Perhaps the major philosophy of a sustainable building for it to be truly called sustainable is that it should be designed to able to service the needs of many generations of diverse users (Shore, 2008).

Wines (2000) argues that today, architecture finds itself at a crossroads. He argues that this is so because building materials and new construction, along with the operation and maintenance of buildings, account for a significant sum of the world's greenhouse gas emissions. Faced with this fact, how are architects to responsibly pursue the act (and art) of architecture without further deteriorating the planet's environmental make-up or depleting its resources? What forms of high and low technology can be developed to curtail the injurious side of building? Can good—or even great—architecture is sustainable? (McKnight, 2014).

Tukur, R.B. & Badiru, Y. Y. (2016). Mitigating Architecture Design Challenges within the Realms of Sustainability. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 483-488

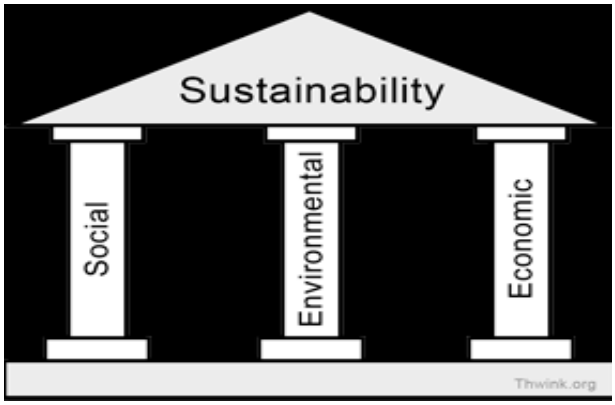

Figure 1 Three Pillars of Sustainablity
Source: twink.org/sustain/glossary/three pillars of sustainability.htm

Figure 1 illustrates the thrust upon which sustainability is built. Environmental sustainability is the ability to maintain rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely. Economic sustainability is the ability to support a defined level of economic production indefinitely. The social sustainability is the ability of a social system, such as a country, to function at a defined level of social well-being indefinitely. As architects, we can identify with the environmental sustainability as our task is all about the built environment – to build individually, but as part of a whole. This built environment must be within the economic realms of the clients whilst upholding their social status (Tukur, 2013).

The philosophy behind sustainable architecture is all about reducing waste. This not only means physical waste but minimizing energy loss as well

i. Sustainable architecture holds the key to an environmentally positive future.
ii. Only by living more economically with our resources can we hope to protect our environment and climate.
iii. So what better way to live more sustainably than by making sure the very structure of our built environment is greener?

When designing a green building, there are some a few salient points to consider as itemized by the Green Building Bible (2008). These include but not limited to:

i. Site and Climate
ii. Form and Function
iii. Fabric and Elements
iv. Infiltration and Ventilation
v. Energy and Renewables
vi. Lighting
vii. Cooling / Heating
viii. Water Conservation
ix. Energy Management and Monitoring

However, sustainable buildings are a broad multi criteria subject related to three basic interlinked parameters: economics, environmental issues and social parameters (Dimitris, Giama and Papadoupoulous 2009). Roaf, Horsley and Gupta (2004) observed that the climate change may bring more sunshine hours, more intense radiation and temperatures. As such, there will be a significant impact on the thermal and lighting performance of buildings which may result in over-heating of the highly glazed and unshaded, as well as increased glare. It is therefore important to design buildings that have a low energy form

Furthermore, it is generally accepted that green buildings can help mitigate climate change, and as by so doing generally improving quality of life (Shore 2008). Some of the problems that can be associated with climate change include severe weather change, high risk of air pollution, massive increase in disease vector ecology leading to ill health in both humans and other animals. Political problems could also be influenced thereby encouraging conflicts, wars and eventually causing forced migration, which is illustrated in Figure 2.

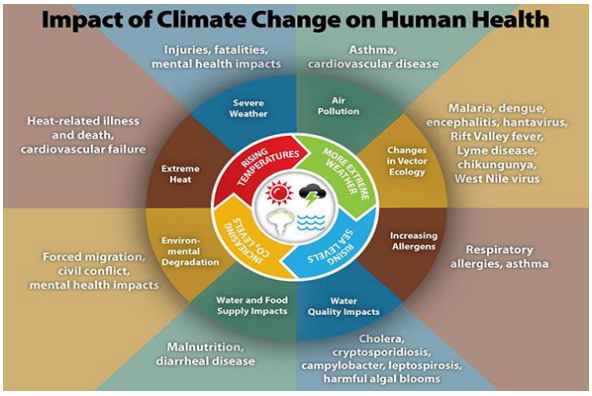

Figure 2 Effects of Climate Change on Human Health (Source: U.S. Climate Resilience Toolkit)

Sustainability and Renewable Architecture

In 1987, the world Commission on Environment and Development sought to address the concern about the accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development (Pomeroy, 2011) and published its findings in "Our Common Future". It is from this report that the phrase sustainable development was first coined (ibid).

Varied and different forms of renewable energy sources are available to us today, as is shown in Figure 3, as well as the projections for the year 2013. The variables range from the high and wide availability of solar power and wind power, to a host of other combined non-renewable energy sources.

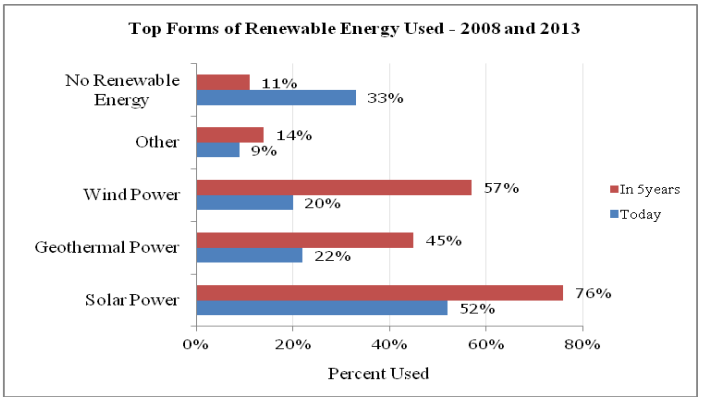

Figure 3:Top Forms of Renewable Energy Used - 2008 and 2013 (Source:Global Green Trends Smart Market Report)

There have been many agitations and reasons as to why the globally green buildings have still not got the popularity required for it to be seen as standard method for construction of all buildings now and in the future. These reasons range from high initial cost of construction, to lack of political will, as well as poverty and extreme harsh weather conditions. This variability is demonstrated in Figure 4.

Figure 4: Key Obstacles to Global green Buildings (Source: Global Green Trends Smart Market Report)

Further statistics from Global Green trends Smart Market Report (McGraw Hill, 2008) as can be seen in Figure 5 show that great efforts have been made around the world to attain the goal of sustainability and the involvement of industry has also helped in bringing to the fore, buildings that that have achieved various levels of sustainability.

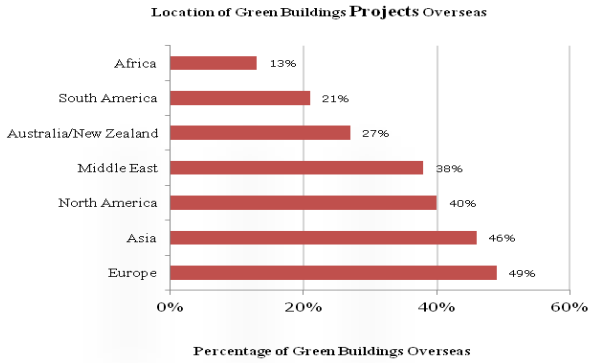

Figure 5 Location of Green Buildings Overseas (Source: Global Green Trends Smart Market Report)

Sustainable Buildings in the Tropics: A Case Study of the Idea House, Malaysia

The Idea house designed by Jason Pomeroy Studio is the first zero-carbon residence South-East Asia, located in Shah Alam, Malaysia, modelled under the concept of the *"Malay Kampung"* house. This house as seen in Figure 6 was conceived with the intention to serve as a test bed, as well as to provide an insight into tropical living in terms of modern terms of sustainability.

Figure 6a: Idea House, Malaysia- approach view (Source: http://www.simedarbyproperty.com)

Figure 6 Idea House, Malaysia – Aerial view (Source: http://www.simedarbyproperty.com)

Due to the careful orientation of the Idea House, with the shorter faces to the east and the west, there was a minimization of solar heat gain as well as that of glare through low angle sun path (Pomeroy, 2011). This was further complimented by deep overhangs so as to provide shading from the sun and torrential rain

The narrow plan form aided in the optimisation of daylight penetration which provided illumination exceeding 150 lux (beyond Nigerian Building Standards of 100-300lux for habitable areas). Daylight factors on ground and first floor respectively were 4.16% and 2.90%. Thus, it can be concluded that there are good levels of natural daylight in these rooms (ibid).

With respect to harnessing the sun's rays as renewable energy source, a 90panel photovoltaic (PV) array was incorporated on the roof to provide an estimated 17,008kWh/year. With the estimated annual consumption (based on a household of 5) being 16,271kWh/year, there is an expected excess of 4.33% which can be fed back into the grid (ibid).

In terms of materials used in construction, timber flooring was used for living areas, ceramic floor and wall tiles for wet areas e.g kitchen and bathrooms. Windows were 8mm double glazed, double layer of plaster board on steel studs with glass studs with glass wool acoustic/thermal insulation was used for internal partitions. For the ceilings, Medium Density Fibreboard (MDF) tile, mineral wool based tile and wood wool based tile were considered but rejected due to heavy weight of the former and high cost of the latter. As such the concensus was to use suspended plasterboard ceiling.

Grey Water and Water Management

The design plans to capture 50 % of the 'grey water' from wash hand basins and showers via a filtration system. The water can then be re-used to flush the WC's, thus reducing water consumption and therefore utility costs. Water wastage is set to be further minimised by aerating the showers, resulting in less water being consumed by the room occupants. Based on an occupant using 133litres of water per day, the aeration of showers could reduce consumption to 64 litres per day.

Green Roof and Rainwater Catchment:

Green roof technology is incorporated into the roof garden, helping reduce storm water run-off and thus minimise the loading onto storm water drains. The green roof can also be replaceable. Whilst currently proposed as a roof garden, the space can be converted in the future to a further habitable room. The rainwater captured by the sloping roof would be collected into water storage tanks from which the water harvested would be used for irrigating the vegetation within the development.

CONCLUSION

There is no doubt that if indeed we are to plan for future generations, then we have to make more meaningful use of the resources that we have, such that we use less to achieve more. In sub-saharan Africa where we are plagued by war and ravaged by diseases, there is doubt that it is amongst the category of regions that will be worst hit by the climate change issues. It is therefore imperative that architects and try to embrace the culture of sustainability as it related to the built environment so that the profession can contribute its quarter to creating a safe and worthy environment this generation and generations yet unborn. This can achieved through appropriate choice of site, careful planning, thoughtful use of building materials, as well as judicious use of locally available resources.

Furthermore, governments need to bring in more sincere policies that will encourage the use of alternative power means. By so doing, this will cut down the cost of acquisition, encourage more research and thereby extending its popularity and reach to even the most remote area. These efforts combined, will go a long way to helping the world reach its sustainable development goals.

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Development of Cement Mortar from Reusable Industrial By-products

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ABSTRACT

The present work involves mixing a high ratio of reusable industrial by product from the steel-making process, Ground Granulated Blast Furnace Slag (GGBFS) with ordinary Portland cement at a ratio of 75%:25% to produce cost effective, environmentally friendly, eco-efficient, yet mechanically and structurally viable cement. Activation of the steel by-product (GGBFS) was done with compounds of different alkalinity. Mortar molds developed were tested for Compressive Strength, Autogenous Drying Shrinkage, Conduction Calorimetry, Scanning Electron Microscopy (SEM), X-ray Diffractometry (XRD), and Porosity. Results obtained showed that a high ratio of GGBFS to Ordinary Portland Cement mixtures produced cement based products with low permeability, improved cementing results, improved workability, and excellent density control.

Keywords: Activator, Cement, Eco – efficiency, GGBFS, Mortar

INTRODUCTION

Environment and human health effects are intricately linked therefore the need for waste reuse is a fact of healthy life. Bentur, (2002), suggested that waste utilization is an attractive alternative to disposal in the sense that disposal cost and potential pollution problems are reduced or even eliminated along with the achievement of resource conservation. Higgins, (1995) reported that the utilization strategy must be coupled with environmental and energy considerations to use available materials most efficiently.

Lane, and Ozyildirim (1995) discussed the production of Portland cement as one involving the grinding of cement clinker, gypsum and calcination of raw materials at a high temperature (approx. 1500°C). This process of production is highly energy intensive and demands a great deal of both power and energy for manufacture to commence.

Öner M, et.al (2003) reported that blast furnace slag is a by-product obtained in the manufacture of pig iron in the blast furnace and is formed by the combination of earthy constituents of iron ore with limestone flux. When the molten slag is swiftly quenched with water in a pond, or cooled with powerful water jets, it forms into a fine, granular, almost fully noncrystalline, glassy form known as granulated slag, having latent hydraulic properties. Such granulated slag, when finely ground and combined with Portland cement (PC), has been found to exhibit excellent cementitious properties.

Usage of slag as a cementitious component requires only grinding. The energy required to grind granulated blast furnace slag is only approximately 10% of the total energy required for the production of Portland cement. As shown in figure 1, this less complex process saves substantial amounts of energy compared with the production of Ordinary Portland cement.

Ango, A. J.; Kimeng, H. T.; Sani, M. & Ekundayo, O. O. (2016). Development of Advanced Cement-based Products from Reusable Industrial By-products. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 489-499

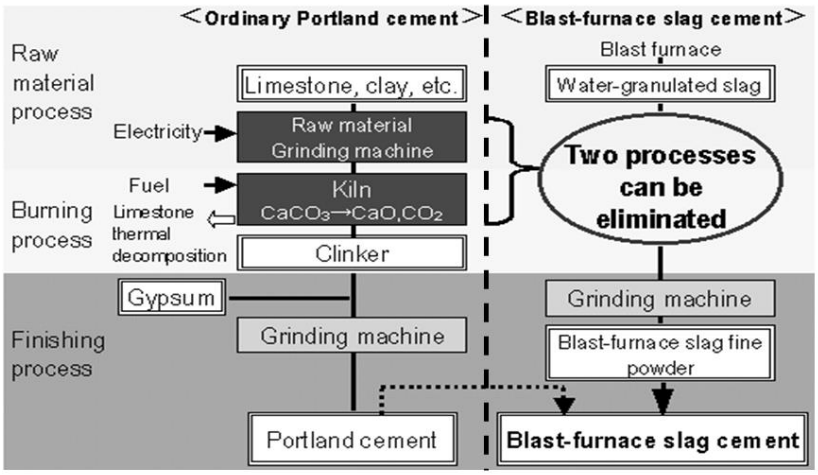


Fig. 1 Comparison between Production Processes of Portland Cement and Blast-furnace Slag Cement

Ganesh and Kumar (2000) opined that ground granulated blast furnace slag (GGBFS) is a pozzolanic material (termed by a few as a supplementary or complimentary cementitious material) and can be used as a cementitious ingredient in either cement or concrete composites. They results of their work also concluded that the utilization of supplementary cementitious materials is well accepted due to the overall economy in their production as well as their improved performance characteristics in aggressive environments.

Kjellsen et.al (1991) reported that blended cements are produced by intimately and uniformly intergrinding or blending ordinary Portland cement (OPC) with one or more supplementary cementitious materials (SCMs). Most SCMs, such as ground granulated blast-furnace slag (GGBFS) are industrial by-products. These materials are generally not used as cements by themselves, but when blended with OPC, they make a significant cementing contribution to the properties of hardened mortar or concrete through hydraulic or pozzolanic activity.

V.D. Glukhovsky, et al., (1980), suggested that since oxides containing in slag are similar to those of Portland cement, the application of the slag for construction material is fully attractive. The industrial manufacturing process of cements based on the alkaline activation of blast furnace slag (AAS) started in Ukraine between 1960 and 1964.

S.D. Wang, et al., (1995), Tailing and Brandstetr (1989), Puertas (1995) reported that these AAS cements present some technological advantages over ordinary Portland cements. These are: the development of earlier and higher mechanical strengths, lower hydration heat, better resistance to chemical attack, better behavior upon carbonation, higher resistance of the aggregate-matrix interface, better behavior to freeze-thaw cycles, among others.

S.D. Wang, et al., (1994) published extensive investigations about the main factors affecting the development of mechanical strengths of AAS cements when used in the development of mortars and suggested that these factors include slag specific surface, curing temperature, type of activator, activator concentration, and alkaline activator nature. In all the studies, the influences of these factors are independently studied. Slags are by-products of metallurgical (iron and steel) industry and consist mainly of calcium-magnesium aluminosilicate glass. As by-products they have a variable composition depending on the raw materials and the industrial process; hence, each slag differs in response to activation.

S.D Wang, (1995) reported activation with waterglass. However, waterglass solution (Na_2SiO_3) is relatively expensive and cannot be readily acquired in some parts of the world. In Scandinavian countries, F-activator, composed of NaOH, Na_2CO_3, and lignosulfonate as the main ingredients together with sodium gluconate and tributyl phosphate as additives, was successfully used as activator. For the purpose of this research, GGBFS was activated with various alkaline activators. These activators are non-expensive and can be acquired from the market.

ACTIVATION OF SLAG

Different alkali-containing activators were used for activation of slag, e.g., liquid sodium silicate, sodium hydroxide solution, compound activator, sodium carbonate, and sodium orthophosphate. Corresponding to the concentration of the alkaline activator added in a solution, the amount of water was varied to maintain a constant w/b ratio.

MATERIALS

The chemical composition of the blast furnace slags used in this work is shown in Table 1. The mortar samples were prepared according to the Okamura et al. (1993) method. The size of the prism samples was 50 x 50 mm. The sand/slag ratio used was 1: 2.45 and the slag to Ordinary Portland cement ratio was 70% :20% for samples activated with powder alkali activators.

Table 1 *Chemical and physical properties of materials used*

	Oxide Composition									
Blaine	SiO_2	Al_2O_3	CaO	Fe_2O_3	MgO	Na_2O	TiO_2	SO_3	LOI	Specific gravity
8000	34.72	11.87	41.05	0.44	8.24	0.11	0.53	2.43	0.29	119
OPC	20.88	5.39	64.73	2.38	1.51	0.27	1.33	1.65	2.04	3.13

All samples were first cured in moist air at 25^{o}C and 60%RH in a curing room for 1 day and then water cured progressively for 3, 7, and 28 days. Samples were then tested for compressive mechanical strength for the preceding days respectively. Tables 2 and 3 present the mix proportion for mortar samples. Four (4) mortar samples were successfully activated with powder activators.

EXPERIMENTAL

The raw materials for the experiment were prepared with sufficient mixing and their formulations are shown in Table 2. The mixing and molding procedure followed ASTM C 109-92. Cubes of fresh cement were put into a Chandler duplex curing chamber at 125°C or 175^{o}C, which was filled with water and kept at a pressure of 1 ± 0.1 MPa (gauge pressure). The Chandler duplex curing chamber was used here due to availability and the "compressed water" situation in it is not normally practicable in fabricating precast concrete. The cubes were at room conditions for nearly one hour between initial molding and processing. The desired processing temperature was reached in 1.5 hours and was held for various lengths of time. Cooling time was more than 1.5 hours. Fragments of tested cubes were taken for physico-chemical examination. Granulated blast furnace slag cement was used in the production of mortar samples which were subjected to laboratory experimental tests. Specimens for determining strength were moist-cured at 23^{o}C until the time of test. The compressive strength was determined using ASTM C 78 (third-point loading) on 10 x 10 x 150 mm specimens at 3, 7, and 28 days. Mix proportions for producing high volume slag mortar using various alkali activators is shown in table 2.

Table 2 *Mix proportions of concrete*

Type	Mix proportions of GBFS (%)						Mixing Proportion (kg/m^3)			
	OPC	GBFS	$CaSO_4.2H_2O$	Na_2SO_4	Na_2CO_3	NaOH	W	C	S	G
OPC	100	0	0	0	0	0				
B70-1	20	70	3	0	7	0				
B70-2	"	"	0	0	7	3	1.79	3..97	7.36	10.60
B70-3	"	"	2	8	0	0				
B70-4	"	"	1	8	0	1				

TEST, RESULTS AND DISCUSSIONS FOR MORTAR SAMPLES

Compressive Strength

The test results of the compressive strengths are shown in Fig. 5.1.1. As seen, the compressive strength of the mortar samples seems to increase with increasing Na_2SO_4 content.

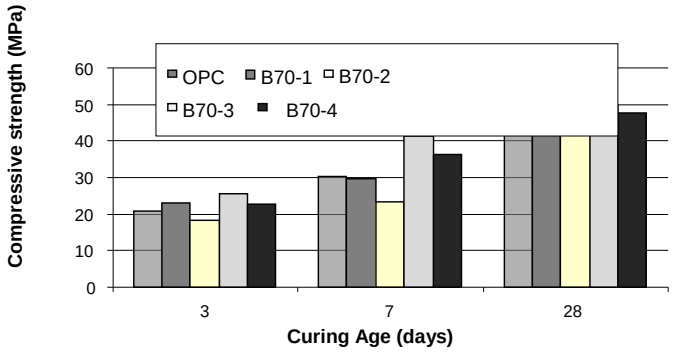


Figure 5.1.1 Compressive strength of powdered – modified slag cement mortars with different curing periods

As seen from Fig.5.1.1, the high early strength development of the high volume slag cement mortars has almost completed in 28 days and in all cases, the compressive strength is equal to or even a bit higher than that of ordinary cement mortar. From the compressive strength graph, it can also be seen that there is a probability for further or future strength development for the high volume slag cement mortars. Though the high early strength was achievable, this was at the expense of the fineness of the slag and its reactive activity index. Since the CaO content of the slag is about 1.5 times less than that of the OPC (see Table 1), a higher replacement of the OPC by the slag would bring to a lower ultimate strength. On the contrary, in this work, the strength increases with increasing the slag contents.

Heikal, et. al, (2000), Linhua, and Yugang, (1999), believed to be due to some properties of the slag other than its CaO content, such as magnetic property, size, and shape. In general, admixtures have very little effect on the ultimate strength of mortar except when they affect the w/c ratio or the porosity of the mortar sample. In this work, it is explained that, due to its texture, the fine slag functions as filler to reduce the porosity. This in turn upgrades the strength of the samples (filler effect).

Isaia et al. recently proved that pozzolanic and filler effects increased as the mineral addition increased in the mixture. They also concluded that the filler effect, however, increased more than the pozzolanic effect.

Autogenous Drying Shrinkage

A report on the relationship between autogenous shrinkage and hydration evolution for different types of cement mixtures and varying activators is hereby presented. The plotted

results in Figure 5.2.1 confirm that the cumulative autogenous shrinkage for all activated slag mixes is higher than that of opc and that it increases with the silica content of the mix. It can also be seen that most of the total autogenous shrinkage takes place during the early hydration stages just immediately after hardening. The average result of the autogenous shrinkage of the silicate mixes increase with the SiO_2 content. The GGBFS mix shrinkage displayed higher shrinkage compared to mixes of OPC.

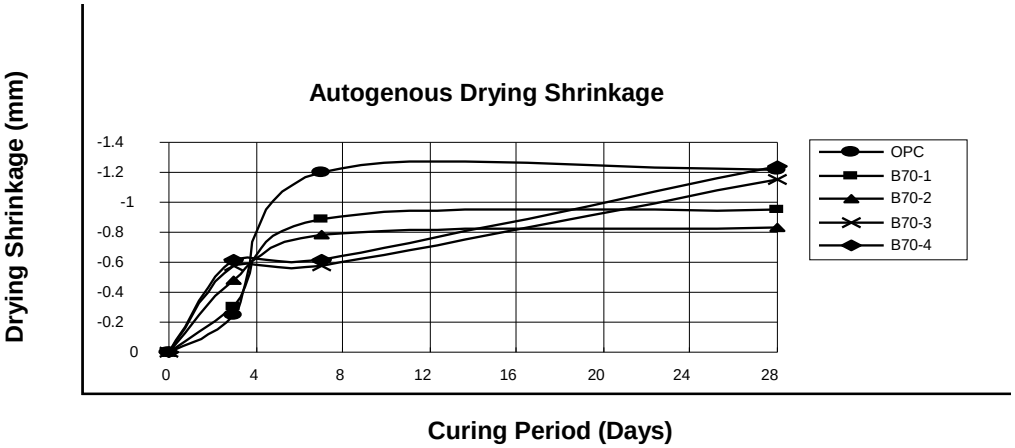


Fig. 5.2.1 Autogenous Drying Shrinkage of Alkali Activated GGBFS

Conduction Calorimetry

Conduction calorimetry, were performed for the investigation of the hydration evolution on paste samples prepared with water/binder ratio of 0.50. All mixes were tested after 6, 8, 10, 12 hours and 1, 2, 3, 7, 14, 28 days.

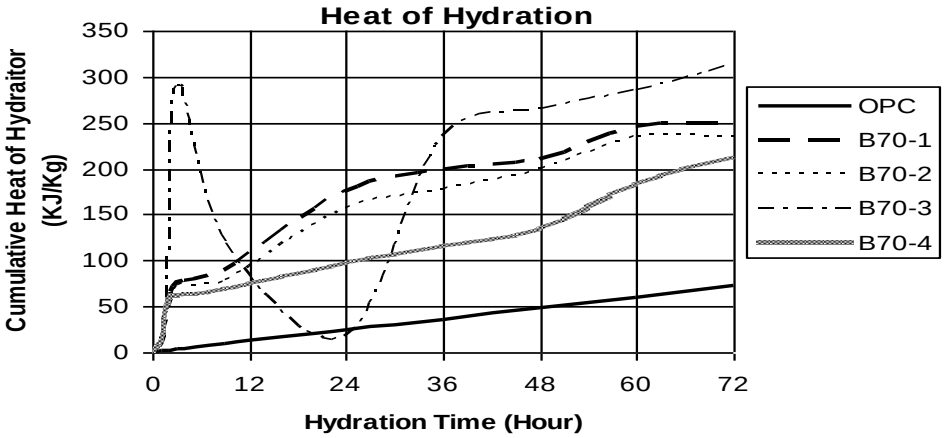


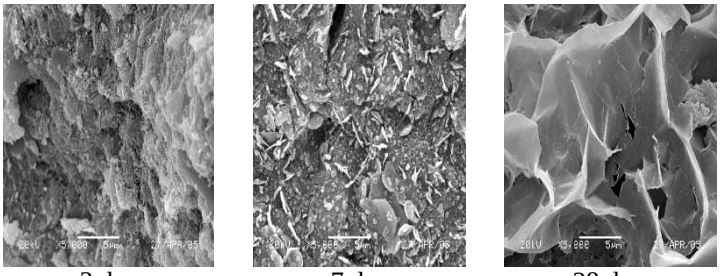
Fig. 5.3.1 cumulative heat of hydration of alkali – slag cement

For the calorimetry tests, samples of paste were prepared by mixing 20g of slag and water + activator in a plastic bag and immediately transferred to a JAF Wexham conduction calorimeter at 20°C. The heat output was recorded after 30 minutes, and the time needed for the system to reach equilibrium. The heat of hydration was determined up to 72 hours after mixing.

Figure 5.3.1 shows the profile of the heat liberation during 72 hours. The GGBFS showed the fastest heat evolution, with a maximum at 6 hours and no induction period. The induction period of all slag activated mixes correlates well with the Na_2O content, increasing as its content decreases, showing the effect of the alkaline media on the solubility of the slag and hydration evolution.

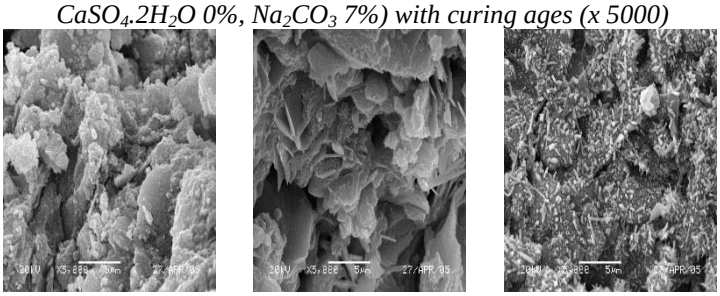
Jiménez, and Puertas, (1997), Shi, (1997), Richardson, and Cabrera, (2000) reported that after the induction period, diffusion is the mechanism that controls hydration. The slag

solubility also influences the reaction sequence, and the total cumulative heat diminishes as Na_2O content decreases. Because the silica modulus is constant, it can be said that the degree of reaction increases with silica content. The influence of the activators on heat evolution rates is clear:



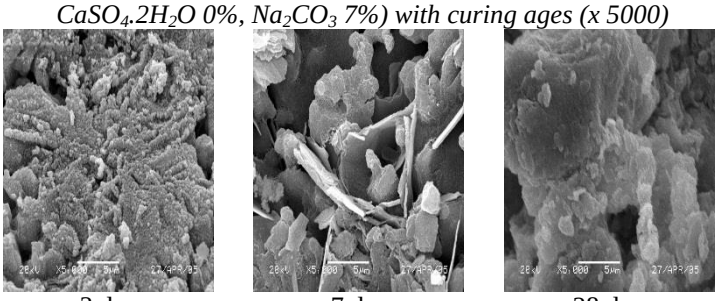
3 days 7 days 28 days

Fig 5.4.1. SEM images of B70-2 mortar (GBFS 70%, OPC 20%, $CaSO_4.2H_2O$ 0%, Na_2CO_3 7%) with curing ages (x 5000)



3 days 7 days 28 days

Fig 5.4.2. SEM images of B70-2 mortar (GBFS 70%, OPC 20%, $CaSO_4.2H_2O$ 0%, Na_2CO_3 7%) with curing ages (x 5000)



3 days 7 days 28 days

Fig 5.4.3. SEM images of B70-3 mortar (GBFS 70%, OPC 20%, $CaSO_4.2H_2O$ 2%, Na_2SO_4 8%) with curing ages (x 5000)

3 days 7 days 28 days

Fig 5.4.4. SEM images of B70-3 mortar (GBFS 70%, OPC 20%, $CaSO_4.2H_2O$ 2%, Na_2SO_4 8%) with curing ages (x 5000)

SEM (Scanning Electron Microscopy) Analysis

From the strength and pore structure tests, it can be seen that according to the hydration mechanism of alkali activated slag cement and Portland slag cement, the mixed activation mechanism of sodium-calcium-sulfate was promoted forward. At the same time, by using the powdered chemical admixtures containing C_4A_3S and/or $C_{11}A_7 \cdot CaF_2$ were synthesized. It

played an important part in ettringite formation in early stages and in the enhancement of strength.

With this background, compound admixtures with three components have been developed that substantially improved the strength and pore structure at early and later periods. Improvement of these properties can be explained by the analysis of hydration products and polymerization degree measurement of silicate anion. At early stages of hydration, although polymerization of hydration products made uni-poly and bi-poly ratio decrease, the breakage of slag made uni-poly and bi-poly ratio increase. Thus, these two actions offset each other. At later stages of hydration, the polymerization of hydration played an important part; thus, the high-poly ratios increased. At early stages (3–7 days), uni-poly and high-poly ratio all increased. This shows the breakage rate of slag and the polymerization rate of hydration products. This is due to the action of compound admixtures.

Figs. 5.4.1, 5.4.2., 5.4.3,and 5.4.4 show the microstructure of hydration products at different ages. At 3 days of hydration, due to fast hydration of early strength ore, the dissolution rate of gypsum was lower, so there was AFm evident in scanning electron microscopy. At 7 days of hydration, because of the continuing dissolution of gypsum, breakage of slag and dissolution of anion are very beneficial to production of ettringite. It played the action of advancing skeleton and microsteel fiber.

Connecting and filling between the ettringite and C-S-H gel have important influences on improvement of the early stage functioning and dense structure formation. At 28 days of hydration, much of the ettringite was wrapped in C-S-H gel and coated by slag particles. It is shown that the hydration of slag surface was greater. More and more C-S-H filled into the pore of hardened paste, so that the later properties could be improved.

X-Ray diffraction

XRD was employed to identify the phases present in hydration products, using standard monochromatic CuKa radiation and operating at 40 kV and 20 mA. Scanning was performed at 0.05_ 2q step size, at 2 s per step, between 5 and 50. Samples were prepared by crushing paste specimens into fine powder. To stop hydration at the desired ages, the crushed materials were slurried with 200-proof ethanol. The powder was vacuum filtered, air-dried, and reground before mounting in the XRD sample holders. This was done in order to identify the phases formed during hydration. Figs. 5.5.1, to 5.5.4 show the XRD pattern corresponding to slag activated with powdered alkali activators, up to 28 days of hydration. C – S – H hydration products are known to produce broad diffusion peaks however, XRD patterns in this region overlap with the major peak for calcite and silicate. This characteristic peak of the calcite dominates the diffractogram at all ages. Calcite and silicate peaks remain constant indicating that carbonate particles are inert and do not participate in any hydration reaction releasing Ca^{2+}. The reactivity of the slag is a function of the alkali and free lime content. The chemical and mineralogical analysis of slag showed the presence of negligible amounts of free lime and excessive amounts of carbonates, which is indicative of the limited availability of Ca^{2+}. At 3 days, hydration products were ettringite and an AFm phase.

Ettringite is a stable hydration product only while there is a sufficient supply of sulfates. When the sulfate source is not able to readily supply enough sulfate ions before the alumina content has completely hydrated, ettringite is converted to monosulphoaluminate. In place of sulfates, other ions such as chloride ions can appear and these phases are known as AFm phases. The AFm phase identified in this blend is the calcium monochloroaluminate hydrate, also known as Friedel's salt, which is the result of the high chloride content (1.8%) of the slag. From 3 days of hydration, the ettringite and the Friedel's salt coexist. At this time, a decrease of the Friedel's salt peak occurs due to the presence of sulfate ions. Further, a

decrease in the amount of dolomite was observed at 3 days, although no products associated with the dedolomization reaction were detected. It should be noted that it was not possible to identify any $Ca(OH)_2$ peaks up to 28 days of hydration.

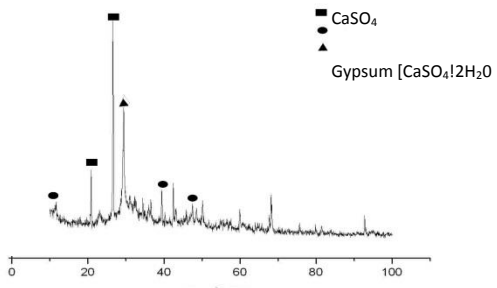


Figure 5.5.1 XRD Pattern for B70-1 ($CaSO_4.2H_2O$(3%) + Na_2CO_3(7%))

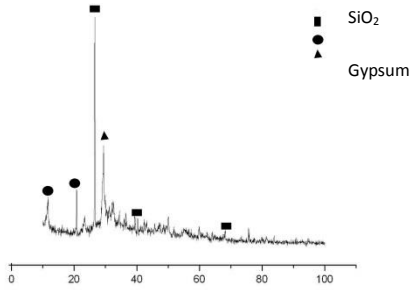


Figure 5.5.2 XRD Pattern for B70-2 (Na_2CO_3(7%) + NaOH (3%))

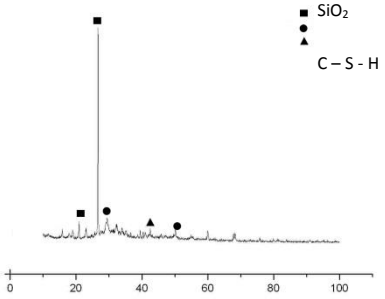


Figure 5.5.3 XRD Pattern for B70-3 ($Ca_2SO_4.2H_20$(2%) + Na_2SO_4 (8%))

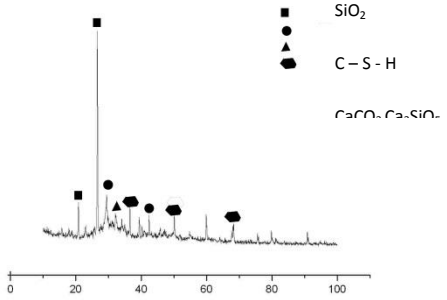


Figure 5.5.4 XRD Pattern for B70-4 ($Ca_2SO_4.2H_20$(1%) + Na_2SO_4 (8%) + NaOH (1%))

Figs. 5.5.1., 5.5.2., 5.5.3., 5.5.4. show XRD patterns for slag activated with powdered alkali activators. This blend unexpectedly exhibited a very long setting time. A more detailed examination of the diffractogram at 3 days of hydration revealed the existence of syngenite peaks, $K_2Ca(SO_4)_2$, at 2q = 31.3 28.2.The precipitation of syngenite occurred due to the high potassium content of the dust, resulting in the removal of sulfate and potassium ions from the pore solution. The peaks were no longer detectable after 28 days of hydration. The subsequent release of sufficient sulfate ions from the dissolution of syngenite and the favorable ratio of SO_4^2 to $Al(OH)_4$ caused the formation of well-crystallized ettringite, which persisted up to 7 days of hydration. Some calcium aluminate hydrates were also detected. Traces of $Ca(OH)_2$ were detected after 7 days of hydration indicating that the available lime was not totally consumed. The diffractogram of the blend with powdered alkali activators is shown in Fig. 5.5.1. At 3 days of hydration, the formation of gypsum due to the rehydration of the anhydrite was observed. Gypsum was not consumed and was detectable even after 28 days of hydration. Ettringite was formed within the first hour of mixing and by 3 hrs was responsible for the very short setting time of the mix. SiO_2, $CaCO_3$, and $CaSO_4$ remained the principal matrix phases up to 28 days of hydration. For this type of blend, slag was essentially activated with calcium sulfate such as in the case of supersulfated cement. Fig. 6.5.2 shows the XRD pattern corresponding to slag activated with Na_2SO_3. At early hydration, the

evolution of the peaks of ettringite and monosulfoaluminate (2q = 9.85) is shown. The Friedel's salt formation is quite evident at 1 day of hydration. Its peak increases up to 3 days, then it decreases and a small amount may be detected at 7 days. A further release of aluminum from the decomposition of Friedel's salt causes the formation of ettringite. Its peaks increase again at 7 days and small amounts of monosulfoaluminate appear up to 28 days of hydration. Both phases are very stable and, as in Portland cement pastes, can coexist. Unreacted $Ca(OH)_2$ can be detected in the mix even after 28 days.

Porosity

At both 3 and 7 days, significant hydrate is found in the system, but this does not effectively fill in the interface, where a higher level of porosity than in the bulk pastes is still found. To some extent, the extra space at the interface is the result of shrinkage cracking on drying for sample preparation; but nevertheless, this indicates a paste that is more porous and fragile in the region of the interface.

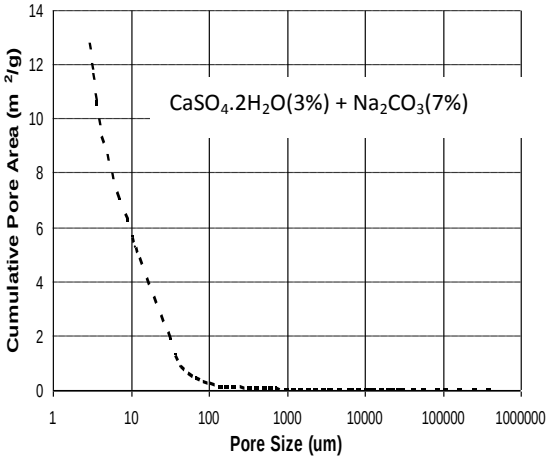


Fig. 5.6.1 Pore Volume for $CaSO_4.2H_2O(3\%) + NaCO_3(7\%)$

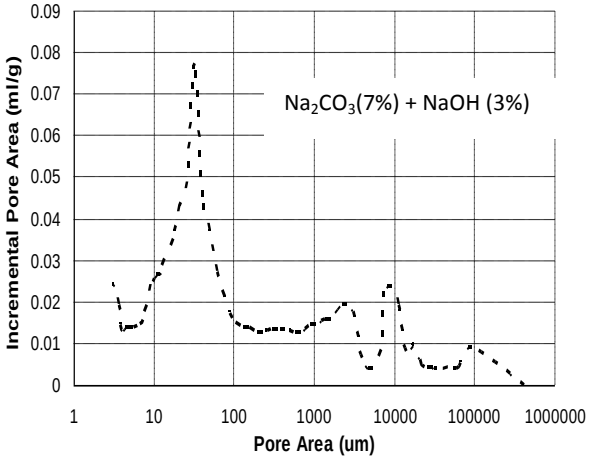


Fig. 5.6.2 Pore Volume for $NaCO_3(7\%) + NaOH(3\%)$

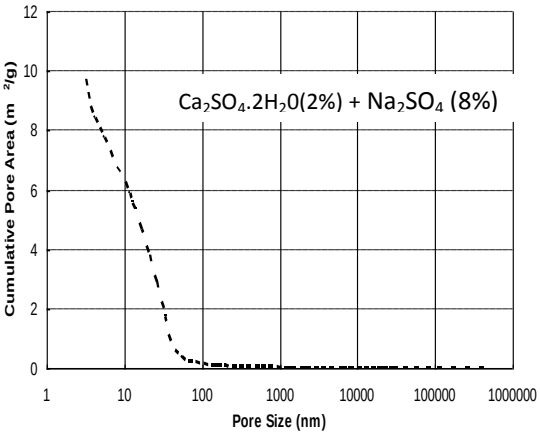


Fig. 5.6.3 Pore Volume for $CaSO_4.2H_2O(2\%)+ NaSO_4(8\%)$

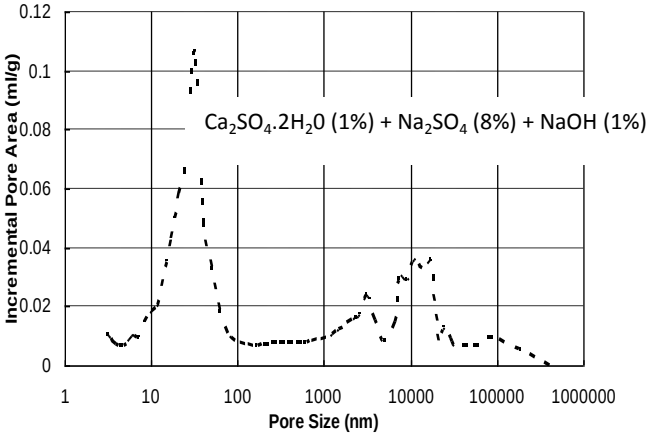


Fig. 5.6.4 Pore Volume for $CaSO_4.2H_2O(1\%)+ NaSO_4(8\%) + NaOH(1\%)$

Figs. 5.6.1, 5.6.2, 5.6.3, 5.6.4., Cumulative pore volume curves of powdered alkali activated blast furnace slag with different curing ages. (3 days – 28 days).

Further hydration to 28 days leads to a system with improved microstructure, with the hydrates much more effectively filling in the space in the system. Considerable hydrate is found in a region where there was originally very little slag, indicating considerable mass transport over a significant distance. In Figures 5.6.1, 5.6.2, 5.6.3, and 5.6.4 the cumulative curves of pore size distribution show the different profile of powdered – alkali Activated slag.

It can be seen that silica plays an important role in the gel densification, being the maximum pore sizes for all the 4 mixes. The activated slag systems have a typical microstructure, which differs from that of hydrated OPC. In the case of alkali-activated slag, the volume of pores in the micropore size range tends to be bigger than that of Ordinary Portland cement.

The volume of pores within the capillary range is smaller than that of Ordinary Portland cement. Under normal application conditions shrinkage depends on loss of water from macropores and mainly from mesopores. The volume of smaller pores is larger for the silicate mixes than for ordinary Portland cement. .

Jiménez, and Puertas, (1997), Xi, and Jennings (1989), Wittman, (1982) suggested that The threshold limit for silicate mixes are in the region of mesopores, whose value diminishes as the silica content increases. The results obtained are in good agreement with other studies on Alkali – Slag - Cement porosity. As measured by the amount of methanol – accessible pores, NaOH of alkali - activate Blast furnace slag pastes changed with time. The concentration of NaOH in the mixing solution is inversely related to NaOH.

Christensen, (1993), and Christensen, et al., (1994) noted that alkali – activate Blast furnace slag pastes have significantly larger volumes of porosity in comparison to OPC pastes when one assumes that only capillary pores are methanol accessible. The volume of pores before reaction is 55.7% of the total volume of the paste, calculated from the density of GGBFS ($2.79 g/cm^3$). The measured amount of pores after 3 days of hydration was about the same for every paste. It is possible that some portion of gel water was exchanged with methanol, in addition to capillary water, since methanol is very small. The difference in NaOH results from either the different degree of hydration or the formation of different microstructural features in alkali - activate Blast furnace slag pastes.

Also, Hydrotalcite was observed in higher pH pastes along with C – S – H. A more sophisticated study is required to determine its effect on various properties of GGBFS pastes.

CONCLUSION

The use of slag when making mortar is interesting because of the savings realized by substituting less expensive slag to a certain volume of cement. From the strength point of view, the results obtained with mortar developed with slag in replacement of the cement are interesting and from analysis of results obtained in the present work, with the factors considered at the selected levels, it is deduced that:

i. The nature of alkaline activator is the most significant factor. As a function of the strengths obtained.
ii. The increase of curing time favours the increase of mechanical strengths at later ages, but has a positive effect at early ages when the activator is Na2SiO3 □ nH2O □ NaOH or Na2CO3.
iii. The fluidity of mortar containing GGBS is associated with Pore Size Distribution of GGBFS. The narrower the Pore Size Distribution of GGBFS, the larger is the fluidity of mortar. The influence of morphological characteristics of GGBFS on the fluidity of mortar is not remarkable.
iv. The strength of mortar incorporating GGBFS is both related to the surface area and Particle Size Distribution of GGBFS. Given the same surface area for GGBFS, when the mortar contains fine particles (<3Am) of GGBFS, the higher its early strength. And, when the mortar contains 3–20Am particles of GGBFS, the higher its long-term strength.
v. GGBFS can be used to develop cement for mortar with high degree of reliability.

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SUB-THEME TWO

Real Estate, Valuation and Management

An Assessment of Labour Productivity Improvement in Construction Project Delivery

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ABSTRACT

Decline in labour productivity in the construction industry has been an issue of concern to professionals in the industry. This concern has sparked series of research efforts which have been reported in many studies. The aim of this research was to assess how labour motivational incentives affect productivity improvement in the construction industry. The objectives included identifying the motivational incentives used by construction companies and examining the effectiveness of such incentives on productivity. Questionnaire survey was used in data collection and descriptive statistics was used in the analysis. Findings from the research revealed that providing required materials for workers, provision and implementation of standard company policies, increase in wages and timely payment of entitlements are among the effective motivational incentives that can lead to improved productivity. Improving productivity is therefore, essential if the industry is to live up to its expectations in terms of project delivery on time, at the budgeted cost and the required quality of finished work. It is recommended that increased attention be given to benefits enjoyed by construction workers in terms of wages, working condition, bonus payment and management of workers' welfare.

Keywords: Labour, Motivation, Productivity Improvement, Project Delivery

INTRODUCTION

The present low levels of productivity in the construction industry and disproportionate dependence on unskilled workers is unsustainable and incompatible with the aspirations for growth of Nigeria's economy. Low productivity cannot be attributed to a single cause but occurs as a result of convoluted interface of individual characteristics and issues in the work environment. There is hardly a single 'cure' for low productivity as such, several intervention approaches are certainly required. Construction performance and productivity improvement are key focus areas of concern in the nation's construction industry, since the construction industry's contribution to the national economy is substantial. Decline in construction productivity across the world has been reported by many researchers such as Karasek and Theorell, (2009). Therefore, evolving ways of improving construction productivity and implementing productivity enhancement measures in terms of labour and management will save billions of naira and make construction a more profitable and attractive business.

Labour is the engine room of the construction industry which plays a key role in the economy of any nation because the industry is among the largest employers of labour. However, despite the importance of the industry, its productivity has been declining. This decline in workers' productivity has caused failure to deliver projects on time and within cost and quality standard (Aiyetan & Olotuah, 2006). Factors such as provision of poor tools and equipment, lack of incentives, unbalanced work gangs among others have been observed to create productivity problems (Akindele, 2003). The benefits of productivity improvement are manifold. At the national level, productivity growth raises living standards because more real income improves people's ability to purchase goods and services, enjoy leisure, improve housing, education and contribute to social and environmental programs. Productivity growth is also important to the firm because more real income means that the firm can meet its (perhaps growing) obligation to customers, suppliers, workers, shareholders, and government (taxes and regulation) and still remain competitive or even improve its competitiveness in the

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market place (Kusanyanagi, 2011). The way forward therefore is to evolve ways of improving productivity especially in terms of labour. This research, therefore, assesses labour productivity improvement strategies in selected northwestern states in Nigeria.

Productivity is an omnibus term that refers not only to the measure of efficiency of material input, labour/management input, or technological input, but also time and financial resources input or a combination of some or all of these critical input factors to produce a finished product. Although, what may account to efficiency or inefficiency of critical input factors of productivity in one organization may differ from the other organization and across locations or regions, Flanagan et al., (2003) describe productivity as a relationship between output and input which varies in terms of the context and the objectives behind measurement. However, looking at it from the materials and human resources point of views, the Encarta Dictionary, (2009) defines productivity as the rate at which a company produces goods or services, in relation to the amount of materials and number of employees needed. Generally, all these approaches attempt to measure the effectiveness with which management; skills, workers, materials, equipment, tools, time and working space are employed at or in support of workforce activities to produce a finished building structure or other fixed facilities at the lowest possible cost (Allardyce, 2007). The aim of this study is to assess how labour motivational incentives affect productivity improvement in the construction industry. Objectives include: identifying factors responsible for low productivity, identifying the motivational incentives used by construction companies, and assessing the effectiveness of these motivational incentives on productivity.

Projects evolve in rapidly changing environments because of the pace of technological development, increasing complexity, new methods and tools, new markets, increased competition, novel business opportunities and demanding customers. This implies that construction projects are dominated by objectives based on time, cost and quality (Nigel, et. al., 2006). Furthermore, the benefits an organisation gains from labour efficiency apart from the aforementioned elements of cost, time and quality; can be about avoiding, reducing, absorbing or transferring risk and exploiting potential opportunities, including profit maximization**.** All of these benefits must be harnessed and calculated above the point of break-even for a construction organisation to feel at ease and avoid being bogged down by inefficiency.

The benefits of high construction productivity cannot be overstated the same way that the dilemma faced by contractors for low productivity cannot be exaggerated. Projects with high productivity share features that include;

i. high degree of standardization in grid layout and sizes of components,
ii. design which shows high buildability, use of pre-fabricated components or pre-assembled forming systems,
iii. architectural details which minimize the use of wet trades, replacing them with dry components,
iv. presence of skilled workers in the relevant trades,
v. high level of construction mechanization, and
vi. not too many workers on site

The essence of all motivational efforts is to increase employee productivity. Motivated workers out-produce unmotivated employees. The factors that influence employee productivity are different from the factors that influence satisfaction. Chike-Okoli, (2002) identified factors that influence productivity of employees to include: Ability, Technological know-how or skill, Physiological drive, Attitude and technology employed, and Managerial ability. The construction pattern in Nigeria is largely traditionally based, justifying the

employment of huge labour gangs; nevertheless, too many workers on construction site usually do not perform proportionately to their output capacities, resulting in reduction in productivity of labour, waste of time and loss of profit.

REVIEW OF RELATED LITERATURE

Low productivity of Nigerian contractors is an unspoken guarantee that accompanies companies' profiles and usually, they seem to always live up to this guarantee. This is because the most significant problems being identified as affecting productivity in Nigerian construction industry which are listed to include; shortage of materials, incomplete drawings, incompetent supervisors, lack of proper tools and equipment, labour absenteeism, poor communication, instruction time, poor site layout, inspection delays and rework still exist at various levels in Nigerian construction companies. However, quality and cost are equally important in assessing the factors that affect productivity. Rose and Mill (2006) argued that any measure of construction productivity that does not account for the changes in design and quality would lead to low, if not negative measures of construction productivity.

Poor productivity of construction workers is one of the causes of cost and time overruns in construction projects. Productivity of labour is of particular importance especially in developing countries, where most of the building construction work is still on manual basis. The most significant problems affecting labour productivity were identified as incompetent supervisors, lack of skills from workers, rework, lack of tools/equipment, poor construction methods, poor communication, inaccurate drawings, stoppages because of work being rejected by consultants, political insecurity, tools/equipment breakdown, and harsh weather conditions (Wahab, 2000).

Productivity Improvement Program

Productivity improvement program offers the single best opportunity to optimize resources utilization, shorten schedule, and achieve dramatic cost saving on capital project, plant turn around and routine maintenance. The productivity improvement program is designed to synergize the expertise and experience of the industry leaders and practitioners in identifying management strategies and execution of initiatives that will improve productivity, accelerate implementation of pragmatic solutions developed during the program which help companies to achieve up to 10-20% productivity gains not only on field execution, but, also for other management functions and support services.

Value Added Feature

The productivity improvement in project program provides the following special value added features.

i. Multi–functional productivity focus: instead of merely focusing on field labour or productivity, all other management functions and support service are also giving much needed attention e.g. inspection, engineering/designed procurement, and planning.
ii. Cost–effective learning: this is the cost effective approach to learn productivity from a wide range of expert and practitioners. The program fee is nominal as compared to the enormous costs of on the job learning or accepting the status and continually suffering from poor productivity.
iii. Accelerated knowledge transfer: this is structured to turn productivity novice staff into smart manager and supervisors with valuable knowledge about all aspects of productivity (Dasaki, 2000).

Management Ability

One of the functions of management is to utilize people in the accomplishment of organization objectives. To accomplish this, management must not only create favourable

environment in which the employee must work, but must motivate the employee to greater performance. When management fails to motivate an employee, the employee becomes a liability to the organization. Liska (2013) observed that the average construction craft worker is only about 40% productive. He argues that workers are only as good as they are trained and they don't produce as well as they could because they are not managed well. He breaks down the other 60% as follows:

i. 20% due to admin delays, waiting for materials and other kinds of resources.
ii. 20% due to inefficient work methods.
iii. 15% due to restrictions in the workplace.
iv. 5% due to personal time.

An organization's productivity depends on how labour is utilized because labour sets the pace, influences the choice of technology, and molds the organizational climate that prevails. An employee with a poor attitude towards his work and the organization is a low producer. Chike-Okoli (2002) posited that attitude is observable and can be infectious and that employees who have bad attitude to their work tend to work because of the compulsion of their economic circumstances, although poor attitude may not be unconnected to lack of motivation. It must be emphasized that there is the need to have a good process in place to monitor performance and assess it during the job in order to increase productivity.

In general, people tend to behave in ways that the organization rewards their efforts. Therefore, the anticipation of rewards can operates as a strong incentive motivating a certain level of behavior and job performance or motivating the choice of an organization as a place of work (Chike-Okoli, 2002). Furthermore, reward motivates performance, leads to reduce turnover, reduce absenteeism, and attract qualified job applicants.

Motivation Studies in the Construction Industry

McGregor (1960) espoused two fundamental theories about workers in the work environment (Theories X and Y). Theory X assumes workers are inherently lazy; Theory Y assumes they are self-motivated. Within Nigerian context, the average workmen belong to Theory X and managers with this type of employees must employ conventional wisdom and goad workers into becoming productive cogs in the machine. Succinctly put, theory X depicts the average Nigerian workers' laziness to work with tendency to avoid work if he could. He is inherently lazy and dislikes work unless he is coerced or forced by economic circumstance. While not clearly on the side of Theory Y, Chike-Okoli, (2002) opined that McGregor seems to lean toward the idea that management should ultimately set the workplace conditions to allow people to not only do well at work, but to want to do well.

The leading exponent of humanistic psychology, Maslow (1954) theorized that the human desire to satisfy ones needs act as motivator influencing their performance positively. He presents these needs as a hierarchy of five categories: physiological, safety, social, self-esteem and self-actualization. Based on Maslow's theory, Schrader (1992) proposed a need of construction workers and identified appropriate techniques which could be included as part of a motivational program. Heseltine (2010) observed that the lower level needs are mostly fulfilled and the higher level needs require attention. He posits that motivational potential inherent in construction work can be used to fulfill the higher level needs of workers.

In order to keep construction workers motivated, their needs must be addressed as construction project goals are reached. Satisfying workers requirements can be viewed as distributing incentives, when certain objectives are achieved. To satisfy the need of both the employers and their employees, workers who are motivated to reach the goals of the employer, should be recognized with an incentive/reward.

Productivity Challenge

When it comes to productivity gains, the construction industry has been ranked at the bottom compared to other industries. Poor productivity has been recognized as a serious problem for years, and unfortunately many companies have accepted this adverse trend as a *fait accompli* and as a result, companies or firms are losing billions of Naira due to poor productivity, schedule slippages, excessive overheads, unnecessary support services and lost production revenues. On the other hand, smart companies are achieving 10-20% productivity gains by implementing innovative approaches and optimizing resources utilization. Companies must recognize that in order to achieve higher productivity they must focus their effort on management effectiveness, value added planning, construction friendly design and procurement and logistical support (Kisako 2004).

METHODOLOGY

The research looked at motivational incentive efforts directed at improving productivity of labour in medium scale construction companies in three states in north-western Nigeria (i.e. Sokoto, Kebbi and Zamfara States). The instrument used for data collection was a structured, Likert-type, close-ended questionnaire. The questionnaire was divided into two parts, section A for personal data and section B for questions pertaining to the research. It was composed of nominal scale with items ratings as 5 - strongly agreed, 4 - agreed, 3 - undecided, 2 - disagreed, and 1 - strongly disagreed. The population of the study comprised some selected professionals from both the client's and the contractor's organisations. In Sokoto, Kebbi and Zamfara states a total of one hundred and twenty (120) questionnaires were distributed to contractors and their workmen in construction site, and professionals within clients' organisation. One hundred and seven (107) questionnaires were returned representing about 89% of the administered questionnaires.

Data analysis was done by descriptive statistics. The mean item score of factors that cause low productivity, the motivational incentives used by construction companies, the effectiveness of the motivational incentives on productivity, and ways of minimizing the negative effect of low productivity in construction industry were calculated and results were ranked in ascending order.

DATA PRESENTATION AND ANALYSIS

Data for this research were obtained from the three states selected in the northwestern Nigeria. Consultants and contractors in these three states were the target population. Each of these states was administered forty (40) questionnaires

Table 1 Distribution of Respondents

Consultants (N = 47)			Contractors (N = 60)		
	Frequency	%	Company Size	Frequency	%
Architects	14	30	Medium	40	67
Quantity surveyors	11	23	Small	20	33
Engineers	10	21			
Builders	12	26			
Total	47	100		60	100

In Table 1, there are two categories of respondents – consultants (with 47 respondents) and contractors (with 60 respondents). For the consultants, the table shows that 30% of the respondents are architects, followed by builders with 26%, Quantity surveyors and Engineers with 23%, and 21%. With regards to the contractors, 67% are medium scale contractors while 33% are small scale contractors. This classification of contractors is based on the number of workers employed by the companies.

Table 2 Educational Qualification

Consultant	Frequency	Percentage
OND/NCE	8	17
BSC/HND	26	55
Postgraduate	13	28
Total	47	100

From table 2, 55% of the respondents are B.Sc/HND holders, 28% are holders of posgraduate certificate, and 17% hold OND/NCE certificates. This signifies that all the respondents have the requisite knowledge to respond to the questions.

Table 3 Working Experience

	Consultants		Contractors	
	Frequency	%	Frequency	%
1-5years	9	19	9	15
6-10years	13	28	15	25
11-15years	15	32	21	35
16years & above	10	21	15	25
Total	47	100	60	100

In Table 3, majority of the consultants have work experience of between 11-15 years representing 32%, followed by 6-10 years with 28%. The respondents with the experience of 16 years and above are represented by 21%, and 1-5 years has 19%. On the contractors' side, 11- 15 years has the highest frequency of 35%. 6-10 years and 16 years and above each has percentage frequency of 25% While, 1-5 years has percentage frequency of 15%.

Table 4 Relationship between motivation, productivity and deliberation on incentives

Question	Consultants			Contractors		
	Agree	Disagree	Undecided	Agree	Disagree	Undecided
Relationship between employee level of motivation and productivity?	83%	17%	0%	100%	0%	0%
Would you agree to any management-employee deliberation before any type of incentives scheme is implemented?	71%	29%	0%	86%	14%	0%
Can motivational incentives result in optimum performance	87%	13%	0%	75%	25%	0%

In table 4, 83% of consultants indicated that there is relationship between motivation and productivity while 17% indicated contrary view. On the other hand, all the contractors (100%) affirmed that relationship exist between motivation and productivity. This signifies that, there is good relationship between employee levels of motivation and productivity.

On the deliberation on the incentive scheme, 71% of the consultants are of the opinion that there is need for deliberation/negotiation between parties on types of motivational incentive schemes to be implemented on employees, while 29% see it differently. On the contractors' side, while 86% agree that deliberation is necessary on types of motivational incentive scheme to be implemented 14% of the contractors did not see any need for deliberation. Higher percentage from the consultants and the contractors implies that deliberation/negotiation is important before any incentive scheme is implemented.

On whether motivational incentives results to optimum performance, 87% of the consultants agree and 13% disagree. On the side of the contractors, their responses show that 75% agree while 25% disagree. This signifies that good majority of the consultants and contractors agreed that motivational incentives lead to optimum performance of employees.

Table 5 Extent of employees' preference of monetary to non-monetary incentives

Question	Consultants		Contractor's	
	Frequency	%	Frequency	%
1. To a little extent	8	17	9	15
2. To a great extent	13	28	30	50
3. To a greater extent	26	55	21	35
4. I don't think so	0	0	0	0
Total	47	100	60	100

Based on table 5, 17% of the consultants indicated that employees prefer monetary to non-monetary incentives to a little extent, while 28% shows it is preferred to a great extent, another 55% shows it is preferred to a greater extent. On the contractors' side, 15% said it is preferred to a little extent, 50% said to a great extent and 35% said monetary incentives is preferred to a greater extent than non-monetary incentives. This signifies that the respondents prefer monetary incentives to non-monetary incentives.

The decision rule to table 6 below is based on the lower limit of the mean, thus: very effective 4.00-3.50; effective 3.49-2.00; partially effective 1.99 - 1.50; not effective 1.49 and below. Therefore, any mean score above 2.00 is considered as effective, while any mean score below 2.00 is considered as not effective (Onoh, 2013).

Table 6 Mean response of the respondents on the effectiveness of motivational incentives

S/N	Types of motivational incentives	Mean for Consultants	Decision	Mean for Contractors	Decision
1	End of year bonus	2.10	Effective	2.40	Effective
2	Accident free bonus	1.47	Not effective	2.25	Effective
3	Free medical bill	2.56	Effective	2.25	Effective
4	Increase in wages	3.43	Effective	3.10	Effective
	Bonus payment	1.73	Not effective	2.75	Effective
6	Conducive environment for work	1.67	Not effective	2.10	Effective
7	Timely payment	2.87	Effective	2.90	Effective
8	Praise of work effort	1.50	Not effective	2.00	Effective
9	Management of workers welfare	3.00	effective	2.95	Effective
10	Training and use of modern technique	3.43	effective	2.30	Effective
11	Job security assurance	3.10	Effective	2.50	Effective
12	Timely supply of adequate material	2.16	Effective	2.00	Effective
13	Cash reward for outstanding performance	2.50	Effective	2.50	Effective

Table 6 shows the mean response of the respondents on the effectiveness of motivational incentives. From the consultants' side, it indicates that the types of motivational incentives that are effective; increase in wages, training and use of modern techniques management of workers,' welfare, timely payment, and cash reward for outstanding performance. The table further indicates that; praise for work effort, favourable working environment and bonus payment are ineffective motivational incentives.

However, on the contractors' side, all the incentives are effective such as; increase in wages with mean score of 3.10, management of workers' welfare with a mean of 2.95, timely payment with a mean of 2.90, bonus payment with mean score of 2.75 and cash reward for outstanding performance with a mean of 2.50.

The decision rule to table 7 is based on the lower limit of the mean, thus: strongly agreed 4.50-5.00; agreed 3.50- 4.49; undecided 2.50 - 3.49; disagreed 1.50-2.49; strongly disagreed below 1.50. Therefore any mean score above 2.50 was considered as agreed, while any mean score below 2.50 was considered as disagreed (Onoh, 2013).

Table 7 Mean response of the respondents on the problems of motivational incentives

S/N	The problems of motivational incentives	Mean for consultants	Decision	Mean for contractors	Decision
1	Lack of advancement	3.60	Agreed	3.30	Agreed
2	incentive not usually prompt and timely	2.87	Agreed	2.50	Agreed
3	The incentives not always worthwhile	2.33	Disagreed	2.25	Disagreed
4	Non attention to non-monetary incentives	3.90	Agreed	3.05	Agreed
5	Lack of possibility of growth	2.93	Agreed	2.50	Agreed
6	Lack of good company policy	3.67	Agreed	2.75	Agreed
7	Inadequate extra payment	3.50	Agreed	2.60	Agreed
8	Lack of increase in salaries	2.70	Agreed	3.05	Agreed
9	Lack of fringe benefits	4.43	Agreed	3.25	Agreed
10	Lack of free education for managers	3.67	Agreed	2.80	Agreed
11	Lack of equity and fairness	3.47	Agreed	2.40	Disagreed
12	Lack of training among the workers	3.33	Agreed	2.75	Agreed

Table 7 shows the mean response of the respondents on the problems of motivational incentives. From consultants' side, the problems of motivational incentives in construction industry are; lack of advancement with mean score of 3.60, lack consideration to non-monetary incentives with mean score of 3.90, inadequacy of extra payment with mean score of 3.50 and lack of free education for managers with a mean score of 4.43. However, the consultants do not see sufficiency of incentives as a problem since it has a mean of 2.33.

On the contractors' side, lack of increase in salary with mean score of 2.70, lack of possibility of growth with mean score of 2.93, lack of advancement with mean score of 3.30 and lack of free education for managers with mean score of 3.25 are among the problems of motivational incentives. However, lack of equity and fairness and sufficiency of the incentive are not much of a problem in their opinion.

The decision rule to table 8 below is based on the lower limit of the mean, thus: strongly agreed 4.50-5.00; agreed 3.50-4.49; undecided 2.50-3.49; disagreed 1.50-2.49; strongly disagreed below 1.50. Therefore any mean score above 2.50 was considered as agreed, while any mean score below 2.50 was considered as disagreed (Onoh, 2013).

Table 8 Mean response of the respondents on the factors of low productivity

S/N	Factors of low productivity	Mean for consultant	Decision	Mean for contractor	Decision
1	Inadequate skill	3.56	Agreed	4.15	Agreed
2	Poor supervision of workers	3.06	Agreed	4.15	Agreed
3	Poor organization	3.27	Agreed	2.50	Agreed
4	Non-availability of machines	2.60	Agreed	3.50	Agreed
5	Lack of career growth path	4.00	Agreed	4.15	Agreed
6	Lack of motivational incentives	3.67	Agreed	4.00	Agreed
7	Shortage of skilled labour	3.30	Agreed	3.20	Agreed
8	Un-conducive environment	3.83	Agreed	3.75	Agreed
9	Delay in supply of materials	3.83	Agreed	4.25	Agreed
10	Lack of training to workers	3.33	Agreed	3.25	Agreed
11	Lack of adequate company policy	3.77	Agreed	4.20	Agreed
12	Additional task not normally part of work trade	3.60	Agreed	3.00	Agreed
13	Inadequacy of material	3.50	Agreed	2.80	Agreed
14	Ineffective communication between management and employees	3.83	Agreed	2.45	Disagree

Table 8 shows mean response of the respondents on the factors of low productivity. From the consultants' side, the factors of low productivity are shortage of skilled labour with mean score of 4.20, lack of motivational incentive with mean score of 4.00, lack of adequate company policy with mean score of 3.77, un-conducive working environment with mean

score of 3.83, then delay in supply of materials with mean score of 3.83 and lack of career growth path with mean score of 4.00. On the contractors' side, the respondents agreed on these factors of low productivity; inadequate skill with mean score of 4.15, poor supervision of workers with mean score of 4.15, lack of motivational incentives with mean score 4.00, lack of training to workers with mean score of 3.25 and shortage of skilled labour with mean score of 3.20. However, the respondents have disagreed that ineffective communication between management and employees (mean = 2.45) is a factor of low productivity.

The decision rule to table 9 below is based on the lower limit of the mean, thus: very important 4.00-3.50; important 3.49-2.00; partially important 1.50-1.99; not important 1.49 below. Therefore, any mean score above 2.00 was considered as important, while any mean score below 2.00 was considered as not important (Onoh, 2013).

Table 9 Mean response of the respondents on ways of minimizing low productivity

S/N	Ways of minimizing low productivity	Mean for consultants	Decision	Mean for contractors	Decision
1	Proving adequate working condition	2.50	Important	2.45	Important
2	Providing standard company policy	2.26	Important	2.00	Important
3	Qualitative technical supervision	2.17	Important	2.00	Important
4	Motivating construction workers	3.00	Important	2.25	Important
5	Good interpersonal relationship	2.67	Important	3.25	Important
6	Providing required material for workers	2.50	Important	2.17	Important
7	Avoiding delay and changes	2.50	Important	2.00	Important
8	Improving communication skill	2.17	Important	3.25	Important
9	Improving availability of machines	3.00	Important	2.00	Important
10	Providing adequate skill labour	3.00	Important	2.17	Important
11	Providing equity and fairness	3.00	Important	3.25	Important
12	Providing opportunity for promotion and self-development	3.00	Important	3.25	Important
13	Providing insurance on accident/death	3.00	Important	3.25	Important
14	Providing adequate training for workers	3.00	Important	3.25	Important

Table 9 shows the mean response of the respondents on ways of minimizing low productivity. On the consultants' side, the important factors of minimizing low productivity include; providing adequate working conditions with mean score of 2.50, improving availability of machines with mean score of 3.00, providing adequate skilled labour with mean score of 3.00.Providing adequate training for workers with mean score of 3.00. Improving communication skill with mean score of 2.17 and avoiding delay and changes with mean score of 2.50 are all considered as important. On the contractors' side, important ways of minimizing low productivity include; providing insurance on accident/death with mean score of 3.25, providing adequate training for workers with mean score of 3.25, good interpersonal relationship with mean score of 3.25 and avoiding delay and changes with a mean of 2.00. Quality of technical supervision with mean score of 2.00, providing required materials for workers with mean score of 2.17 and provision of standard company policies with a mean of 2.00 are all considered important.

DISCUSSION OF RESULTS

The most fundamental benefit that employees seek in the workplace according to (Hamukwaya, & Yazdanifard, 2014) is satisfaction, while employers seek maximum work performance. For these benefits to be attained, a relationship is necessary. This connection is indicated in table 4.4 which shows that employee level of motivation is related to productivity and the use of motivational incentives leads to optimum performance of employees. This result bears relation with Ou and Wang (2009) that rewards closely tied to key performance

measures will induce employees to perform above minimum expectations to maximize those performance measures and consequently maximize their pay level.

Finding in table 1.5 shows that employees prefer monetary incentives to non-monetary incentives. This is not surprising because the lower-level employees are at the physiological level of need according to Maslow hierarchy of needs and may not necessarily be in dire need of non-monetary incentive such as recognition. Wallace and Zeffane (2001), cited in Harunavamwe and Kanengoni (2013) reported that management depend upon rewards like money as the main factor of motivation because, money is a unique reward that can satisfy different needs such as physiological need for food. This is also in agreement with Arnolds and Venter (2007) whose findings show that financial rewards are the best motivators.

However, Harunavamwe and Kanengoni (2013) conducted a study which shows no significant relationship between monetary rewards and motivation. Non-monetary rewards according to Harunavamwe and Kanengoni (2013), have proved to be effective on lower-level employee, and suggested that non-monetary rewards be used to create a sincere focus of appreciation that is linked directly to compensation not necessarily motivation. So where deliberations are held as result indicates in table 4.4, management measures will be implementation of agreed incentives tailored towards meeting the desired performance. The management-employee deliberation underscores the need to identify and provide for the identified needs of the employees before implementation and also ensures that the incentives are timely and not misplaced. Furthermore, where discussions are held, apart from the sense of recognition accorded the employees, the motivation strategy serve to integrate workers needs into meeting the organization's need.

CONCLUSION AND RECOMMENDATIONS

The purpose of the study was to assess how labour motivational incentives affect productivity improvement in construction industry. The objective was to find an appropriate strategy for improving the productivity of labour in the industry. It was found out that providing adequate working condition, avoiding delays in supply of materials and enhanced salary package are among the motivational ways of improving labour productivity in construction works. It was therefore concluded that improving productivity is essential if the industry is to live up to its expectations in terms of project delivery on time, at the budgeted cost and the required quality of finished work. It was recommended that:

i. Management of construction companies should be concerned with the welfare of the workers. This will give the workers a sense of belonging and being appreciated and will make them to be more focused and committed to their work.
ii. Bonus payment should be used as motivators to increase performance of construction workers.
iii. Management of construction companies should provide favourable working conditions to their workers. This will reduce dissatisfaction with work on site.
iv. Regular payment of wages to operatives should be maintained. This will enhance their morale and thus increase their productivity.
v. The quality of technical supervision should be increased because when employees are not able to receive answers to job-related questions, they become frustrated.
vi. Good interpersonal relations among peers, supervisors, and subordinates should be encouraged.

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Effect of Socio-Economic Variables on Residential Land Accessibility in Owerri, Nigeria: A Gender Perspective

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ABSTRACT

Access to land for any type of development in the built environment is fundamental. Land defines the social, economic and political relations in the society and is the most crucial factor of production. Various means of gaining access to land since ancient times to the 21st century have ranged from first settlement, long time occupation, conquest, gift, inheritance, purchase and government allocation. This paper aims at revealing the sources of gaining access to residential land in Owerri by both male and female with a view to engendering appropriate policy response towards female housing ownership. The target population was home-owners in the core of Owerri. The sample size was determined from the 2006 population census figure of the Owerri Municipal Local Government Area using appropriate formula. A total of 396 questionnaires were administered to home-owners using stratified random sampling technique out of which 376 were found useful. Discriminant Function Analysis was used to determine which socio-economic variables were the best predictors of how access to land can be gained. Income, marital status and occupation emerged as the best predictors. The paper recommends public campaigns against gender discriminatory inheritance systems, joint titling of land documents by spouses and provision of enabling environment to boost informal employment which is predominant in the study area.

Keywords: Accessibility, Gender, Nigeria, Owerri, Residential land

INTRODUCTION

The centrality of land to any development in the human habitat cannot be over emphasized. Land is regarded as one of the most important factors of production without which development of any kind will be almost impossible. The ease with which individuals and organizations gain access to land goes a long way to determine the rate of development. Different factors interplay when it comes to the issue of gaining access to land especially in developing countries like Nigeria. Availability of finance is a major determinant of gaining access to land. An equally important factor affecting access to land is the societal perspective or norm of who should have access to land especially in traditional settings of Africa where gender distinction in access to land is prevalent. This paper reviews literatures on women access to land in different parts of Africa and examines the means through which males and females gain access to land in Owerri, Nigeria.

REVIEW OF LITERATURE

Gender Access to Land

Rights to land in Africa stem from many different sources, such as first settlement, conquest, allocation by government, long occupation or market transaction. In some cases, these rights are transferable to heirs or can be sold (Toulmin, 2006). Men gain access to land through being members of a social group, through labour and investment and through purchase (Shipton and Goheen, 1992). In Africa and South-Asia especially, women are systematically denied their human rights to access, own, control or inherit land and property. The vast majority of women cannot afford to buy land, and usually can only access land and housing through male relatives, which makes their security of tenure dependent on good marital and

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family relations (Marjolein, 2004). This is further authenticated by Kironde (2006) that "in many societies, women's claim to land within the customary systems is usually realized through men, as daughters, sisters but especially as wives. Such rights are known as secondary rights since they are of uncertain duration, are not well-defined and are subject to change based on maintaining good relations between parties." Property ownership, use and inheritance are regulated in practice in many African cultures by customary laws mostly unwritten but influential local norms that are based on gender distinctions (Okello, 2003).

Women's rights to land are also rights to use land not to control what to grow or the proceeds of the harvest. For instance, in Tanzania, as Kevane and Gray (1996) attest, women may have control over food banana trees but not over beer banana trees. They may also grow annual crops like maize, potato and beans but may not grow or own coffee trees. Toulmin and Quan (2000) reveal that in male-led societies, there is generally the fear that access of women to land may lead to increased independence of women. In Uganda, there is a stigma attached to a woman owning land. Such women used to be given little respect and it was believed that their marriage may not be stable. In Cameroon, men refuse to give their wives land for fear of losing their labour to work on their own fields. Women tend to be allocated less fertile lands and usually have smaller land holdings than men.

Duncan and Brant (2004) conducted a gender study in the Volta Region of Ghana on access to and control over land and found that ninety-six percent of women respondents indicated that both men and women had access to lineage, stool or clan land. A similar study was conducted by Owusu (2008) on land tenure dynamics in Volta and Central Regions of Ghana to determine the effect of gender and access to land on livelihood of males and females. Although gender did not have statistically significant effect, having access to land turned out to be the main determining variable for livelihood. This shows the importance of access to land.

Concept of Land Accessibility

There are four components of land accessibility which are availability of usable land, afforda bility of such land, ease of transaction with that land and security of the owner's right. For lan d to be said to be accessible to the end users, it must be physically available, economically aff ordable with ease of transaction and security of tenure (Ominrin, 2002; Bello, 2009). Accessi bility to land is significant for growth and poverty reduction in any society. Access to land an d security of tenure are necessary for people to raise and stabilize other income and to particip ate in economic growth. Physical overall supply of land within a geographical area is fixed w hile the demand for land is on the increase, leading to higher land values. Scarcity of land has been identified as one of the constraints of access to land and housing. To the Nigerian urban poor, the issue of affordability constitutes the major hindrance to land accessibility. The costs of land especially in urban areas are high and usually not affordable for low and medium inco me group. In this study, income is used as one of the predictors of how access to land is gaine d. Ease of transaction is related to the transferability of land right especially through purchase . Transferability of land is one of the qualitative parameters to measure access to land accordi ng to Komjathy and Nichols (2001).

RESEARCH METHODOLOGY

The setting for this paper is Owerri, the capital of Imo State. It is located in the eastern part of Nigeria. The people of Owerri are mainly Igbo tribe and the predominant culture of inheritance is patriarchy (Ajayi, Bello & Asaju, 2010).The study relied on the population figures of 2006 of the Owerri Municipal Local Government Area to which a formula for determining sample size was applied. Male and female respondents were sampled from

selected streets in the town using stratified and systematic random sampling techniques. The basic instrument for collecting needed data for this study was a set of questionnaire. Out of the 396 administered in Owerri, 376 were found useful for analysis. Discriminant Function Analysis was employed in order to determine the variables that are best in discriminating between groups of people based on how they gained access to land. The predictors or independent variables were the socio-economic characteristics of respondents which were sex, marital status, educational status, income level and occupation while the grouping or dependent variable was the means of gaining access to land namely purchase, inheritance, government allocation and gift. Mathematically, the model is given as:

$$d=a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5 \quad \text{(equation 1)}$$

where d= discriminant score

a = constant $b_1, b_2.....b_5$ = discriminant coefficients

x_1= sex x_2= marital status x_3= educational status

x_4= income level x_5= occupation

DISCUSSION OF RESULTS

Data were got on the socio-economic variables of respondents as well as the means of gaining access to land. These variables were used in the Discriminant Function Analysis as the predictors and grouping variables respectively. The distribution of respondents is presented on a gender basis in Table 1.

Table 1: Socio-Economic Variables of Respondents

Response	Male	Female	Total
Marital Status			
Single	53(17.3)	12(17.1)	65(17.3)
Married	211(69.0)	38(54.3)	249(66.2)
Divorced	12(3.9)	2(2.9)	14(3.7)
Separated	13(4.3)	5(7.1)	18(4.8)
Widowed	17(5.5)	13(18.6)	30(8.0)
Total	**306(100.0)**	**70(100.0)**	**376(100.0)**
Education			
No formal education	25(8.2)	7(10.0)	32(8.5)
Primary education	19(6.2)	6(8.6)	25(6.7)
Secondary education	84(27.5)	16(22.9)	100(26.6)
Tertiary	161(52.6)	40(57.1)	201(53.5)
Total	289(94.4)	69(98.6)	358(95.2)
Missing	17(5.6)	1(1.4)	18(4.8)
Total	**306(100.0)**	**70(100.0)**	**376(100.0)**
Monthly income			
20,000 and below	65(21.2)	25(35.7)	90(23.9)
21-40,000	70(22.9)	11(15.7)	81(21.5)
41-60,000	78(25.5)	8(11.4)	86(22.6)
61-80,000	31(10.1)	8(11.4)	39(10.4)
Above 80,000	291(95.1)	65(92.9)	356(94.7)
Missing	15(4.9)	5(7.1)	20(5.3)
Total	**306(100.0)**	**70(100.0)**	**376(100.0)**
Occupation			
Civil service	95(31.0)	20(28.6)	115(30.6)
Self-employment	99(32.4)	24(34.3)	123(32.7)
Private sector employment	58(19)	16(22.8)	74(19.7)
Retired	37(12.0)	5(7.1)	42(11.2)
Others	6(2.0)	2(2.9)	8(2.1)
Total	295(96.4)	67(95.7)	362(96.3)
Missing	11(3.6)	3(4.3)	14(3.7)
Total	**306(100.0)**	**70(100.0)**	**376(100.0)**

Table 1 show that there were 306 male respondents and 70 females. The predominant marital and educational status of home owners was married and tertiary education respectively. The

highest percentage of income range (94.7%) was above N80000. Self employment was predominant for both genders, closely followed by private sector employment.

Table 2: Gender Distribution of the Means of Access to Land/ Housing

Response	Male	Female	Total
Purchase	136(44.4)	39(55.7)	175(46.5)
Inheritance	158(51.6)	27(38.6)	185(49.2)
Gift	6(2.0)	1(1.4)	7(1.9)
Government allocation	6(2.0)	3(4.3)	9(2.4)
Total	**306(100.0)**	**70(100.0)**	**376(100.0)**

Table 2 reveals that inheritance was the major means of gaining access to land in Owerri (49.2%). For male, inheritance was the greatest means of access to land and housing (51.6%) while only 38.6% of female home-owners got access through inheritance. More than half (55.7%) of female home-owners got access through purchase. Access through gift and government allocation was generally low in the study area.

The DFA was used to determine the best predictors of access to land and housing in the study area. Out of the 376 respondents, 326 (86.7%) were valid enough to be used for the Discriminant Function Analysis. 13.3% were excluded because there was at least one missing discriminating variable. The results of the DFA are in the next tables:

Table 3 Eigenvalues

Function	Eigen values	% of Variance	Cumulative %	Canonical Correlation	Proportion of variance (R^2) %
1	.215[a]	92.9	92.9	.421	17.7
2	.012[a]	5.1	97.9	.108	1.2
3	.005[a]	2.1	100.0	.069	0.5

Table 3 shows the efficacy of the Discriminant function. The canonical correlation of 0.421 for Function 1 suggests the model explains 17.7% of the variation in the grouping variable that is whether a home - owner gets access to land through purchase, inheritance, government allocation or gift. Function 2 and 3 having canonical correlations of 0.108 and 0.069 suggests the model explains 1.2% and 0.5% of the variation respectively.

Wilks' Lambda indicates the significance of the Discriminant functions and provides the proportion of total variability not explained.

Table 4 Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1 through 3	.823	67.681	15	.000
2 through 3	.984	5.271	8	.728
3	.995	1.531	3	.675

In Table 4, only function 1 indicates a highly significant function ($p < .000$) and provides the proportion of total variability not explained, i.e it is the converse of the squared canonical correlation which gives 82.3%.

In the standardized canonical discriminant function coefficients table, the variables with the largest coefficients stand out as those that strongly predict allocation to the group.

Table 5: Standardized Canonical Discriminant Function Coefficients

	Function		
	1	2	3
Gender	.306	-.035	-.377
Marital status	.430	.846	.265
Educational level	.132	-.099	-.414
Occupation	-.231	-.280	.696
Income level	.875	-.301	.433

In Function 1, income level score was the strongest predictor (0.875), in Function 2, marital status score was strongest (0.846) while occupation score (0.696) was strongest in Function 3. This means that income level, marital status and occupation were more successful as predictors in allocating to the four groups of how land was acquired.

Table 6: Cross Tabulation of Means of Access to Land/ Housing and Occupation

Occupation	Purchase	Inheritance	Gift	Government allocation	Total
Civil Service	62(35.8)	51(28.3)	0(0.0)	2(100.0)	115(31.8)
Self-employment	51(29.5)	66(36.7)	5(71.4)	0(0.0)	122(33.7)
Private sector employment	44(25.4)	28(15.6)	2(28.6)	0(0.0)	74(20.4)
Retired	16(9.3)	26(14.4)	0(0.0)	0(0.0)	42(11.6)
Others	0(0.0)	9(5.0)	0(0.0)	0(0.0)	9(2.5)
Total	173(100.0)	180(100.0)	7(100.0)	2(100.0)	362(100.0)

The type of occupation of homeowners affected the means through which they gained access to land. Civil service or formal employment provides enlightenment and access to information on the availability and procedure of allocation of government land. Hence, it was found that the two respondents (100%) who got access through government allocation were civil servants. Self- employment had the greatest percentage of 36.7% for access through inheritance and it was the highest employment type that was predominant in the town. This reveals the importance of the informal sector to the Nigerian economy.

Table 7: Cross Tabulation of Means of Access to Land/Housing and Marital Status

Marital Status	Purchase	Inheritance	Gift	Government allocation	Total
Single	21(11.9)	41(21.6)	2(28.6)	1(33.3)	65(17.3)
Married	118(67.0)	129(67.9)	1(14.3)	1(33.3)	249(66.2)
Divorced	10(5.7)	3(1.6)	1(14.3)	0(0.0)	14(3.7)
Separated	9(5.1)	5(2.6)	3(42.9)	1(33.3)	18(4.8)
Widowed	18(10.2)	12(6.3)	0(0.0)	0(0.0)	30(8.0)
Total	176(100.0)	190(100.0)	7(100.0)	3(100.0)	376(100.0)

66.2% of respondents were married and inheritance (67.9%) and purchase (67%) were the predominant means of gaining access to land in the study area. This shows that inheritance is a major means of gaining access to land in Owerri; which is mainly patriarchal.

Table 8: Cross Tabulation of Means of Access to Land/Housing and Monthly Income

Monthly Income	Purchase	Inheritance	Gift	Government allocation	Total
20,000 and below	18(10.6)	38(21.6)	3(42.9)	0(0.0)	59(16.6)
21-40,000	33(19.4)	56(31.8)	1(14.2)	0(0.0)	90(25.3)
41-60,000	28(16.5)	49(27.8)	3(42.9)	2(66.7)	82(23.0)
61-80,000	56(32.9)	30(17.1)	0(0.0)	0(0.0)	86(24.2)
Above 80,000	35(20.6)	3(1.7)	0(0.0)	1(33.3)	39(10.9)
Total	170(100.0)	176(100.0)	7(100.0)	3(100.0)	356(100.0)

Table 8 reveals that 32.9% of home owners who got access to land through purchase were in the medium income group of ₦61- 80000 while 10.6% were in the least income group. Income is a major factor in land purchase and housing development.

CONCLUSION AND RECOMMENDATIONS

This study has examined the socio-economic variables that affect how access to land was gained by both males and females in Owerri. Using the Discriminant Function Analysis to determine the variables that best predict how access to residential land was gained, findings showed that occupation, income and marital status were the best predictors. This study is of

importance in advising policy makers and citizens in the study area on the issue of gaining access to land. The paper has revealed that majority of people who gained access to land through purchase were involved in informal sector of the economy (mainly self employment). This confirms the fact that the informal sector of the economy is very vital in contributing to economic growth of the nation. It therefore recommends the provision of enabling environment (such as stable power supply, access to microfinance for SMEs) to boost informal employment which is predominant in the study area. This will in turn increase the income level of the citizens and enable them to access land for housing development. The paper recommends public campaigns against gender discrimination in inheritance systems that inhibit women land rights. Joint titling of land documents by spouses as most respondents are married is also recommended to ensure that the titles of especially the wives are secured and safe from property grabbing by in-laws (Ajayi and Olotuah, 2005) This phenomenon of property grabbing at the demise of the household head by his relatives is prevalent in the Igbo culture and constitutes a hindrance to women's access to land and housing.

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Cost and Value Management in Projects

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ABSTRACT

The key features that define project success are twofold: managing costs to achieve efficiencies, and creating and enhancing value. These two elements enable project stakeholders to understand the activities and resources required to meet project goals, as well as the expenditures necessary to complete the project to the satisfaction of the customer. Unfortunately, in the field of project management today, significant cost and schedule overruns are the norm, rather than the exception. The document clearly delineates the objectives and requirements of the project, and identifies key activities in broad terms. Forecasting methods for projects fall into two broad categories: qualitative and quantitative. Qualitative methods are used where no reliable, historical, or statistical data are available. Quantitative techniques, on the other hand, are appropriate in project situations where measurable, historical data are available and are usually used in forecasting for short or intermediate timeframes. These techniques can be classified into two broad categories: time series analysis and causal methods. It should be evident that achieving project success hinges on effectively managing both project costs and value. The discussions, however, focused on the various issues and approaches to individually managing these two critical project success factors. We begin our discussion with the concept of a project value chain, which demonstrates the inseparable and interwoven nature of project costs and value. We present various approaches to simultaneously managing cost and value to achieve project success. To effectively manage for cost and value, a cross-functional mindset must prevail throughout the organization, so that ideas, alternatives, and creative solutions have the widest possible arena for exploitation.

Keywords: Cost Management, Value Management, Cash Flow Management, Project Budgeting, Quality Management

INTRODUCTION

The past 30 years have witnessed a dramatic increase in the number and variety of organizations engaged in project-based work. In addition to ‘‘traditional’’ project-oriented industries, like construction, aerospace, and pharmaceuticals, service industries as diverse as finance, utilities, telecommunications, and insurance are beginning to embrace project-based ventures.(AP Wire Reports, January 25, 2007)

This paradigm shift is due to growing recognition that projects and their effective management can provide organizations with a significant competitive edge through cost reduction, enhanced responsiveness, and overall value to customers. Consequently, a number of organizations have adopted many of the well-known techniques of project management, and professional project management organizations have witnessed marked increases in membership.

Despite this enormous interest in projects and project management practices, success rates in many industries are at alarmingly low levels. In addition, bad news about high-profile projects continues to dominate the headlines—in both the public and private sectors. Consider these recent examples:

Importance of cost and value management in projects

The key features that define project success are twofold: managing costs to achieve efficiencies, and creating and enhancing value (*Wall Street Journal*, January 16, 2007). These

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two elements enable project stakeholders to understand the activities and resources required to meet project goals, as well as the expenditures necessary to complete the project to the satisfaction of the customer.

Unfortunately, in the field of project management today, significant cost and schedule overruns are the norm, rather than the exception (Pinto, J. K. (2007)). In fact, recent research that examined the success rates of information technology (IT) projects indicates that the majority of these projects neither met their cost objectives nor delivered the promised value. For example:

i. In a study of 300 large companies, consulting firm Peat Marwick found that 65 percent of hardware and/or software development projects were significantly behind schedule, were over budget, or failed to deliver value in terms of expected performance. (Millet, I. and Pinto, J. K. (1999)
ii. In a report on the current state of IT project implementation, the Standish Group predicted that out of a total of 300,000 projects that cost over $350 billion, approximately 43 percent will overshoot their initial cost estimates, while 63 percent will fall behind schedule and perform at only two-thirds of their expected capability. In other words, these projects will meet neither their cost nor their value objectives.(Standish Group (2001)

Why do these problems persist, despite the fact that tools for cost efficiency and value enhancement are widely used, and their benefits are well understood? One key answer is the lack of an integrated cost and value management framework. (Garvin, D. A. (1992)

Before we explore this integration of cost and value, a brief discussion of their concepts in relationship to projects is worthwhile. Both require well-defined and structured management processes, commonly referred to as cost and value management. Project cost management focuses on issues such as cost estimation and budgeting, cash flow management, and cost control. On the other hand, the emphasis of value management is on optimizing project value—given cost, time, and resource constraints—while meeting performance requirements such as functionality and quality.

Cost and value management remains a critical but often underrepresented issue for a couple of reasons. First, in this book, we define value as the relationship between meeting or exceeding the expectations of project stakeholders, as well as the resources expended to meet or exceed those expectations. This definition clearly implies that project cost and value are inextricably linked, to the point where any attempt to enhance project value without a thorough understanding of its impact on cost and associated trade-offs is meaningless.

Second, project value is a multidimensional concept. Different project stakeholders with different vested interests have different perceptions about what constitutes value to them. For example, the expectations of top management often leave IT project teams scrambling to complete projects as quickly as possible. Internal customers, however, may request additional features that will delay completion. Each stakeholder sees value in the finished project; however, the measures they use to determine value can actually conflict. And yet, despite these differences, the one constant in any attempt to enhance project value is its cost ramifications. The inability to clearly understand this complex relationship between project cost and value is one of the primary reasons why it is an under-represented issue. The following case example illustrates this point.

Keys to effective project cost management

Effective project cost management is an extremely complex process that begins very early during a project life cycle, and long before its actual start. Among the factors that influence

success is a reasonable and accurate system for estimating costs (Turner, J. R., and Simister, S. J. (2000). Table 1 drawn from Rodney Turner's work, highlights some of the most important considerations when creating a cost estimation system.

Keys to effective cost estimation are:

i. A clear, complete, and unambiguous definition of the project and the scope of work involved
ii. A thorough assessment of the potential risks involved, with well-thought-out action plans to minimize their possible impact
iii. A well-trained and competent project manager
iv. A thorough understanding, by all stakeholders, of the various types of costs that are likely to be incurred throughout the life of the project
v. A project organizational culture where there is a free flow of com-munication, so that all project participants clearly understand their responsibilities
vi. A well-defined project work structure where work packages are broken down into manageable sizes
vii. Meaningful budgets, where each work package is allocated its appropriate share of the total budget, commensurate to the work involved
viii. An accounting system and coding scheme that are well aligned with the work breakdown structure and are compatible with the organization's management information system
ix. A cost accounting system that will accumulate costs and allocate them to their relevant cost accounts as and when they are incurred
x. A prioritized and detailed work schedule, drawn from the work break-down structure, which assigns and tracks the progress of individual tasks
xi. Effective management of well-motivated staff, to ensure that progress meets or beats the work schedule
xii. A mechanism for comparing actual and planned expenditures for individual tasks, with the results extrapolated to cover the entire project
xiii. The ability to bring critical tasks that are late back on schedule, including providing for additional resources or taking other prompt remedial measures
xiv. Adequate and effective supervision to ensure that all activities are done right the first time.
xv. Supervision of staff time sheets so that only legitimate times are booked to various cost codes
xvi. Proper drafting of specifications and contracts
xvii. Discreet investigation to confirm that the customer is of sound financial standing, with sufficient funds to make all contracted payments
xviii. Similar investigation, though not necessarily as discreet, of all significant suppliers and subcontractors (especially those new to the contractor's experience)
xix. Effective use of competitive tendering for all purchases and subcontractors to ensure the lowest cost commensurate with quality and to avoid committing to costs that exceed estimates and budgets
xx. Proper consideration and control of modifications and contract variations, including charging all justifiable claims for price increases to the customer
xxi. Avoidance of all nonessential changes, especially those for which the project customer will not pay
xxii. Proper control of payments to suppliers and subcontractors to ensure that all invoices and claims for progress payments are neither overpaid nor paid too

soon

xxiii. Recovery of all incidental expenses allowed for in the contract charging structure (for example, expensive telephone calls, special printing and stationery, travel, and accommodation)

xxiv. Proper invoicing to the customer, ensuring that claims for progress pay-ments or cost reimbursements are made at the appropriate times and at the correct levels, so that disputes that could delay payments do not arise

xxv. Effective credit control to prevent payments from the customer from becoming long overdue

xxvi. Internal security audits to help prevent losses through theft or fraud

xxvii. Regular cost and progress reports to senior management, highlighting potential schedule or budget overruns in time for corrective action to be taken

xxviii. Cost-effective design, perhaps using value engineering

xxix. Prompt action to close off accounts at the end of the project, to prevent unauthorized time bookings and other items from being charged to the project (Turner, J. R., and Simister, S. J. (2000)

While this list is not all-inclusive, its elements do have a significant influence over the effectiveness of cost management for projects large and small. Of more immediate interest is the sheer complexity and breadth of an effective cost estimation system, suggesting that organizations intent on controlling their costs need to recognize that there is no such thing as a simple, quick fix. Rather, downstream project cost management rests heavily on the care and accuracy of detailed estimation occurring early in the project.(Pinto, J.K and Venkataraman,R.R Copyright 2008). As the old saying suggests, ‘‘we can’t fix what we can’t see.’’ Taken one step further, we can’t control what we did not plan for!

Essential features of project value management

‘‘Project value’’ refers to the relationship between the needs of different project stakeholders and the resources used to satisfy them. What constitutes project value, however, can be hard to pin down, because different stakeholders have different views. The challenge of value management is to understand and reconcile these differences.

Essentially, value management focuses on enhancing project value, given cost and time constraints, without any negative impact on the project facility’s functionality, reliability, or quality.(Ibid) Effective project value management includes the following key features (Ibid):

i. *Careful analysis and identification of project needs and scope*—the first step in effective value management lies in a clear project definition and scope analysis.

ii. *Thorough planning of the project and subsequent work* - Effective planning helps to ensure that the project is developed to maximum cost efficiency with no unnecessary steps or wasted effort.

iii. *Identification of key areas of opportunities that can influence project value*—The project team’s goal is to enhance positive features of the project while keeping control of costs. Carefully weighing the cost/benefit analysis for a project is the key to enhancing value.

iv. *Development of alternatives for exploiting the identified opportunities for improving project value*—Multiple paths may be available for enhancing value, some of which are cost effective than others.

v. *Evaluation of alternatives; development of proposals and action plans*—performing a clear trade-off analysis can help create alter-natives and select the best choices for improving value.

vi. *Use of a performance monitoring system for tracking project value*— The project team must have the means to accurately monitor the project, gain timely and

actionable information, and make ‘‘on-line’’ decisions and choices among alternatives.

vii. *Ensure a free flow of communication that cuts across organizational boundaries*—to effectively manage for value, a cross-functional mindset must prevail throughout the organization, so that ideas, alternatives, and creative solutions have the widest possible arena for exploitation.

Integrating Cost and Value in Projects

It should be evident that achieving project success hinges on effectively managing both project costs and value. The discussions will, however, focus on the various issues and approaches to *individually* managing these two critical project success factors. My goal, therefore, is to unify the concepts and processes of project cost and value management so that these two vital decision areas can be treated as an integrated whole.

I begin this discussion with the concept of a project value chain, which demonstrates the inseparable and interwoven nature of project costs and value. In subsequent sections, I will present various approaches to simultaneously managing cost and value to achieve project success.

The project value chain

The concept of ‘‘value chain’’ was first articulated by Michael Porter (Porter, M. (1985). The essence of Porter’s value chain concept is that an organization needs to manage a set of basic activities to create value that in monetary terms is greater than the cost of providing the organization’s product or service. The end result of effectively managing these activities is that the organization generates a profit margin and sustains its competitive advantage in the marketplace. The figure below presents the basic model of Porter’s value chain.

In Porter’s value chain model, there are two distinct sets of activi-ties: primary activities and support activities. In a typical organization, primary activities are directly responsible for creating or delivering the product or service. They comprise inbound logistics, operations, outbound logistics, marketing and sales, and service. The support activities that are linked to each of these primary activities help to improve their effective-ness or efficiency. Support activities can be grouped into procurement, technology development (including R&D), human resource management, and infrastructure (systems for planning, finance, quality, information management, etc.).

Value chain analysis evaluates the value that each particular activity adds to the organization’s products or services. The goal is to make it possible to produce a product or service that delivers the value customers want, and for which they are willing to pay a price. Porter contends that the ability to perform these specific activities and to manage the linkages between them is a source of value and competitive advantage to the firm (Recklies, D. (n.d.).

Project value chain analysis provides an entirely different perspective on what constitutes project success. While the traditional measures of project success, such as schedule, cost, and technical validity, are still relevant, project value is much more than these internal measures, and ultimately it is the customer who determines that value. In project management, the adoption of the value chain concept offers considerable potential for ensuring that projects meet the unique needs of customers.

A basic model of the project value chain is presented in Figure 1. It is similar to Porter’s value chain model in that the project value chain is also composed of primary and secondary activities.

The primary activities are procurement and inbound supply chain management, project design or fabrication, and project delivery or installation. All of these activities are directly

responsible for creating the project's facility, and therefore, project value. Secondary activities include the project infrastructure, management information, and human resource management systems.

The critical elements of the project infrastructure that enhance or optimize project value are cost management, scope management, schedule management, quality management, configuration management, and change control systems. Within the project infrastructure, cost management is an umbrella system that is concerned with all cost-related subsystems such as accounting and finance, and all cost-related activities such as project cost estimation, budgeting, and cost control.

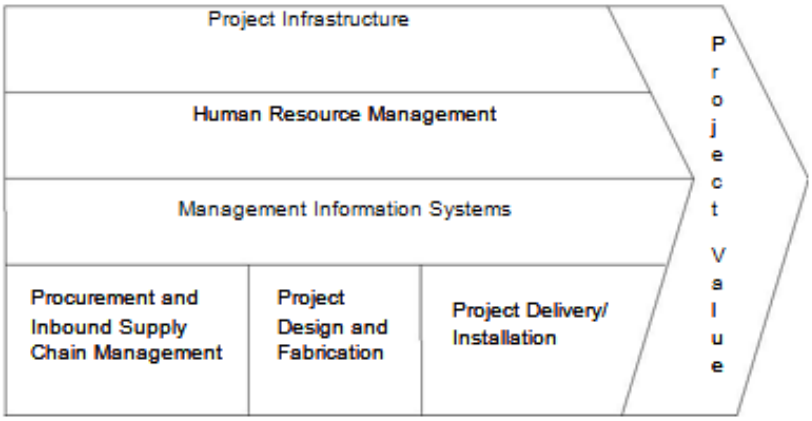

Fig. 1 Project value chain

Project value chain analysis

The primary thrust of project value chain analysis is to help companies understand, without any ambiguity, how they can create and deliver the value that is most critical to the customer and their activities. A project organization that can successfully accomplish this goal has a clear competitive advantage. An important prerequisite of a successful value chain analysis is that the company has thorough knowledge of not only its own strengths and weaknesses, but also those of the potential customer. Armed with this knowledge, the project organization is better equipped to address the unique and critical needs of the customer's business operations.

Performing a successful value chain analysis requires the following four steps:

Step 1*: Construct a value chain that is unique to the customer*—because each project is unique, the first step in developing a value chain is for the project organization to clearly understand its role in the customer's value chain. To review, a project value chain consists of a sequential chain of activities that begins with acquisition of raw materials from suppliers, progresses through the development of the project, and concludes with the delivery of the completed project to the customer. While each activity in the chain has the potential to add value, the key role of the project organization in the value-adding process is to provide superior quality at lower costs and risks by effectively designing and fabricating the project facility.

To develop a meaningful value chain strategy, the project organization should be fully aware of the areas in which they can make the most significant contributions that will benefit the customer. This requires that the project firm clearly understand its own competitive strengths—the activities that the organization does well, and that can add value. For example, one project organization may use superior technology and design capabilities to add value to client operations, while another may enhance value by using global links to suppliers and distribution capabilities to acquire high-quality raw materials at a lower cost.

Conversely, the project organization also needs to understand its weaknesses—those activities that it does not do well relative to the competition. The key is to recognize areas where the project organization can best use it competitive strengths, instead of attempting every aspect of the client's operations.

***Step 2**: Identify the client's value drivers*—At this step, value analysis should focus on identifying the activities and linkages of client operations that distinctly add value and are sources of competitive advantage for the client. For example, the focus should be on activities that enable the client to achieve a cost advantage or produce a distinctly unique product, which are value drivers that create differentiation. By focusing on the client's value drivers, the project organization can develop project design choices that can provide the customer with maximum competitive benefits.

***Step 3**: Clearly identify the weaknesses of the project organization*—to develop and deliver a successful project, it is necessary that the project organization be superior in every aspect of the project. However, the project organization cannot provide value enhancement in every aspect of the client's project—there will be areas in which the project firm is clearly not superior to the competition. The key is to recognize those activities in which the firm is inferior and operates at a competitive disadvantage, and to outsource them to those who can do them well. As long as the project organization can provide the client with a source of competitive advantage by engaging in activities where it can enhance value, while at the same time eliminating the sources of competitive disadvantage, the end result will be a successful project that can reap superior returns both for the client and the project firm.

***Step 4**: Target the activities and linkages that have the greatest impact on project value*—In the final step of the project value chain analysis, the project organization and the client should come to clear understand-ing of the options and alternatives for activities where maximum value enhancement can be achieved, and for activities that require improve-ment. This will ensure that sources of competitive disadvantages can be eliminated. It is in this final step of value chain analysis that the project organization can set the stage for achieving project excellence. To do so requires two things: first, the project firm must view project success from the client's perspective, instead of through the usual parameters of time, budget, and specifications. Second, the project firm must develop a partnership with the client so that it can play an active role in the success of the overall project, rather than playing the passive role of a contractor fulfilling a contractual obligation.

Table 1 Strategies for integrating cost and value

S/N	Method	Advantages	Examples
1.	Inbound supply chain management	Primary means to minimize costs through vendor management	Kaizen, international sourcing, reverse auctions, project partnering
2.	Project design	Allows integration of cost and value through enhanced design, creative problem solving, and collaboration	Value engineering, concurrent engineering, Kano modelling
3.	New product development	Links procurement and design to new product development, allows for gated reviews, rapid product modification response	Total quality management (TQM), Six Sigma, lean manufacturing, target costing
4.	Project delivery	Enhances value to customer through	Life cycle costing, turnkey project management

Project Cost and Value Integration process

There are some essential prerequisites to the process of integrating project cost and value. First, it requires a team approach, with representation from all project stakeholders, including the client, project team, designers, people responsible for implementing the project facility,

and all potential users. In essence, the team should be composed of all stakeholders who are knowledgeable about the project and have decision-making authority. It would helpful at this stage to bring the team together for ‘‘creative’’ workshops to generate ideas for integration. Second, the team should be willing to think ‘‘out of the box,’’ utilize imagination, and forego the penchant to exercise pet solutions. Third, the team should focus on overall project objectives, targeting only those areas that are likely to yield maximum benefits. Finally, the team should be led by an experienced, cost-oriented project management facilitator.

The objective of project cost and value integration is to obtain, for each activity selected for analysis, the optimum value for every dollar spent. The process involves a sequence of five steps.

i. *Generate information*—the objective of this step is to come up with an information base, or ‘‘cost model,’’ and to select areas or activities in the project for detailed study. For each project activity, information should be generated by asking the following questions:
   a. What is the exact nature of this activity?
   b. What is the activity intended to accomplish?
   c. What is the cost of performing this activity?
   d. What is the potential value generated by this activity? (i.e., is this activity necessary?)
   e. Is there another alternative than to do the same job, and at what cost?

   Some of the techniques that can be useful in answering these questions are functional analysis and cost–benefit analysis.

ii. *Generate alternatives*—the objective of this step is to generate creative alternative solutions. For each project activity, think about alternative ways of meeting the same requirements or performing the same functions. Brainstorming sessions by the project cost and value integration team can generate many new ideas.

iii. *Perform analysis*—the objective of this step is to evaluate each of the alternatives generated in the previous step, culminating in the selection of the one that presents the best combination of cost savings and required value. The appropriate questions to ask at this stage are
   a. Which of the alternatives will meet essential functionality requirements?
   b. What is the cost of each alternative
   c. Which will meet essential functions and still offer the greatest cost savings?

iv. *Generate a proposal*—the objective of this phase is to present the best sets of alternatives for achieving cost and value integration to appropriate decision makers. An important caveat in this step is to create a proposal that is most convincing, and to present it in the most effective way possible. A combination of techniques, such as narrative reports, schematic displays, graphic illustrations, and video clips of similar installations can be used to accomplish this.

v. *Issue a final report*—finally, at the last stage it is important to define and, if possible, quantify the results in terms of which recommendations were actually approved and implemented. Techniques such as standardized comparative reporting can be useful in generating the final report.

CONCLUSION

In the final analysis, integrating cost and value in a project cannot be viewed as a short-term, quick-fix solution. It is an ongoing improvement process that requires the total commitment of all project stakeholders, and, in particular, the commitment of the project organization’s

top management. To accrue long-term benefits, the process should be started very early in the project and should continue throughout its life cycle.

In other words, as we have attempted to show, cost and value management do not begin with the commencement of the actual project planning and execution. Rather, the seeds for successful cost and value management are sown much earlier in the project's life, during procurement and supply chain development, and they run well past the point of project completion. In fact, cost and value management involve a number of critical delivery activities as the project is transferred to its intended users. Thus, in understanding project cost and value management, it is first important to adjust our thinking toward Morris's ''management of projects'' paradigm.

Likewise, it is critically important to understand that successfully managing for value requires us to embrace a systems thinking perspective. Certainly, we can find ways to occasionally ''save money'' on our projects, or find features that add value as we move through a development cycle. However, the theme of this paper is to avoid a disconnected, fragmented mindset that treats cost and value management as issues to be addressed when it's convenient to do so.

The key is to understand that a model for cost and value management in projects involves a systematic, life-cycle philosophy based on their integration and used as an ongoing feature. This paper has attempted to offer just such a framework for systematically integrating these two critical elements in successful projects: cost management and creation of value. An unyielding commitment to this process is vital for developing the kinds of projects that will provide our firms with a decided competitive advantage.

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Challenges facing the Sustainability Operations of Vehicle Inspection Officers in Abuja, Nigeria

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ABSTRACT

The need for vehicle inspection operations in Nigeria is fundamentally to ensure vehicles meet all safety requirements. This will ensure sustainable movement on roads characterised with reduced environmental effect and traffic problems. This study therefore examines the challenges facing the sustainability of the operations of Vehicle Inspection Officers (VIO) under the Directorates of Road Traffic Services (DRTS) in Abuja, FCT Nigeria. The study made use of secondary data collected from the records of the DRTS on the number and status of vehicles inspected in the city from 2007 – 2014, and primary data collected through questionnaire survey randomly administered to a total of 107 respondents on the challenges facing sustainable vehicle inspection operations in Abuja. The study employed descriptive and a combination of factor and regression analysis as techniques for data analysis. The result of the factor analysis showed manpower shortage (76.3%) and inadequate equipment (87.6%) as the most significant challenges facing sustainable operations of vehicle inspection officers in Abuja. The results point out the need for recruitment of more vehicle inspection officers, as well as provision of equipment needed to assist the operations of the officers.

Keywords: Vehicle, Inspection, Traffic, Abuja, Sustainability

Introduction

Transportation had constantly played a dynamic role in the development of any nation. This is based on fact that the primary function of transportation is to move passenger or goods from a place of lesser value to a place of higher value (Oyerinde and Aregbesola, 2008). There are various modes of transportation and each with own its attendant problems, although the level of the problems may be reduced by certain level of measurement. In Nigeria, road transport sector remains the dominant mode for movement of goods and services. Road transport accounts for 99% of all domestic freight and passenger movement. Despite the huge Investments, the roads mode is still characterized by poor performance in term of vehicle administration, poor physical condition of the road infrastructures, level of service, traffic and safety regulation (Filibus, 2012). Oyerinde and Aregbesola, **(**2008) noted that the efficiency of road transportation relies heavily on the type and condition of vehicle under use, the road condition, the driver's competence, the attitude of the driver to traffic engineering, control, management as well as the policy strategies that give directions to the whole transport system.

It has been argued extensively that improper vehicle inspection before used on road often results to accidents (Aruwa, 2014; Gana and Emmanuel, 2014). In agreement with the above, Oyeyemi (2003) opines that drivers operate mechanically deficient vehicles on the roads, carrying passengers and property without safety consideration may result to accident. Such vehicles are not road worthy and they do not meet minimum safety standards. However, vehicle inspection is a process authorized by national or subnational governments in many countries of the world, through which a vehicle is inspected to ensure that it conforms to regulations governing safety, emissions, or both to ensure life and property for effective

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traffic movement (Aruwa, 2014). In Nigeria, proof of inspection is required before a vehicle is registered or vehicle License can be renewed. According to Filibus, (2012) vehicles are supposed to be driven and maintained by a driver in accordance with the road traffic regulations. The purpose of vehicle inspection, whether the vehicle is a public, private or commercial, is to find out whether the vehicle is mechanically sound as the Law requires. The laws requires certain standards of efficiency of most mechanical components of a vehicle to ascertain the level of it safety such component are the brakes, lights, horn, steering, windscreen, wipers, mirrors, exhaust pipes, tyres etc. According to the author all the above components must be inspected before vehicle registration and must be dually conducted by the vehicle inspection officers.

Alade (2012) identified the function of vehicle inspection officers to include the following: inspect and certify vehicle before registration or renewal of vehicle particulars, collaboration with companies with large fleet for onsite vehicle inspection to ensure compliance that will enhance safety on roads, patrols on roads and highway to carry out routine checks and enforce compliance. This can be achieved through effective enforcement through vehicle impoundment and payment of fines. Unfortunately this has been hampered as a result of corrupt practices among officers in the country (Alade, 2012). The issue of poor funding was identified by Aruwa (2014) as major challenge facing vehicle inspection operations in Nigeria. Consequently, Alade (2012) also noted that over focusing on the revenue generating aspect of vehicle inspection operations at the expense of safety standards constitutes a major problem facing vehicle inspection offices. This paper aims at examining the challenges facing the sustainability operations of vehicle inspection officers using the Directorate of Road Traffic Services (DRTS), Abuja, Nigeria. The study is an attempt to look at the challenges of officers rather than the overall organisational challenges of vehicle inspection which has been the focus of many studies.

METHODOLOGY

The study relied on both primary and secondary sources of data collection. Secondary data were extracted from the records of DRTS on the number and status of vehicles inspected in Abuja from 2007 – 2014. The primary data made use of survey of vehicle inspection officers (VIO) who are staff of the Department of Road Traffic Services (DRTS) of the Federal capital Territory (FCT), Abuja, through questionnaire administration. A total of 242 vehicle inspection officers were surveyed using simple random technique. The sample size for the study is said to be adequate according to the suggestion of Hair *et al* (1995) referred to in Williams *et al* (2010) that sample sizes should be 100 or greater. The sampling technique ensures that vehicle inspection officers were surveyed with equal chance of probability. This was meant to certify that the information obtained reflects the intents of the officers as regards the challenges facing their sustainable operations. The instrument was designed on a multiple-item measurement scale fashioned on the 5-point Likert type of scale to allow for a wide measurement of the degree of the officers' consideration of each challenge presented in the questionnaire. The variables were tabulated for the officers to rank in order of significance from 1 – Not Significant to 5 – Highly Significant.

Factor analysis was employed as technique for data analysis. This is in the light of the need to reduce the variables to a few orthogonal ones that could be used to explain the major challenges facing sustainable operations of vehicle inspection officers. The main purpose of the factor analysis is to determine the number of common factors needed that can adequately describe the correlations between the observed variables, and estimating how each factor is related to each observed variable by estimating the factor loading (Oyesiku, 2000). This study

adopted the notation for factor analysis presented by Laudau and Everitt (2004) and used by Ubogu (2013) as a model for mathematical specification;

$$\chi_1 = \lambda_{11} f_1 + \lambda_{12} f_2 ... + \lambda_{1k} f_k + u_1$$
$$\chi_2 = \lambda_{21} f_1 + \lambda_{22} f_2 ... + \lambda_{2k} f_k + u_2$$
$$\chi q = \lambda_{q1} f_1 + \lambda_{q1} f_2 ... + \lambda_{qk} f_k + u_q \quad (1)$$

The equations above can be re-written as:

$$\chi = \Lambda f + u, \quad (2)$$

Where,

$$\chi = \begin{bmatrix} x_1 \\ . \\ . \\ . \\ xq \end{bmatrix}, \Lambda = \begin{bmatrix} xu ... \lambda_{1k} \\ . \\ . \\ . \\ \lambda q_1 ... \lambda qk \end{bmatrix}, \quad f = \begin{bmatrix} f_1 \\ . \\ . \\ . \\ fk \end{bmatrix}, \quad u = \begin{bmatrix} u_1 \\ . \\ . \\ . \\ uq \end{bmatrix} \quad (3)$$

Results and Discussion

DRTS FCT has routine inspection operations where vehicles can be spot checked whether occupied or not. If faults are discovered, a defect notice will be issued in which case the owner will be required to have repairs made, and obtain a full inspection from a licensed examiner with 14 days to clear the notice. If serious safety violations are found, the vehicle's registration can be suspended on the spot and the operator will need to have the vehicle towed. Table 1 presents the number and status of vehicles inspected in Abuja from 2007 – 2014.

An increasing trend in the total number of vehicles inspected in Abuja is observed in Table 1 in the sense that the total number of vehicles inspected stood at 65,397 in 2007 and by 2014; it has increased to 145,537 vehicles. This might be as result of the increasing car ownership rate in Nigeria due to increasing income of the people. Based on this, it is expected that the trend in the number of vehicles for inspection will continue to increase in the forward years. The status of vehicles inspected in Abuja from 2007 – 2014 shows the number of vehicles that failed or passed inspection test.

Table 1 Number of vehicles Inspected in Abuja from 2007 – 2014

Year	No Passed	No Failed	Total
2007	49,735	15,662	**65,397**
2008	29,134	17,134	**46,268**
2009	21,160	20848	**42,008**
2010	64,227	18755	**82,982**
2011	40,872	25,551	**66,423**
2012	105, 508	9,426	**114,934**
2013	97,858	1,680	**99,538**
2014	141,997	3,540	**145,537**
Total	**444,983**	**112,596**	**557,579**

Source: DRTS, FCT

Every vehicle inspection operation that will be sustainable requires that inspection officers are faced with less challenge to ensure efficiency in service delivery. It is normal that a data set to be used in statistics of this nature be subjected to test of suitability and adequacy. Therefore, to evaluate the suitability of the data, internal consistency checks were conducted using Kaiser-Meyer-Olkin (KMO) measure of sample adequacy and the Bartlett test of sphericity (See Table 2). These tests are employed based on the requirement of factor

analysis prior to extraction as suggested by Williams et al. (2010). The importance of the test is to determine if the samples were adequate to allow the use of factor analysis.

Table 2 KMO and Bartlett's Test to examine Challenges of Vehicle Inspection Officers

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.860
Bartlett's Test of Sphericity	Approx. Chi-Square	730.279
	Df	28
	Sig.	.000

The result in Table 1 shows a sampling adequacy value of 0.860, and significant at $p<0.01$, which indicates that the data obtained is adequate and suitable for the analysis. This is according to Cornish (2007) statement that a KMO result should be over 0.700 to be sufficiently correlated. Therefore, with a value above this threshold, the data is considered to be reliable for the use of factor analysis.

The various challenges facing the sustainable development of the operations of vehicle inspection officers in Abuja are naturally in varying degrees, which the response of the officers reveals the level of significance of each variable. The results of the analysis in Table 3 showing the communalities estimates of the variables after extraction indicates that little of the variance of the item "administration bureaucracy" (with 43.8%) and inadequate staff motivation (with 40.8%) can be attributed to the common challenge facing the operations of vehicle inspection officers in Abuja. However, the other variables with extracted values greater than 50.0% shows percentage variance that is high, and suggest the variables can be attributed to the common factors.

Table 3 Communalities

	Initial	Extraction
Inadequate Technology	.479	.500
Shortage of Manpower	.521	.624
Inadequate Funding	.492	.528
Inadequate Training	.514	.599
Administrative Bureaucracy	.405	.438
Inadequate Staff Motivation	.374	.408
Inappropriate Posting of Staff	.552	.609
Inadequate Equipment	.506	.872

Extraction Method: Principal Axis Factoring.

Furthermore, the total variance of challenges facing vehicle inspection officers presented in Table 4 indicates that the percentage of the total variance accounted for by the factor analysis shows two factors with eigenvalues greater than 1. The percentage of total variance explained indicates that factor one has an eigenvalue of 3.921 accounting for 49.0% of the total variance explained by the analysis. Similarly, factor two reveals an eigenvalue of 1.019 thereby accounting for 12.7%. The significance of these factor loadings provides a clear indication of the underlining dimensions of the variables that have been reduced to two major factors with eigenvalues greater than 1.00. These are the dominant loadings for each factor. These eigenvalues are the proportion of the total variation in the data set that is explained or at best summarized by a factor.

The cumulative percentage of the variance revealed that the two factors alone account for 61.76%, which indicates the proportion of the total variation that is explained by these two factors. Meanwhile, the third factor accounts for a very small proportion of the total variation of the explained variables of 11.3% (See Table 4).

According to Laudau and Everitt (2004), attempt must be made to identify the variables that can be used to explain the underlining dimensions of the issue under consideration. However,

the communality table alone cannot be relied upon to identify the factors that explain the challenges facing the operations of vehicle inspection officers in Abuja. Therefore, some method of factor rotation (varimax) is employed. The purpose is to maximize the variance of the squared loadings to produce orthogonal factors with a view to interpreting the results of the factor analysis. In practice, an arbitrary threshold value of 0.4 is equated as high loadings while the factor loadings are reordered according to size (Laudau and Everitt 2004).

Table 4 Percentage of Total Variance Explained by the challenges

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.921	49.016	49.016
2	1.019	12.739	61.755
3	.901	11.269	73.024
4	.623	7.788	80.812
5	.442	5.519	86.331
6	.429	5.361	91.692
7	.374	4.676	96.369
8	.291	3.631	100.000

Extraction Method: Principal Axis Factoring

Table 5 shows the rotated factor matrix of the explanatory variables. It can be observed from the Table that all the variables are loaded on the two extracted variables. This indicates that the variables are significant in the discussion of the challenges facing the sustainable operations of vehicle inspection officers in Abuja.

Table 5 Rotated Factor Matrix

	Factor	
	1	2
Shortage of Manpower	.763	
Inadequate Training	.744	
Inappropriate Posting of Staff	.667	.406
Inadequate Funding	.666	
Administrative Bureaucracy	.630	
Inadequate Equipment		.876
Inadequate Staff Motivation		.562
Inadequate Technology		558

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 3 iterations.

Loaded on Factor 1 are 5 variables, which are shortage of manpower, inadequate training, inappropriate staff posting, inadequate funding and administrative bureaucracy. Factor 2 has inappropriate staff posting; inadequate equipment, inadequate staff motivation and inadequate technology. All these variables are listed in order of their severity as challenges facing sustainable operations of vehicle inspection officers in Abuja.

For inappropriate staff posting (66.7% and 40.6% respectively) to load on the two extracted factors indicates a significant challenge facing the sustainable development operations of vehicle inspection officers. It is significant in a scenario where personnel with educational background in non-engineering fields are assigned to carry out vehicle inspection duties.

Policy Recommendation and Conclusion

The overall contribution of vehicle inspection operations to safety standard and compliance to traffic regulations in a country cannot be overemphasised. This calls for the need to ensure efficient and sustainable operations of vehicle inspection officers in Nigeria cities. This should be done out with a view to minimising the challenges facing the inspection officers while carrying out their duties. The government through the directorate of road traffic services (DRTS) should make effort to recruit more staff into the organisation so that there

will be adequate hands on desk to carry out the mandate of the organisation. The measures to mitigate the challenges facing sustainable operations of vehicle inspection officers need to be put in place in the light of the identified issues raised in this study. This will serve to motivate the officers to be committed to maximum delivery of service.

In conclusion, the study highlighted the number of vehicles inspected in Abuja from 2007 – 2014 and subjected 8 variables believed to be serving as challenges to the sustainability operations of vehicle inspection officers in Abuja to factor analysis. The study therefore concludes that shortage of manpower and inadequate equipment serve as the most significant challenges facing the sustainable operations of vehicle inspection officers in Abuja.

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Evaluation of the Problems Associated with Construction Claims Management Process in Ondo State, Nigeria

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ABSTRACT

Dispute has become a global epidemic in the construction industry, despite the considerable efforts that have been made to avoid it. Majority of construction projects in Nigeria experience disputes due to the problems associated with construction claims management process. This study evaluated the problems associated with construction claims management process and generates means of improving construction claims management process. A survey approach using questionnaire administered on clients, contractors and consultants was used. Data collected were analysed using percentile, mean item score and Kruskal Wallis K-test. Findings revealed that difference in awareness and interpretation of contract terms, too many bureaucratic procedure in claims management and delay in client or his representative response to claims were the top three problems associated with construction claims management process. The study recommended that contractors should improve their site staff potentials in construction management through on-the-job training. The study also recommended that public clients who are the major financial of construction projects in Nigeria should execute construction works in "business-like manner" instead of using the current complicated structures and procedures. The study concluded that the implementation of these suggestions would ensure amicable settlement of construction claims.

Keywords: Bureaucratic procedure, Business-like manner, Construction claims, Construction claims and management process and Nigeria

INTRODUCTION

In the recent years, only few number of construction projects in Nigeria were completed on time and within budget. This is due to construction claims that are outside the control of both the contractors, clients and other stakeholders. Indeed many of these projects have cost and time overruns as a result of the complexity of construction projects that makes claims inevitable. In most cases, management of these claims always leads to disputes that may end up in either arbitration or litigation. These may eventually lead to delay in the execution of the project or abandonment. These disputes occurred due to the problems associated with construction claims management process. Therefore, for effective management of construction claims these problems need to be recognised and mitigated by the stakeholders.

Over the years, significant literature on the problems associated with construction claims management process has been result of research conducted in Europe, Canada, America and Middle East, yet very little or none has been conducted in Nigeria. In view of the differences in culture, varying nature of construction claims based on the prevailing social and environmental factors, it has become necessary to bridge the gap in literature.

Therefore, the focus of this study is to evaluate the problems associated with the implementation of construction claims management process with a view to mitigating them and ensuring amicable settlement of construction claims.

LITERATURE REVIEW

Construction Claims Management Process

Enshassi, Mohamed and El-Ghandor (2009) opined that no construction project can be shielded from a potential claim and that such claim can lead to significant financial damages.

Akinradewo, O. F., Ogunsemi, D. R.; Dada, M. O. & Aje, I. O. (2016). Evaluation of the Problems Associated with Construction Claims Management Process in Ondo State, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 534-543

Therefore, the owner, consultants and contractor need to understand the construction claim management process, so as to be able to manage claim effectively. Enshassi *et al.* (2009) postulated that the objective of the construction claim management process is to resolve problem in an efficient way, in order to avoid litigation and arbitration. Singh and Sakomoto (2001) supported this assertion that all parties including owner, consultants and contractors should understand the construction claim management process in order to ensure proper claims management practice.

Kahssay (2003) concluded that construction claims occurred when the terms and conditions of the contract change in such a way that the contractor is unable to recover expenses and profit. According to Bunmi (2005) a claim means an assertion of a right to money, property or to a remedy. Powell-Smith and Stephenson (2000) described claims in general terms as the assertion of the right to money, property or to remedy. Polts and Ankrah (2013) observed that a claim may arise out of or in connection with contract relates to remedy which is not designate in the contract, such as breach of contract (contract law) or misrepresentation (law of tort) or unjust enrichment (quantum merit). From the above definitions, one important fact is that there would be an unpleasant or difficult situation arising from the problems encountered during the execution the contract that requires treat by the parties to a contract.

Tochaiwat and Chovichien (2004a) opined that in order to deal with or control construction claims in an effective way, all parties should establish good construction claim management process in their organizations. Kululanga *et al.,* (2001) concluded that the variables that form the construction claim process comprises six processes namely: Claim identification; claim notification; claim examination; claim documentation; claim presentation and claim negation. Levin (1998) and Nbabazi (2004) supported this standardisation by stating that the key to continuous occurrence of claims in the construction industry is claims management process which includes proper identification, notification, documentation, presentation and resolution. Enshassi *et al.,* (2009) also support this standardization, when they professed that the solution to the problem of claims management is claim management process which involves identification, notification, examination, documentation, presentation and negotiation. Most of the previous researchers on claim management agreed that in order to avoid disputes that may arise, it is better to follow claim's management process as discussed below:

Identification

Oyegoke (2006) opined that the contractor should recognise the occurrence of events that are likely to result in claims in advance (direct loss and/or expense suffered or incurred or extension of time) and document the characteristics of each event. Moura & Teixiera (2007), Enshassi *et al.,* (2009) emphasised that identification is the first and critically important ingredient of claims management process. Identification involves both "timely" and "accurate" detection of a construction claim. Kululanga *et al.,* (2001) observed that construction claim recognition and identification involves "timely" and "accurate" detection of a construction claim and it is critically important ingredient of claim process.

Notification

Enshassi *et al.,* (2009) asserted that the owner or representative must be formally notified of a claim or a change if the contractor intends to seek an equitable adjustment for additional time or costs. The initial letter of a claim notice to other party should be short, clear, simple, conciliatory and co-operative. Mitchell (1998) opined that the purpose of notification is to allow both parties to verify conditions, assemble facts and resolve disputes while the issues are fresh in their minds. Tochaiwat and Chovichien (2004a) opined that construction claim notification involves alerting the other party of a potential problem in a manner that is non-adversarial. The researchers concluded that the time limit requirements are very crucial and

critical and an initial letter of notice to the other party should be concise, clear, simple conciliatory and cooperative.

Kululanga *et al.,* (2001) concluded that the letter should indicate problem and alert the other party of the potential increase in time or cost and it is very hard to argue with someone who appear polite and sincere, hopeful and cooperative. For example, section 2 Clause 2.27 of JCT 2009 conditions of contract stated that the contractor is required to give a written notice to the Architect/Contract Administrator of the material circumstances, including cause or causes of the delay. Section 2 Clause 2.28 of the JCT 2009 also stated that if the Architect/Contract Administrator finds that any of the events stated by the contractor is a relevant event and will delay the work beyond the completion date, he shall in writing to the contractor give an extension of time that he considers to be fair and reasonable.

Examination

According Kululanga *et al,* (2001) claim examination involves establishing the legal and factual grounds on which claim is to be based and the estimate of the potential recovery. Chovichien and Tochaiwat (2005) confirmed that the objective of this sub process is to determine the impact of the change that occurs. Chavichien *et al,* (2005) explained that the claimant shall perform schedule analysis to calculate the time impact while breaking down the cost into various cost components to assess the impact. The researchers concluded that there are various methods used for calculating time and cost impacts and that this detailed cost description is necessary for understanding, negotiating and justifying extra contract costs. Enshassi *et al.* (2009) asserted that claim examination involves establishing the legal and factual ground upon which the claim is based. The researchers explained that this stage should also involve an estimate of the potential recovery sought and that the issues may be investigated by interviewing staff who worked on the project. The researchers concluded that primary sources for claim examination include project files, video, memos, minutes of site meetings e.t.c. which must be used to prove the time and cost elements of the claim. Tochaiwat and Chovichien (2004a) observed that there are two types of pricing namely: forward pricing and post pricing. Tochaiwat *et al* (2004a) explained that under the forward pricing, the price is negotiated before the work is done while in post pricing the risks have been incurred and the added costs have been known.

Documentation

Kululanga *et al* (2001) postulated that documentation is the collection of the hard facts that give the actual history of construction claims. Enshassi *et al* (2009) corroborated this assertion that a well prepared defence quickly demolishes evidence and claim costs that not supported by accurate records but a well-documented facts are the glue that holds the legal framework together. Kululanga *et al* (2001) explained further that a detailed cost record, a comparative programme (progress schedule, correspondence records of site meetings and site diaries are the essential documents required for construction claims. The researchers concluded that the contemporaneous record not only helps in claims but in other legal tussles especially in the project administration. Chovichien *et al,* (2005) observed that records and documentation play a very important role in the settlement of construction claims. The researchers concluded that events and details of the jobs must be documented to substantiate claim entitlements and prove damages.

Presentation

Chovichien *et al,* (2005) opined that presentation should be logically built up, well organized and factually convincing and that it can be divided into two sections; claim entitlement and claim quantum. Oyegoke (2006) suggested that it is important to start with an introduction which gives a brief outline of the contractor's submission, also to summarise the subject

matter, to be precise and concise. The researcher concluded that presentation of claim can be broken down into the following logical sequence: introductory, contractual basis, comprehensive assessment and auxiliary data.

Negotiation/Resolution

Ren, Anumba and Ugwu (2003) described negotiation as tool that help to sustain amicable relationship between the parties to a contract, before the application of other disputes resolution methods. Fidan *et al,* (2010) observed that negotiation entails exchanges between project parties to reconcile their differences with the aim of reaching a settlement. Zeleznikow (2002) affirmed that negotiation assist the construction parties to avoid the risk of extra cost and unfavourable outcome in claims management. Zeleznikow (2002) explained that the determination of facts of a case and careful exploration of legal documents in order to figure out legal arguments related with claim issues is one of the essentials of claim negotiation. Kululang *et al,* (2001) also observed that to benefit from this stage in claims process, a construction contractor needs experts that have skills for negotiation. The research confirmed that "it is more important to be prepared than it is right" because "right" is often difficult to determine and it is preparation for negotiation that really counts. Ren *et al* (2001) asserted that negotiation go on throughout the whole claims management process from justification of the settlement of a claim. The researchers explained further that basically there are two kinds of claim negotiation: qualitative and quantitative negotiation. Qualitative negotiation is the entitlement of contractor to a claim which is mainly regarding the justification of a claim based on the identified causes, liabilities and contract conditions while quantitative negotiation is the amount of compensation for the entitled claim, which deal with the amount of the quantity of claim items, rates of material or labour and indirect costs. Enshassi *et al,* (2009) confirmed that claim negotiation plays an important role in resolving claims, preventing disputes and keeping harmonious relationship among project participants. The researchers concluded that the most economical, practical, simplest and fastest method of settling claims is negotiation. Chovichien *et al,* (2006) concluded that the contractors in Thailand are able to negotiate the employer`s claims against them than those against the employers.

Evaluation

This sub-process is the link between presentation and negotiation, several researches on construction claims management process concentrated on the last six sub-processes that are related to the contractor`s activities at the expense of client or his representative activity which is evaluation. Aibinu (2007) observed that evaluation is the process of administering the claims by the certifier. In perform this important responsibility, the certifier is expected to form his view on the validity of the contractor`s claims and make recommendation on the quantum of the contractor`s entitlements. Perlman (1984) cited in Aibinu (2007) confirmed that before the certifier can form an opinion, the following question of facts that are potential causes of disagreements must be addressed:

i. Whether or not the works giving rise to the claims is required by the contract or is extra work
ii. Whether the delay is due to the contractor`s inefficiency or employer`s or his representative actions (hereafter referred to as Responsibility of delays)
iii. Whether the delay is on the critical path (hereafter referred to as Criticality of delays)
iv. Whether the employer-related delay is concurrent with another contractor-related delay (hereafter referred to as Concurrency of delay)
v. Whether or not the contractor actually incurred added costs.

Zack (2002) and Kumarswamy and Yogeswarm (2003) observed that the use of different approaches to claims substantiation and assessment may also constitute an area of disagreements because the contractor and certifier will produce different results from different approaches. Aibinu (2007) observed that reaching a decision on claims will also depend on the interpretation of the provisions relating to extension of time and additional cost claims, thus the following are the other potential issues that could generate disagreements: the type and amount of information used in substantiating claims; the methodology and technique used in substantiating and assessing claims; the quantum of contractor`s entitlements and contract interpretation.

Several researchers have developed various approaches to evaluation technique in the construction industry. Verster (2005) confirmed that evaluation is a vital sub-process that enable other party to consider claims submitted by the contractor in terms of its validity, contractual terms and possible outcome (quantum of contractor`s entitlements). Oke and Makinde (2011) observed that evaluation is necessary in construction project so as to ascertain the monetary value of decrease or increase from the contract sum which will be claimed by one of the parties to the contract accordingly. Bower (2000) proposed a mechanism for the 'evaluation of compensation due in the event of a variation order under the contracts for construction work'. The researcher developed influence curves that can be used to derive indirect costs of variation. Akpan and Igwe (2001) developed a suitable model for the evaluation of cost overrun during construction project execution, focusing on cost effect with respect of the extent of work done, payment schedule and government fiscal/monetary policies. Chovichien and Tocaiwat (2014) reported that a committee set up by the procurement regulatory act in Thailand is responsible for the evaluation of the contractor's claims by determine entitlement and the amount of compensation the contractor deserves.

Problems Associated with Construction Claims Management Process

Ren *et al*, (2001) observed that despite the extensive studies, theories and practices, the increasing incidence of claims and disputes imply that the current claims management principles and process are ineffective in meeting construction industry requirements. Chovichien *et al*, (2005) also observed that construction claim management is very important to all parties concerned in a construction project and several research works confirmed the insufficiency of the claim management processes resulting from associated problems. The researchers concluded that lots of the insufficiencies were caused by the negligence or ignorance on the implementation of effective claim management process by the stakeholders. Ren *et al*, (2001) explained that the current industry practice shows that the main challenge of claims management is not from the overall management process, but from ineffectiveness of management activity at each stage. The researchers recognized that identification of causes of claims and proper documentation are two most important and difficult factors to justify a claim.

A considerable number of prior studies have explored the issues associated with interpreting or understanding construction contracts and their impacts (Cutts, 2004; Broome and Hyes, 1997; Styllis, 2005; Rameezdeen and Rajapakse, 2007). Candin, Bhatia and Jensen 2002; Chong and Rosli, 2009; identify the use of legalise or technical terms or jargons as another problem associated with claims management process. Other empirical researchers have identified the use of language and characteristics in legal documents (Hill, 2001; Feinmann, 2003; Cutts, 2004). These studies reported that the construction contractors often encounter difficulties in understanding and interpreting contract documents due to non-legal background and the inherent legal terminologies stated in the contracts. Chovichien *et al*, (2005) opined that contract terms are sometimes incomplete, unclear in specifying each party's right and duties, lead to different interpretations by different parties. The study observed that some

contract provisions allowed insufficient time for both parties to handle their claims in Thailand.

Chovichien *et al,* (2005) explained further that some problems arise from the employer and his representative, such as intervening or impeding the construction process despite their to lack of construction knowledge, too much bureaucratic procedure, lack necessary data and lack of clear regulations. The researchers explained further that designers sometimes issue impractical drawings which cause delay or cost overrun in the construction phase, corruption by some employer's representative, supervising officer issue an incomplete or oral variation and delay in response to claims in Thailand. Chovichien *et al.,* (2005) concluded contractors sometimes caused problems to construction management process such as lack of contract knowledge; incompetence; lack of management skills; refusal to comply with the defective liability warranty or obligations; delay in response to claims and ignorance on some contract provisions and professional ethics. Ren *et al.,* (2001) supported this opinion that many contractors' management systems are ill designed to support claims.

Some researchers have identified inadequate information and poor documentation to support claims as major problems in current claims management practice. (Chvichien and Tochaiwat 2006, Enshassi *et al.,* 2009 and Ren *et al.* 2001) emphasised that lack of factual evidence is the prime cause of delayed payment and protracted disputes. Hassanein *et al* (2008) pointed out that 57% of the sampled projects indicated that change orders had been lost due to poor documentation practices in Egyptian industrial construction sector. Enshassi *et al.,* (2009); Chovichien and Tochaiwat (2006); Badger and Gay (1996) all stressed that lack of initial records, such as minutes of meetings, correspondence, progress reports, logs, photographs, records of delay and disturbance and revised drawings as the major reason for the failure of claims. Vidogah and Ndekugri (1998) concluded that the reasons for the problems of claims management are: a culture of bias against paperwork on site operations, poor design of recording systems, the relevant information and poor resourcing of the claims management role in contracting organisations. Hassanein *et al.,* (2008) linked the loss of change order in Egyptian industrial construction sector to lack of contract awareness of the site team and fear of consultant phenomenon. Enshassi *et al.,* (2009) pointed out that lack of awareness of contractor's site staff in detecting a claim is still a major contributor to the problem of claims management process in Palestine.

Bakhary *et al.,* (2013) stressed the need to develop structured instrument for auditing construction contractor's claims process. Ren *et al,* (2001) postulated that research efforts at seeking to develop effective tools to support claims management are very few when compared with such efforts on the legal basis and principles. The study emphasised it that claims management rely on very few project management tools especially systematically designed tools that are appropriate for claims management and that even with the support of Information Technology claim documentation is still perceived to be woefully inadequate in terms of record keeping. Chovichien *et al.,* (2006) in surveys research in Thailand observed that adoption of information system in the construction industry seems to be given less attention and documentation is still paper –based without sufficient document code. The study concluded that these problems affect the efficiency of the claims management process and it should be eliminated.

Enshassi *et al.,* (2009) confirmed that the main problem associated with claim negotiation in Palestine is conflicts arising during negotiation. The study linked this problem to lack of negotiation skills which usually impact on the ability of the contractor to convince the owner. Hu (1997) opined that most project managers consider claims negotiation as the most time and energy-consuming activity in claim management. Vidogah and Ndekugri (1998) observed

that the involvement of the client in negotiation is currently very low. Vidogah *et a.l,* (1998) explained further that there are several deficiencies in the consultant's claims management process such as ad hoc manner implementation of claim management, poor performance in claim management functions of the existing management information systems, inadequacies in the contents of the products of the basic good management practice (diaries, timesheets and programmes) and impossibility to quantify claims with precision.

Smith (1992) pointed out that negotiation has been labelled as a basic survival skill for today's project manager, but very few construction participants have adequate negotiation expertise. The study concluded that unnecessary concession and stubbornness are common mistakes which make the negotiations harder and inefficient.

Hypothesis

In accordance with the specific objectives of the study as mentioned above, a null hypothesis was postulated which will assist in assessing the statistical significant difference between the perception of the groups of respondents about the problems associated with construction claims management process. The null hypothesis is as follow:

H_o1: There is no significant difference in the perception of the clients, contractors and consultants about the problems associated with construction claims management process.

METHODOLOGY

The instrument used for data collection in the study was questionnaire administered to clients, contractors and consultant architects and quantity surveyors that were engaged in building projects executed for a period of nine years (from 2006 to 2014) in Ondo State, Nigeria. The population for the study was 322 respondents comprising of 52 clients and 168 contractors while the architects and quantity surveyors were 52 and 50 respectively. A total of 197 questionnaires which represented about 61% response rate were used for the study. Data collected were analysed using percentile, mean item score and Kruskal Wallis K-test. About 53.3% of the respondents are corporate or registered members of their professional bodies while 19.8% and 8.7% are probationer and fellow of their professional bodies respectively. This implies that they are well educated, professionally qualified and competent to answer the questions and their opinion could be relied upon.

FINDINGS AND DISCUSSIONS

In assessing the problems associated with construction claims management process, the three groups participated in the survey. Table 1 shows that the three major problems associated with construction claims management process in the studied area in the opinions of the clients are: too much bureaucratic procedure in claims management; corruption among the construction stakeholders and difference in awareness and interpretation of contract terms with mean values of 3.51, 3.47 and 3.42 respectively while the least problem is designers issuing impractical drawings which cause delay and cost overrun with a mean value of 2.80. In the contractor's opinion, the three major problems related to construction claims management process are: difference in awareness and interpretation of contract terms; delay in clients or his representative response to claims and too much bureaucratic procedure in claims management with mean values of 3.44, 3.27 and 3.21 respectively while the least problem is lack of necessary data (factual evidence) with a men value of 2.50.

In the opinions of the consultants, the three major problems that are related to construction claims management process are: delay in client or his representative response to claims, lack of proper documentation and too much bureaucratic procedure in claims management with mean values of 3.57, 3.46 and 3.38 respectively while the least problem is lack of adequate time for contracting parties to handle claims with a mean value of 2.76. The table further

shows that the overall opinion of the respondents is that the three major problems associated with construction claims management are: difference in awareness and interpretation of contract terms, too much bureaucratic procedure in claims management and delay in client or his representative response to claims with men values of 3.37, 3.31 and 3.30 respectively while the least problem is inefficient claims negotiation procedure with mean value of 2.71. This implies that the fifteen (15) identified problems were strong considering there mean that ranges from 2.71 to 3.37. Table 2 reveals that an asymptotic significance value of 0.421 was generated using Kruskal-Wallis K-test which is higher than 0.05. This implies that there is no significant difference in the overall responses of the groups.

The overall opinion of the respondents is that difference in awareness and interpretation of contract terms is the first major problem associated with construction claims management process. This agrees with prior studies such as (Ren *et al.,* 2001; Chovichien *et al.*; Cutts 2004; Broome *et al.,* 1997; Styllis 2005; Rameezdeen *et al*., 2007). In the overall opinion of respondents too much bureaucratic procedure in claims management was also ranked second as the problem associated with construction claims management process. This result disagrees with the outcome of previous studies like Tochaiwat and Chovichien (2004a) in Thailand; Hassanein and Nemr (2008) in Egypt and Enshassi *et al.,* (2009) in Palestine. This may be a peculiar problem to Nigerian construction environment. The result further ranked delay in client or his representative response to claims as the third major problem associated with construction claims management process. The result agrees with Hassanein *et al*., (2008) which revealed that the major problem associated with claims management in the Egyptian industrial construction is effective delay caused by the owner.

Table 1: Problems Associated with Construction Claims Management Process

The Problems	Client		Contractor		Consultant		Overall	
	MIS	Rank	MIS	Rank	MIS	Rank	MIS	Rank
Average	*3.13*		*2.87*		*2.84*		*2.97*	
Difference in awareness and interpretation of contract terms	3.42	3	3.44	1	3.32	4	3.37	1
Too much bureaucratic procedure in claims management	3.51	1	3.21	3	3.38	3	3.31	2
Delay in client or his representative response to claims	3.16	5	3.27	2	3.57	1	3.30	3
Lack of proper documentation	3.16	5	2.91	4	3.46	2	3.10	4
Corruption among the construction stakeholders	3.47	2	2.81	8	3.06	9	3.02	5
Contractor's lack of claims management skills or expertise	3.78	4	2.78	10	2.85	6	3.01	6
Supervising officers issuing incomplete or oral variation	2.98	8	2.84	5	3.13	5	2.98	7
Lack of involvement of client in claims negotiation	3.00	7	2.79	9	3.10	6	2.93	8
Intervening and impending of the construction process by the client or his representative	2.98	8	2.78	10	3.10	6	2.93	8
Lack of information management system	2.96	11	2.84	5	2.84	12	2.86	10
Lack of effective claims management tools	2.91	13	2.84	5	2.76	15	2.82	11
Designers ng impractical drawings which cause delay and cost overrun	2.80	15	2.77	12	2.97	10	2.81	12
Lack of adequate time for contracting parties to handle claims by contract provisions	2.98	8	2.54	14	2.81	12	2.73	13
Lack of necessary data (factual evidence)	2.96	11	2.50	15	2.81	12	2.72	14
Inefficient claims negotiations procedure	2.87	14	2.74	13	2.81	12	2.71	15

Table 2: Overall Significant Difference in the Opinions of the Respondents on the Problems Associated with Construction Management Process

S/N	Problem	Chi-Sq. Value	Asymptotic Sig. P
1	Problems associated with construction claims management process	1.732	0.421

Kruskal-Wallis K-test was used to test the difference in the opinion expressed in Table 3 on the problems associated with construction claims management process by the groups of respondents. This is to assist in decision making on the hypothesis earlier postulated in this

study. The result of Kruskal-Wallis analysis shows that the p-value of seven identified problems is 0.000; it implies that there is significant difference regarding the groups of respondents in 7 out of 15 identified problems. This is not enough to reject the null hypothesis. Hence null hypothesis is accepted. The decision on this aspect of the study was based on the overall asymptotic value of 0.421 which is higher than 0.05 using Kruskal-Wallis K-test as indicated in Table 2. This implies that there is no significant difference in the three groups assessment of the problems associated with construction claims management process.

Table 3: Difference in the Assessment of the Clients, Contractors, and Consultants about the Problems Associated with Construction Claims Management Proces

Problem	Overall rating		Chi-square Value	Kruskal-Wallis sig. p
	MIS	Ranking		
Difference in awareness and interpretation of contract terms.	3.37	1	3.296	0.348
Too much Bureaucratic procedure in claims management	3.31	2	2.276	0.517
Delay in client or his representative response to claims	3.30	3	4.636	0.200
Lack of proper documentation	3.10	4	9.846	0.020*
Corruption among the construction stakeholders	3.02	5	11.850	0.008*
Contractor's lack of claims management skills or expertise	3.01	6	13.213	0.004*
Supervising officers issuing incomplete or oral variation	2.98	7	4.962	0.175
Lack of involvement of client in claims negotiation	2.93	8	10.132	0.017*
Intervening and impending of the construction process by the client or representative	2.93	8	1.309	0.727
Lack of information management system	2.86	10	2.312	0.510
Lack of effective claims management tools	2.82	11	5.203	0.157
Designers issuing impractical drawings which cause delay and cost overrun	2.81	12	10.909	0.012*
Lack of adequate time for contracting parties to handle claims by contract provisions	2.73	13	4.953	0.175
Lack of necessary data (factual evidence)	2.72	14	15.429	0.001**
Inefficient claims negotiations procedure	2.71	15	9.987	0.019*

** = p less than 0.05, ** = p less than 0.01*

CONCLUSION

Findings revealed that difference in awareness and interpretation of contract terms, too many bureaucratic procedure in claims management and delay in client or his representative response to claims were the top three problems associated with construction claims management process. The study recommended that contractors should improve their site staff potentials in construction management through on-the-job training. The study also recommended that public clients who are the major financial of construction projects in Nigeria should execute construction works in "business-like manner" instead of using the current complicated structures and procedures. The study concluded that the implementation of these suggestions would ensure amicable settlement of construction claims.

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Effects of Work Attitudes of Design Team on the Service Delivery of Quantity Surveyors

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ABSTRACT

The dynamism of the construction industry everywhere in the world requires no other skill, for stringent cost control and effective cost management in providing value for money for construction clients, than the skills of the professional quantity surveyor. The effectiveness in delivering quantity surveying service efficiently to meeting clients' requirements is entirely dependent on the products of designers in the design team. This research work assesses the effects of work attitudes put on by the design team and how it affects the service delivered by quantity surveyors. Primary data were collected via well-structured close-ended questionnaire. Percentile and mean item score were employed in the analysis using Statistical Package for Social Science (SPSS). This study revealed that the design team is a well-structured and organized team for quantity surveyors to perform their professional obligations, but designers' work attitudes reflected from their design products create a mundane and frustrating atmosphere for the quantity surveyors. This study finally recommended a need for personal improvement by the architects and the engineers in order to enhance a proficient service of the design team.

Keywords: Construction Industry, Design team, Quantity Surveyor, Service, work attitude

INTRODUCTION

The construction industry is a complex organisation which centres on the project under construction or adaptation, (Willis, et al. 1994). It embraces a wide range of loosely integrated organisation that collectively constructs, alter, refurbish and repair a wide range of different building and civil engineering structures. (Gavin, 2002) defined design as a combination of group of object and requirement which have been designed to create something new as a result of or in anticipation of their collective performance. The construction industry is also described as an assembly industry, assembling on site the products of other industries. Construction generally encompasses building and civil engineering works, building works such as residential houses, flats, schools, hospitals, shops, offices, factories and ware-houses; civil engineering works such as roads, bridges, reservoirs, waste water system, rail ways, power stations, harbours and dams. These construction works are undertaken in both the public and private sectors. Public sector includes government (federal, state or/and local), development corporations and public corporations and private sector includes developers, financial institutions, industries and commerce, building societies, individual promoters and privatised companies. Researchers all over the world have highlighted the significance of teams in a general organizational perspective. Most organizations that seek to improve efficiency have embraced teams as a way to meet the demand of the turbulent and challenging market place (Fisher et al. 1997).

There are various disciplines and professionals within the industry; architects, quantity surveyors, engineers, builders who are more on the periphery of the industry, the planners, economists, lawyers, and accountants, the contractors, suppliers, and manufacturers, sub-contractors of various types and specialist firms who do highly skilled work, (Seeley, 1997).

The construction industry is bounded by an ever-increasing numbers of rules and regulations with different trades and professional organizations monitoring them intently and dealing

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with variety of problems which may affect or affecting the efficiency, reputation and work of the industry before the 'client'- the most important person to the industry.

The building sector is very important in the national economy and it's a very sensitive sector. To a good extent the fortunes of the Nigeria construction industry are closely related to the state of the Nigeria economy as a whole as postulated by (Ajanlekoko, 2002). He opined that the output of the construction industry has a significant impact on the country's Gross Domestic Product (GDP) and the Nations construction investment. Therefore, it is not the sole responsibility of the quantity surveyor to establish a successful cost solution and guarantee an effective project delivery in the terms of cost, time, safety and quality standard. All the professionals within the industry are responsible, most especially the design team, being the decision maker for all construction work in the construction industry.

Practicing quantity surveyors are been faced with numerous challenges erupting from his design team-mates in most project works, ranging from clients' attitudinal behaviours, design decisions, drawings provided by the architect/engineers to professional superiority complex that exist among the professionals. Every activity of each design team member has significant effect on one another's service(s). The quantity surveyor been the centre of attraction (cost expert), depends so much on the service products of the design/production team-mates. A close collaboration between the design team members and the quantity surveyor throughout the design stage for effective cost control will enable the production members to be kept fully informed of the cost implications of all the design decisions. Team should work together to represent the interest of the client by achieving his aim and objectives in terms of cost, time, quality and standard performance. A successful project is a justification of expertise and if otherwise, the purpose of professionalism and expertise is jeopardized and defeated. (Sepani and Akalaka 2009). When good team spirit is developed among team-mates in a construction design team, the quantity surveyors enjoys the joy of rendering quality service to his client or employer. To distribute generated design knowledge among design team members for the progress of design, they need to process their own specialist data before useful information can be delivered to others. Designers participate in various ways in the team and are depending on each other's output. Many participate as individuals, working alone for crucial periods and then return to the network process, (Dainty et al. 2006). These will in-turn boosts the good reputation of the design team and the construction industry as a whole. This will invariably contribute to the nation's economy and development.

RESEARCH METHODOLOGY

The descriptive survey method, (Leedy and Ormond 2005) was adopted for the study using structured questionnaires as the main tool for exploring the opinions and the individual experiences of quantity surveying practitioners in research area. The respondents were given statements to assess based on a five point Likert scale on a questionnaire designed comprising three (3) sections with relevant questions pertaining to the topic; section 1, personal data of respondents, section 2, design team features, design products and attitudes of design team members and section 3, services of the quantity surveyor at the design stage.

The population of respondents for data gathering was drawn from among practising professional quantity surveyors in the Nigerian construction industry resident in Akure and Ibadan cities respectively. The sample population of respondents was from registered and practising quantity surveyor only numbered 72 and 35 in Ibadan, Oyo and Akure, Ondo states respectively, who are well experienced in the profession and have being involved in building design team.

The Yamane (1967) formula used to determine the sample size is $\frac{N}{1+N(E^2)}$
Where N = Number of professionals and E = Degree of precision 10%

Applying the above formula, a total of 68 Quantity surveyors; 41.86 and 25.93 was sampled out from the 72 and 35 registered and practising quantity surveyors in the Ibadan, Oyo and Akure, Ondo state respectively.

From the formula used to derive the sample size for respondents, random selection was done on the list of the professionals particularly to Ibadan and Akure residents. This is simply due to the fact that most contracted building works happens more in these places. Primary data was fetched using a structured questionnaire for this research work. This is to enable perpetual disclosure of qualitative and relevant experiences of my respondents without any undue influence**.** The questionnaire covered the demographic background of the respondents and specific aspects that revealed their professional experiences in relation to work attitudes of professionals in the design team to how it affect the service delivered by the quantity surveyors.

Preliminary research approach comprising a qualitative method of data production from the target population was adopted. Data was retrieved through questionnaires by direct contact.. The addresses of practicing quantity surveyors were sourced for and were also used to locate them. Secondary data were sourced for this study from: journals, published/unpublished articles, conference scripts, textbooks and the World Wide Web (websites). Data collected were processed and analysed with the use of the Statistical Packaged for Social Science (SPSS) software version 17 Frequency distribution table, percentage and mean were used.

QUAESTIONNAIRE ANALYSIS

This section presents how the questionnaire is been administered in respect to distribution and collection expressed in percentage:

Table 1 Quaestionnaire Analysis

S/N	No. of questionnaire distributed	No. received	Percentage received	Percentage not returned	Total percentage
1	68	51	75.00	25.00	100.00

Table 1 above shows that a total of sixty-eight (68) questionnaires were distributed to respondents in person at Ibadan and Akure cities, Oyo and Ondo states respectively, only 51 were returned for analysis representing 75% proportion of the total number distributed.

Frequency Distribution Table for Demography Data

This section presents the frequency distribution tables and their respective percentage accruable.

From Table 2, above, two sectors (private and public) were reached out to with 22 private firms and 29 public organizations of respondents. Company/firm type, 22 consultant firm, 3 consortium, 23 client organization and 3 other firms/company of respondents. Organizations with more than 10 years working experience in building construction took the largest proportion (72.50%) and organization with less than 10 years' experience have a cumulative percentage of 27.50%. This is expected to make the finding of this work more reliable. 41 males (60.4%) and 10 (19.60%) female quantity surveyors professionals were my respondents. Age range 41 - 50 took the largest percentage while age under 25 took the lowest. This invariably will also enhance the reliability of the findings of this work. Educational highest qualification of the respondents are Diploma, Postgraduate Diploma, and

Bachelor's Degree each with over 20% proportion while Master's Degree holders took the largest (27.50%) percentage proportion. Respondents with less than 5 years personal working experience in the construction industry are 11.80%, 33.33% are have between 5-10 years' experience and 54.90% have more than 10 years working experience. This is a true justification of any outcome from this research work as this will have great influence on the response output. Positions of office of my respondents,19.60% principal quantity surveyors, 49.00% senior quantity surveyors, 17.60% assistant quantity surveyors and 13.70% others offices

Table 2 Demography data of respondents

		Frequency	Percentage	Total Percentage
Sector	Private	22	43.1	43.1
	Public	29	56.9	100.0
Company/Firm	Consulting firm	22	43. 1	43.1
	Consortium	3	5.9	49.0
	Client organization	23	45.1	94.1
	Others	3	5.9	100.0
Year of org. experience				
	Less than 5 years	8	15.7	15.7
	5 years - 10 years	6	11.8	27.5
	More than 10 years	37	72.5	100.0
Gender	Female	10	19.6	19.6
	Male	41	80.4	100.0
Age	Under 25 years	2	3.9	3.9
	25-30 years	8	15.7	19.6
	31-40 years	13	25.5	45.1
	41-50 years	18	35.3	80.4
	Over 50 years	10	19.6	100.0
Qualification	Diploma	11	21.6	21.6
	Postgraduate Diploma	13	25.5	47.1
	Bachelor's Degree	13	25.5	72.5
	Master's Degree	14	27.5	100.0
Personal years of experience				
	Less than 5 years	17	33.3	45.1
	5 years - 10 years	6	11.8	11.8
	More than 10 years	28	59.4	100.0
Office	Senior QS	25	49.0	68.6
	Assist. QS	9	17.6	86.3
	Principal	10	19 .6	19.6
	Others	7	13.7	100.0

Table 3 Characteristics of building design team

Design Team	Frequency					Mean	Rank
	5	4	3	2	1		
Quantity surveyors (QS) are introduced at the conceptual stage	19	20	6	6	0	4.02	1
Design team members come together to gain initial awareness about each other	20	15	10	6	0	3.96	2
Design team develops to maturity to attain effectiveness before production stage	10	29	10	2	0	3.92	3
High level of trust and flexibility exists among design team members	11	21	17	2	0	3.80	4
Ideas are discussed freely at design sessions especially with the QS	10	18	14	7	2	3.53	5
Qualitative and quantitative information are transmitted in clear and understandable language to the QS	11	18	9	12	1	3.51	6

From the table 3 above, it is clear that quantity surveyors are introduced at the conceptual stage of building construction projects; 4.02 mean value ranked as the first, members of design team comes together to gain awareness of one another; ranked second (mean value 3.96). Also design team develops to maturity to effectiveness before the production stage i.e. construction on site, 3.92 mean value. High level of trust and flexibility exists among design team members, 3.80 mean value. Only the 5th and 6th variables were rated little above neutral, (3.53 and 3.51 mean value) for "ideas are discussed freely at design sessions especially with the quantity surveyors and Qualitative and quantitative information are transmitted in clear and understandable language to the quantity surveyors respectively. On the average (3.79 mean score) it is seen that the design team is characterized as a well-structured and organized team for quantity surveyors to perform their professional obligations and services

Table 4 Characteristics of building design products

Design Products	Frequency					Mean	Rank
	5	4	3	2	1		
NTS – Not To Scale, wrong scale and mixed scaling are often design deficiencies	23	12	12	4	0	4.06	1
Advancement in designs and construction works has positive and significant effects on designer's work attitude	13	28	8	2	0	4.02	2
Design inadequacies are as a result of designer's negligence, inexperience and incompetence	18	18	10	4	1	3.94	3
Architects and engineers supply inadequate details	11	22	10	6	2	3.67	4
Designers supply coordinated information in designs, drawings and schedules	7	25	13	3	3	3.59	5
Designs are reviewed by team members many time before quantities are prepared by the QS	12	15	12	10	2	3.49	6
Complete drawings, specifications and schedules are provided for the QS to use for his estimate preparations	13	17	5	8	8	3.37	7
Drawings, specifications and schedules provided are clear and understandable	11	14	8	14	4	3.27	8
Designs are deficient in contents	5	20	11	11	4	3.22	9
Designs are inefficient	0	20	13	14	14	2.96	10

From the table 4 above shows that advancement in designs and construction works has positive and significant effects on designer's work attitude, is ranked second, designers supply coordinated information in designs, drawings and schedules (3.59), designs are reviewed by team members many time before quantities are prepared by the quantity surveyor (3.49) and complete drawings, specifications and schedules are provided for the quantity surveyor to use for his estimate preparations (3.37).

Despite the good characteristics of design products as characterized by the above result, there are reflections of some self-attitudes in these products; not to scale (NTS), wrong scale and mixed scaling have been identified as design deficiencies as it is ranked highest with mean score of 4.06, this implies that is often a major challenge in the design team. Design inadequacies are often as a result of designer's negligence, inexperience and incompetence, ranked third (3.94) this is intone with (Adefolalu, 2006) in his work, and a respondent in his personal opinion attributed this to laziness of the designers in doing their job. Architects and engineers supply inadequate details (3.67) is ranked forth which is buttressing the above facts.

It is clearly revealed that design products are not absolutely of professional standard. Deficiencies are pin-pointed especially in quantifiable product contents which are valuable and could enhance the quantity surveyors effective service delivery.

The table 5 above shows a mean average score of 3.94 also revealed that nature of client influences positively the output of quantity surveyors although, 3.43 mean score revealed that clients alter and/or delay the progress and estimate of the quantity surveyors .3.75 mean score

revealed that information are transmitted to the quantity surveyors through dialogues and meetings media by design team members, queries to architects and engineers are responded to promptly (3.16), (3.71) mean showed that architects and engineers corporate and contribute positively to the cost planning process of design and (3.45) and designers listen to the professional advice of quantity surveyors (3.67).

Table 5 Designers and their Work Attitudes in Design Team

Work Attitudes	Frequency					Mean	Rank
	5	4	3	2	1		
Specialists designer's organization influence their work attitudes positively	10	31	9	1	0	3.98	1
Nature of client influences positively the output of quantity surveyors	19	16	11	4	1	3.94	2
Information are transmitted to the QS through dialogues and meetings media	12	26	5	4	4	3.75	3
Architect and engineers corporate and contribute positively to the cost planning process of design	12	20	13	4	2	3.71	4
Architect makes excessive changes to design especially when estimates are prepared by the QS	10	25	7	8	1	3.69	5
Individual designer attitudes are reflected in their product drawings	6	28	13	2	2	3.67	6
Designers listen to the professional advice of quantity surveyors	10	15	16	8	2	3.45	7
Government rules and legislations influences designers work attitudes positively	4	23	16	8	0	3.45	7
Clients alter and/or delay the progress and estimate of the QS	5	24	12	8	2	3.43	9
Queries to architects and engineers are responded to promptly	4	16	16	14	1	3.16	10
Designers are unwilling to provide quantifiable and qualitative information	0	22	15	10	4	3.08	11
Designers exhibit hostile relationship with quantity surveyors	2	18	17	8	6	3.04	12
Quantity surveyors are seen unimportant by other design team members	4	14	9	12	12	2.73	13

A mean average score of 3.98 has revealed that specialist designer's organization also influences their work attitudes positively as well as government rules and legislations (3.45). But designers are still unwilling to provide quantifiable and qualitative information (3.08) necessary to enhance the quantity surveyor's work; the architects also make excessive changes to design especially when estimates are prepared by the quantity surveyors (3.69). Though 2.73 mean, opined in disagreement that quantity surveyors are seen unimportant by other design team members but designers exhibit hostile (unfriendly) relationship with the quantity surveyors (3.04) reflected in their individual self-attitudes and their products.

Table 6 Effects on the Quantity Surveyors

Effects	Frequency					Mean	Rank
	5	4	3	2	1		
Work pressure/stress increases for the QS at insufficient information	33	10	3	2	3	4.33	1
Wrong attitudes toward the quantity surveyor has brought constraints to the profession's awareness in Nigeria	21	14	10	6	0	3.98	2
Commission opportunities are loss by QS due to harsh attitude of team members especially the architect	18	13	10	6	4	3.69	3
Quantity surveyor's professional fee are delay or/and denied due to adversarial attitudes form team members (client)	3	8	19	8	13	2.61	4

The table 6 above revealed that hostility and unfriendly relationship exhibited by designers in design team as revealed in the above result, shows that work pressure/stress for the QS especially at insufficient information in the designer's products (4.33) is increased. This was ranked highest of the effects. Also, this wrong attitude toward the quantity surveyor has

brought constraints to the profession's awareness in Nigeria (3.98); ranked second, Even commissions opportunities at times are loss by quantity surveyors due to these harsh attitudes of team members especially the architect (3.69). The research has in disagreement revealed that (2.61) quantity surveyor's professional fee are delay or/and denied due to unfriendly attitudes of team members (such as the client).

Table 7 Effects on the Quantity Surveyors' products

Effects	Frequency					Mean	Rank
	5	4	3	2	1		
Bills of quantity (BOQ) preparation	27	20	4	0	0	4.45	1
Preliminary cost advice	26	19	4	2	0	4.35	2
Cost estimate	19	18	13	1	0	4.08	3
Cost planning	13	23	10	4	2	3.78	4
Contractual arrangement	13	23	10	1	4	3.78	4
Financial management	9	20	15	5	2	3.57	6

Table 7 shows the effects of these attitudes to the quantity surveyors have significant consequences on his products. These effects was rated highest on the Bills of quantities (4.45) provided by the quantity surveyors and preliminary cost advice (4.35) was rated second. Cost estimate (4.08) third, Cost planning 3.78 and Contractual arrangement 3.78 were rated fourth while Financial management 3.57 was rated least among all the services provided by the quantity surveyors it the design stage. On the average this research study/work revealed that the hostility exhibited by design team members exhibited in their work (products) and behavioural/self-attitudes (Abiola-Falemu, 2007) have significant (reducing) effects on the service offered by the quantity surveyors.

SUMMARY OF FINDINGS

The study revealed that the design team is a well-structured and organized team for quantity surveyors to perform their professional obligations, tasks or/and services but designers' work attitudes through their design products create a mundane and frustrating atmosphere for the quantity surveyors. Instead of providing production drawings which could be valuable and enhance the quantity surveyors effective and proficient service delivery (and invariably the design team), sketches are provided as working drawings.

The work attitudes revealed by this research work in building construction projects during the design stage include:

i. Personal attitude and individual way of designing without full consideration for the quantity surveyor.
ii. Hostile (unfriendly) relationships with the quantity surveyors (drawing wise).
iii. Unwillingness to provide quantifiable and qualitative information on drawings.
iv. Poor team spirit in team work as earlier stated by (Ajayi, 2004).
v. Provision of not to scale (NTS), wrong scale and mixed scaling drawings, these attributed to laziness of the designers
vi. Excessive changes to designs especially when an estimate has being prepared by quantity surveyors.

CONCLUSION

The study has been able to explore the various effects of work attitudes put on by design team and how it affects the service delivered by the quantity surveyors. These design inadequacies are often as a result of designer's negligence, inexperience and incompetence or unethical behaviours and self-attitude or work stress on them (Statt, 1994) but I perceive a drift from the standard of RIBA plan of work by these professionals' designers especially as apply to

design which is a reflection of the dominance of personal attitude over professional discipline.

This work has also revealed the following effects of these work attitudes of the design team on the services delivered by the quantity surveyors;

i. The hostile and unfriendly relationship exhibited by designers in a design team increases work pressure/stress for the quantity surveyors especially at insufficient information/details in the designer's products (working drawing)
ii. This wrong attitudes toward the quantity surveyors has brought constraints to the profession's awareness in Nigeria, even many do not see the need for the Quantity Surveyor.
iii. Commissions opportunities at times are loss by quantity surveyors due to these harsh attitudes of team members especially from the architect
iv. The hostility, unethical and poor team spirit exhibited by design team has efficient reducing effects on the service offered by the quantity surveyors.

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Performance of Insurance Firms in Housing Deliveryin Nigeria

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ABSTRACT

Housing is a major necessity of man but its provision has remained a major challenge to most people especially in the developing countries like Nigeria due to huge capital it requires. While insurance firms constitute a major potential source of housing finance, it is not clear if they are contributing significantly to reducing the national housing deficit. This study therefore assesses the role of insurance firms in housing delivery in Nigeria. Both primary and secondary data are employed for analysis in this study. Structured questionnaires were employed to retrieve data from thirty-five (35) insurance firms and sixteen (16) real estate developers operating in Lagos metropolis. Data on investment engagements of insurance companies were also retrieved from the National Insurance Commission and Central Bank of Nigeria. The results of the analysis show that the contribution of insurance firms to housing finance either through direct investment or through loans and advances is very low. The study also revealed that most of the insurance firms do not grant long-term loans which are most suitable for real estate development. Lack of trust in real estate developers, risk associated with real property investment and low public patronage are found as the three most significant factors inhibiting the contribution of insurance firms to housing finance. It is recommended that government should provide an enabling environment that can foster a high level commitment of insurance firms to housing delivery in Nigeria.

Keywords: Challenge, Delivery, Finance, Housing, Insurance firm

INTRODUCTION

Housing constitutes one of the most important needs of man. It is recognized world-wide as one of the basic necessities of life and a pre-requisite to survival of man (Waziri & Roosli, 2013). Housing is also perceived as a measure of success and economic freedom (Ayoola, 2006). This accounts for the high aspiration for home ownership among eligible populace across the globe. Perhaps no aspiration is more deeply embedded in human mind than the desire to own a home(Maller, Horne, & Dalton, 2012).While the Nigerian real estate sector is growing fast and is now the sixth largest sector in the economy,the quality of housing stock in the country is poor and far below the national housing demand with abysmal low homeownership rate of 25% far behind Indonesia (84%), Kenya (73%), and South Africa (56%) (CAHF, 2015).

Whereas, housing provision is one of the preoccupations of the government, the ever increasing national housing deficitis a reflection of the fact that public housing programmes have failed to contribute meaningfully to housing provision(Waziri & Roosli, 2013).The ramification for households is the huge financial burden that comes with home ownership. According to Manda, Nkhoma and Mitlin (2011), finance remains a major hindrance to home ownership especially among the low and medium income earners in Malawi. Also, OmirinandNubi, (2007) note that as desirable as housing could be, its production regardless of the scale is bedevilled with the problem of inadequate access to funds. Therefore, in order private sector to be able to meet up with the huge capital requirement of housing provision, there is the need for a good source of finance.

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The importance of finance in housing delivery cannot be over-emphasized. It is the economic power needed to mobilize materials and other resources required to actualize the goals of the various housing policies and schemes of any government (Odu, 1992). Provision of housing and other infrastructures depend on the financial sector which makes it the life-wire and engine of growth for all national economies (Ningi, 2013). Globally, the role of the financial sector in the growth and development of economic and social systems remains crucial. It plays an essential role in providing and channelling financing for investment as it serves as both source of short and long-term finance for investors (OECD, 2013).

According to the National Housing Policy of 1991, some financial institutions in Nigeria are expected to contribute to the housing finance system in a bid to help increase the number of housing units developed in the country. These include commercial banks, merchant banks and insurance companies (Agbola, 2005). The National Housing Funds (NHF) Act Decree No. 3 of 1992 states that a minimum of 20% of the non-life funds and 40% of the life funds should be contributed by insurance companies operating in Nigeria to real property development. Furthermore, the new Insurance Act of 2003 stipulates that not more than 35% of the general insurance business and life insurance business funds are to be invested in real estate and property. While this sounds odd to existing provisions, it implies insurance companies are allowed to invest up to 35% of their investible funds.

This study therefore assesses the performance of insurance industry in housing delivery in Nigeria. The main questions of focus in the study are (1) how significant is the contribution of insurance companies to housing finance in Nigeria? and (2) what are the factors responsible for such level of contribution? The rest of the paper is structured as follows. The second section presents a review of extant studies on Nigerian housing policies and sources of housing finance. The section reveals the position of insurance companies in the housing finance system. Research methodology is presented in the third section followed by results and findings. The fifth section is devoted to discussion of findings before the presentation of conclusion and policy implications in the final section.

LITERATURE REVIEW

One of the areas that have been heavily researched in the real property domain is housing. Core aspects that have been dealt with include housing supply, demand and affordability, housing finance, mortgage lending and default, roles of relevant stakeholders such government, financial institutions, property professionals and private sector, housing development policies and programmes among others (See Adewale, Siyanbola, & Siyanbola, 2014; Omirin & Nubi, 2007; Ukoje, State, & Kanu, 2014; Waziri & Roosli, 2013; Oyalowo & Nubi, 2013, etc). While all these studies were conducted in a bid to solve the national housing problem, the ever increasing national housing deficit is a reflection of the fact that housing programmes have not deliver the required respite (Waziri and Roosli, 2013). Availability and access to finance has been identified as a huge constraint to home ownership (Omirin and Nubi, 2007). Lemo (2007) observed that the production and supply of housing continues to be constrained due to lack of long-term finance for construction and mortgage finance. Also, Anota (2008) lamented the paucity of insurance industry in the building

market. It posited that the absence of sustainable long-term fund, which is required for construction, is the impediment of the insurance system.

Despite the challenge of housing finance, the role financial institutions has been clearly defined given their potential as funds mobilizers (Oyalowo & Nubi, 2013). Among the financial institutions, insurance firms have been rated high as possible source of housing finance given their relatively huge capital base and ability to issue long term funds (Oloke, Durodola, & Emeghe, 2015; Ubom, 2014).It has however been opined that the Nigerian insurance sector seems to be underperforming this role (Ubom, 2014). Consequently, the absence of thriving and sound insurance system has made Nigerians to have no other choice than to obtain loans from commercial banks (Akomolede, 2007), which ought to be short-term financiers with high interest rate. Despite the unattractiveness and non-suitability of such loans, stiff conditions still need to be met before advancement because banks are not ready to bear the risk of mismatching short-term deposit to fund mortgage concerns (Folorunso, Khan and Olowoyo, 2012). Ironically, the low income groups who occupy the largest segment of the Nigerian society are the most affected by this finance menace.According to section 5(2) of the National Housing Funds Act of 1992, a minimum of 20% of the non-life funds and 40% of the life funds should be contributed by insurance companies operating in Nigeria to real property development. Sub-section 3 further stated that nothing contained in the Insurance Act or relating to investment of insurance companies on real property shall affect the provision of this Act.

Housing problem is a global phenomenon confronting the developed and developing nations of the world. Accordingly, a combination of factors were identified as the bane of effective and sustainable housing among which are the problem of land accessibility, stunted financial and insurance system, exorbitant prices of building materials and disproportional capacity building in the sector in Lagos (Alufohai, 2013). In Nigeria, despite several housing policies in the past years, the housing deficit is ever increasing. The study of housing situation in Nigeria put existing housing stock at 23 per 1000 inhabitant. Housing deficit is put at 15 million houses (Mabogunje, 2007), while N12 trillion will be required to finance the deficit. This is about 4 times the annual national budget of Nigeria (FHA, 2007).

Insurance is a system under which individuals, businesses, and other organizations or entities, in exchange for payments of a certain sum of money known as premium, are guaranteed compensation for losses caused by certain perils and other specified conditions. The cost of purchasing insurance (Premiums) are not fixed arbitrarily; however, it depends on the level of risk involved. High risk usually attracts high premium (Kunreuther and Pauly, 2005). According to section 25 (3) of the Insurance Act of 2003, not more than 35% of the general insurance business and life business funds are to be invested in real estate and property. The Act stipulates that policy holder's funds shall be invested as loans to building societies by the Nigerian Insurance Commission, which can be made a veritable source of long term funding in real estate development. Since life funds of insurance companies are long term savings in form of annuities or endowment policies, which can only mature at the occurrence of certain known events, this can enable life assurance companies to invest primarily on long-term capital assets like real estate investment. Despite the various pronouncements, regulations and

deregulations, and all financial implementation policies of this country, the issue of accessing sufficient funds for an effective housing delivery system remain perpetually unsolved (Ozurumba, 2011). It averred thatthe loss of focus by some Primary Mortgage Institutions (PMIs) in favour of non-core activities such as trading as well as the slow disbursement of National Housing Funds (NHF) to the PMIs, made some of them to be competing with the banks in sourcing of funds for purposes other than mortgage financing coupled with the inability of the financial institutions to mobilize resources effectively for low-income housing.

METHODOLOGY

This study focuses on the performance of insurance firms in the provision of housing finance in Nigeria. The study is based on both primary and secondary data. Two different surveys were conducted to obtain (primary) data from the real estate developers as fund users and insurance companies as fund providers; while secondary data was obtained from the NAICOM annual report and CBN Statistical Bulletin. Likert-type scale structured questionnaire was adopted. The questionnaire for the real estate developers contains questions on (1) the forms of real estate development finance mostly used or easily assessable by them and (2) their desirability of finance from insurance companies. On the other hand, insurance companies were asked on the factors inhibiting their contribution to housing finance. While the study relates to Nigeria as a country, the city ofLagos has been selected as the study site. This is not in any way an attempt to localize the issue under consideration; rather it ismainly for the purpose of data collection. Being a former national capital city and currently the hub of the nation's commercial activities, Lagos houses more number of real estate establishments and insurance companies than any other city in Nigeria(NBS, 2015). Besides, it is one of the largest Nigerian cities in terms of population and has similar housing shortage asthe entire nation.Lagos alone accounts for 5 million housing deficit representing 31% of the estimated national housing deficit of 18 million (Oshodi, 2010).Thus, the authors believe that the data emanating from the city can be safely used to generate conclusions that are applicable nationally.

The real estate developers surveyed are those on the membership list of the Real Estate Developer's Association of Nigeria (REDAN). These are mainly corporate organizations involved in business related to the housing industry or commercial real estate development such as building of residential, commercial and industrial structures. According to the list provided on REDAN's website, there are only one hundred and six (126) financial members nationwide as at November 2015. However, as the list only contains names of companies and not details of their locations, the authors had to search manually for company addresses and locations. Eventually, only twenty-six (26) companies who are members of REDAN are traceable to Lagos metropolis. According to the NAICOM's website, there are fifty-four (54) licensed insurance companies as at November 2015 operating in Lagos. However, in the course of data collection, only fifty (50) of them were reachable. For both surveys, authors ensured that the data obtained satisfy relevant quality and reliability criteria (Creswell, 2009). This was achieved by ensuring that only the senior and experienced personnel were targeted among the companies and only their responses were considered for analysis. At the end,

thirty-five (35) insurance firms out of fifty (50) and sixteen(16) real estate developers out of twenty (26) operating in Lagos metropolis participated in the survey, which yields response rates of 70% and 62% for the two groups respectively. All the questionnaires that were returned were found suitable for analysis and the response rates are found satisfactory for the research design adopted (Nulty, 2008).Surveys were conducted between June and October 2014.

Secondary data on major investment engagements of insurance companies were also retrieved fromNAICOM. Due to data accessibility, the data which ought to cover the period 1996-2014 terminates at 2011. Data analysis is mainly through the weighted average estimated using Equation I. given the nature of data while presentations are done through the use of frequency tables and charts.

$$\bar{x}_w = \frac{\sum_{i=1}^{N} x_i w_i}{\sum_{i=1}^{N} w_i} - - - - \text{Equation I}$$

Where:$\bar{x}_w$ is the weighted item; x_i is value of ith item *x*;w_i is the weight of ith item *x.*

RESULTS AND FINDINGS

This section presents the results of data analysis starting with the background information of the respondents presented in Table 1. This is followed in Table 2 by real estate developers' response on the type of real property mostly developed by their firms in Lagos. On a 5-point rating scale, '5' is used to denote mostly developed property type, while '1' is used to denote the least developed.

Table 1:Years of Operation of Real Estate Developers and Insurance Firms

Years of Operation	Real Estate Developer's Firms		Insurance Firms	
	Frequency	(%)	Frequency	(%)
1-10 years	5	31.3	3	8.6
11-20 years	6	37.5	21	60
21-30 years	2	12.5	11	31.4
31-40 years	3	18.8		
Total	**16**	**100.0**	**35**	**100.0**

Table 1 shows the years of operation of Real Estate Developers Firm and insurance firms in Lagos. From the table, most of the real estate developers firms are below 20years. This indicates that the firms are recent phenomena as individual developers now find it very difficult to access funds for real estate development. But the coming of these firms has made development more feasible and achievable.

Table 2:Type of Property Developed by Real Estate Developers

Property Type	**Development Rating**					**Weighted**
	5	**4**	**3**	**2**	**1**	**Average**
Residential properties	12	4	0	0	0	4.75
Office accommodation	10	6	0	0	0	4.63
Shopping centres	8	7	1	0	0	4.44
Industrial properties	4	6	4	2	0	3.63
Recreational properties	3	2	5	2	4	2.88

Table 2 shows the various types of real property mostly developed by real estate developers in Lagos. From the table, residential property ranks highestwith a mean score of 4.75, while this is followed by office accommodation and shopping centres developments with mean

rankings of 4.62 and 4.44 respectively. This has rapidly improved the commercial sense of these areas, turning areas like Victoria Island into central business district (CBD) where the core of business emerges. The result shows that real estate developers do not go much into industrial and recreational properties as they ranked 4th and 5thwith mean score of 3.63 and 2.88 respectively. This is an indication that housing development is of high demand and this ought to be given utmost attention by all stakeholders.

In Table 3,real estate developers' responses were sought on the sources of finance mostly available for the developers. On a 5-point rating scale, '5' is used to denote highest level of availability, while '1' is used to denote the least available.

Table 3: Source of Finance for Housing Development

Source of finance	Availability rating					Weighted
	5	4	3	2	1	average
Mortgage institutions	9	3	2	0	2	4.06
Commercial Bank loans	8	3	2	3	0	4.00
Equity fund	5	6	2	3	0	3.81
Loans and advances from insurance company	4	7	2	1	2	3.63
Loan syndication	2	9	1	2	2	3.44
Real Estate Investment funds	1	9	1	2	3	3.19

As shown in the table, mortgage institutions and commercial banks are the two most significant sources of housing finance to real estate developers with weighted averages of 4.06 and 4.0 respectively. Equity ranks third with a weighted average of 3.81 followed by insurance sector which achieves weighted average of 3.63 to occupy the fourth position. The least rated sources of housing finance in terms of availability are syndication and real estate investment fund with weighted averages of 3.44 and 3.19 respectively. In order to identify if lack of interest in loans from the insurance sector is the reason for the low rating achieved by the sector as reported in Table 4, real estate developers were asked to rate their desirability of the various sources of housing finance. On a 5-point rating scale, '5' is used to denote highest degree of desirability while '1' is used to denote the least desirable. The responses of the real estate developers are presented in Table 4.

Table 4: Desirability of Real Estate Finance for Housing Development

Source of finance	Desirability rating					Weighted
	5	4	3	2	1	average
Mortgage institutions	7	5	1	2	1	3.94
Loans and advances from insurance company	5	6	3	0	2	3.75
Loan syndication	4	6	2	0	2	3.63
Commercial Bank loans	4	6	3	1	2	3.50
Real Estate Investment Funds	4	6	2	1	3	3.31

The table shows that mortgage institutions and insurance sector are the two most desired sources of housing finance with weighted averages of 3.94 and 3.75 respectively. With weighted averages of 3.63 and 3.50 respectively, syndication and commercial banks rank third and fourth as the most desired housing finance sources by the real estate developers. As shown in the table, the least desired source of housing finance is real estate investment fund with 3.31 weighted average. The performance of insurance companies is further examined through secondary data on their major investment commitments over the period 1996-2011 as presented on Table 5.

Table 5 shows that in terms of nominal value, the amount of money investedby insurance companies into the real estate and mortgage was in excess of ₦2.5 billion in 1996. The figure grew to ₦2.7 billion in the year 1997 followed by drastic decline and lower investments

between 1998 and 2004. Over this period of trough, investment in real estate and mortgage fell to ₦212 million in 1998 while the highest volume of investment was ₦960 million recorded in 2002. Things however changed remarkably in 2005 when the volume of investment climbed up again to ₦33.8 billion. Since then, investment volume has continued on the rising trend with 2011 figure at about ₦49.5 billion. In order to assess the commitment of insurance companies to mortgage and real estate investment, the proportions of investment in government securities and stocks are calculated. Fig. 1 presents the insurance companies' investment in the three selected investment media expressed as percentage of total investment.

Table 5: Major investments of insurance companies, 1996-2011

Year	Govt. Securities(₦' million)	Stock & Bond (₦' million)	Real Estate & Mortgage (₦' million)	Cash deposits (₦' million)	Bills of exchange (₦' million)	Others (₦' million)
1996	1,546	4,048	2,523	3,347	119	796
1997	2,012	4,095	2,684	3,816	164	842
1998	4,146	3,633	212	1,993	3,371	2,301
1999	2,987	4,174	333	4,184	5,781	4,124
2000	3,559	4,993	282	3,844	7,302	5,212
2001	3,843	6,886	359	4,285	10,178	6,706
2002	3,752	8,351	960	4,095	11,881	7,901
2003	3,559	4,993	282	3,844	7,302	5,212
2004	8,708	No data	352	2,669	2,594	8,357
2005	4,178	61,801	33,788	10,185	6,301	5,591
2006	4,858	121,813	45,187	30,314	6,303	7,885
2007	20,915	222,279	45,332	22,508	5,268	12,946
2008	21,375	227,169	46,329	23,004	5,384	13,231
2009	21,845	232,167	47,349	23,510	5,502	13,522
2010	22,326	237,274	48,390	24,027	5,623	13,819
2011	22,817	242,495	49,455	24,556	5,747	14,123

***Sources**: NAICOM Annual Reports, 2008& 2011; CBN Statistical Bulletin Vol. 20, 2009*

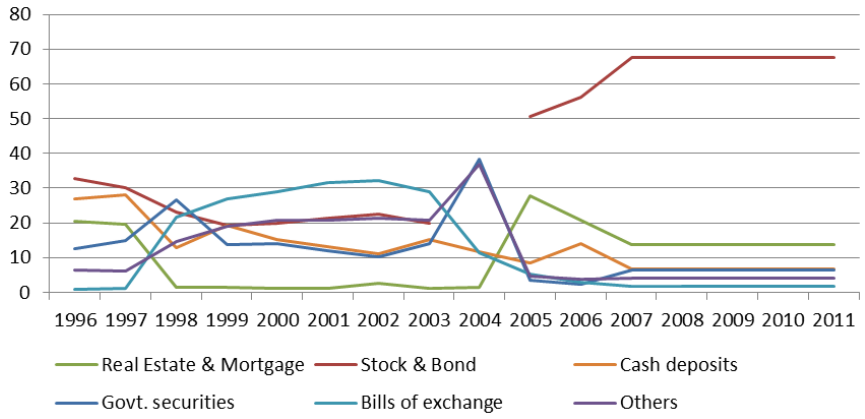

Fig. 1: Investments of insurance companies as percentage of total invested fund, 1996-2011

As shown in the figure, the percentage of investment of insurance firms in real estate and mortgage was about 20% in 1996 which was above investments in government securities, bills of exchange and 'others' but far below stock and cash deposits. There was a general fall in the period 1997 - 2002 except for bills of exchange during which investment in real estate and mortgage fell below other outlets. In fact, investment in real estate and mortgage did not pick up not until 2004 which was a year after the other outlets such stock and bond and government securities have experienced rise in investment volume. Since 2005, real estate and mortgage has maintained middle position similar to the pre-1996 period.

The chart also shows that investment in real estate and mortgage exhibits inverse relationship with bills of exchange as the former moves in opposite direction with the latter almost throughout the period under study. While investment in stock has increased remarkably from about 33% to 68%, investment in real estate and mortgages reduced to 14 per cent.

In order to identify the reasons for the low level of investment in real estate and mortgage, insurance firms were asked to rate a list of possible factors as reported in Table 6. On a 5-point rating scale, '5' is used to denote most severe, while '1' is used to denote the least severe factor inhibiting the contribution of insurance firms to housing finance.

Table 6: Factors Inhibiting the Contribution of Insurance Firms to Housing Finance

Factors	**Severity rating**					**WA**
	5	4	3	2	1	
Lack of Trust in real estate developers	17	16	2	0	0	4.43
Low patronage of insurance industry by the general public	14	16	3	0	2	4.14
Huge tax burden payable on profits realized	9	22	3	0	1	4.09
Ineffective disbursement of funds through mortgage	8	22	4	1	0	4.06
Stringent government counter policies	10	19	3	2	1	4.00
Uncertainty/risk in financing real estate	0	11	20	3	1	3.17

As shown in Table 6, lack of trust in real estate developers ranked 1st with 4.43 as mean, while low patronage of insurance industry by the general public ranked 2nd with a mean of 4.16. Other factors are huge tax burden payable on profits realized (4.09), ineffective disbursement of funds by mortgage institutions (4.06) and stringent government counter policies (4.00), while uncertainty involved in financing the housing development ranked least with a mean score of 3.17. In order not to lose its funds or investment to real estate development, the Insurance Act of 2003 has placed a maximum percentage of premiums investable in real property development at 35%. Though, this was to curb the menace of bankruptcy or foreclosure of insurance companies and loss of funds meant for policy holders should any unforeseen event occur, but it is a policy which has countered that of NHF Act of 1992 thereby encouraging insurance firms to contribute less to housing development in Nigeria.

DISCUSSION OF FINDINGS

In Nigeria, insurance companies are encouraged to contribute to funding of real estate development especially provision of affordable homes. This is because they Insurance firms forma major segment of the national financial system. The main preoccupation of insurance companies relates to financial intermediation, mobilization of financial resources and utilizationof such for economic development including provision of housing (Ubom, 2014).However, this study shows that the proportion of investment flowing into the real estate and mortgage from the insurance companies is very low. This agrees well with the study by Oloke, Durodola and Emeghe(2015)in which forty-six insurance firms (representing 96% of the total firms surveyed) only allocate 10% or less of their investable funds to real estate. In terms of availability for housing development purpose, finance from insurance sector ranks fourth behind mortgage institutions, commercial banks and equity (Table 3).While insurance companies are well-suited to provide ample housing finance due to their stable source of income and long-term nature of their liabilities, the result gives an indication that the insurance sector has not been a good source of finance for housing development.

The low finance contribution from the insurance sector is further unveiled by the sector's investment activities (Table 5 and Fig. 1). Throughout the period under consideration, investment into the real estate and mortgage was never in excess of 28% (recorded in 2005) of the total insurance companies' investment. In fact, between 1997 and 2002, investment in

real estate and mortgage was in melting pot after a drastic fall from 20% it enjoyed until 1997. It is worthy of note that all the investments outlets except bills of exchange suffered the downward trend due notably to the global financial crisis that rocked the decade. Whereas, real estate ought to have high risk-hedging capability than most other investment outlets, the fact that investment in real estate and mortgage went under might be a reflection of the insurance companies' lack of trust in this potential in line with a recent study by Oloke, et al. (2015) in which Nigerian insurance companies generally affirm they perceive real estate as risky asset. The second and perhaps the most important reason that may explain the dwindling investment in real estate and mortgage especially during the downturn is the relatively illiquid nature of real estate assets. Insurance companies rate illiquidity as one of the critical risk elements that are germane to their investment decision (Oloke, et al., 2015). This sounds reasonable as they need to guide against not being able to access fund to perform their primary function in the face of economic gloominess.

However after the crisis, one would expect investment in real estate and mortgage to shoot up again at least to 20% recorded in 1996 and 1997. While this has been the case for investment in stock which has increased drastically from 33% to 68%, investment in real estate and mortgages remained moderately low at 14 per cent since 2007 after a momentary period of spike between 2005 and 2006. In the absence of data on the total fund as well as insurance categories, it is difficult to ascertain whether this current level of investment in real estate by the insurance companies meets up with the minimum benchmark provided by NHF Act of 1992. While the law stipulates that 20% of the insurance companies' non-life funds should be committed to real property sector, it is not clear if the current 14% of total investment is big enough to meet benchmark. The provision of the Insurance Act of 2003 which stipulates (as interpreted)that insurance companies can invest in real estate to the tune of 35% of their funds seems to weaken the NHF Act. Based on these laws, the insurance sector can be exonerated from any potential blame for not doing more in housing finance as the functions of the lending institutions in the property market rests heavily on the policy environment in which they operate (Omirin and Nubi, 2007). While the governments have made series of interventions at solving the problem housing, presence of multiple policies with conflicting provisions can be blamed for the failure of such programmes (Waziri and Roosli, 2013).

There is evidence that the real estate developers would want loan from the insurance sector. Conversely to the level of availability where it ranks fourth (Table 3), insurance sector ranks second after mortgage institutions in terms of desirability as source of finance for housing (Table 4). While the real estate developers rely more on mortgage institutions, commercial banks and equity, this result shows that they still desire their funding from insurance companies. This can be adduced to the fact that insurance companies are potential long-term financiers. The preference for equity funding over loans from insurance companies no doubt is worrisome. Thus, finance has been and will continue to constitute major hindrance to effective production of affordable housing in Nigeria unless necessary actions are taken (Manda et al., 2011).The contribution of the insurance firms to the housing sector is low as found in this study. Earlier, Ubom (2014) concluded that insurance sector's contribution to national economic development as a whole seems very insignificant. All these point to the under-utilization of fund from a sector with good capacity to fuel economic growth and development.

There cannot but be reasons why insurance companies detest or seem to have little interest in financing real estate development especially housing. As reported, lack of trust in real estate developers constitutes a major factor preventing insurance companies. This may be the case given the level of non-performing loans and default in the country (Akinlo & Emmanuel, 2014).Furthermore, insurance firms have not been at the forefront of financing real property

development. This could be the reason for the low patronage received from the general public as this ranked second. Other factors are huge tax burden payable on profits realized (4.09), ineffective disbursement of funds by mortgage institutions (4.06) and stringent government counter policies (4.00). For instance, the National Housing Fund Act of 1992 stipulates that 20% of non-life insurance fund and 40% of life fund should be contributed to real property development. However, in order not to lose their funds or investment to real estate development, the Insurance Act of 2003 places a maximum percentage of premiums investable in real property development at 35%. Though, this was to curb the menace of bankruptcy or foreclosure of insurance companies and loss of funds meant for policy holders should any unforeseen event occur, but the policy has countered that of NHF Act of 1992 thereby encouraging insurance firms to contribute less to housing development in Nigeria.

CONCLUSION

It is evident that the insurance sector remains a key player in the financial services sector and a leading contributor to the sour-economic growth of the nation. But the fact still remains that its huge reserves and investible funds that are diverted into other forms of investments have been inadequately exploited to fund housing development, which remains crucial and indispensable to the existence of man. Insurance industry has remained relevant in the area of mortgage financing through loans and advances to mortgage institutions. These loans and advances to building societies and primary mortgage institutions could be a veritable source of long term funding for housing development. However, evidence shows that this has not been adequately exploited. This was basically due to lack of trust in real estate developers, low patronage by the general public, ineffective disbursement of mortgage loans and stringent policies from the government, which sometimes counter each other.

Government can help facilitate effective contractual agreements between developers and insurance companies to deal with issue of lack of trust. Since insurance companies would not commit to long-term investment as we found due to risk of liquidity, Government should put framework in place to always come to the rescues of insurance firms anytime they are short of fund for insurance cover due to their investment in real estate. Government can also develop aggressive motivational strategies, which give reward to insurance companies that invest well into housing provision.

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An Assessment of Risk Factors Impacting on Construction Contractors' Cash-in Forecasts in the Nigerian Construction Industry

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ABSTRACT

Consideration for risk factors impacting on cash flow forecasts has been identified as a key issue affecting contractors' application of forecasting models. This research was conducted in order to assess the risk factors influencing the prediction of "cash-in" flow by contractors in the Nigeria construction industry. The perceptions of construction contractors were sought on a list of risk factors that influence cash-in flow forecasts. The research data were collected through an industry-wide questionnaire survey of contractors operating in the entire Nigerian construction industry. A list of 40 risk factors influencing "cash-in" flow was generated from literature review. Responses obtained from 157 contractors were used to analyse the major risk factors that are responsible for the impact on cash in forecasts. The research provides stakeholders with information on factors which, if properly understood, will make planning for "cash-in" for construction projects easier and thus render project delays less likely. Seventeen risk factors were found to significantly influence cash-in forecasts for projects executed in Nigeria. These include- "delay in receiving retention", "accuracy of estimates", "change in government officials", among others. The findings from this research have regional dimension. It is therefore suggested that contractors should apply the results with caution. For, the risk factors influencing cash-in forecasts is affected by individual culture, regulations and nature of the construction industry under consideration.

Keywords: Nigeria, Construction Industry, Risk factors, Cash Flow, "Cash-in", Forecasts

INTRODUCTION

The success of any construction company depends largely on the ability of its management to foresee and prepare for the future. One area of great challenge is that of managing present and future financial requirements. An essential component of financial management is that of forecasting cash flow. Cash flow in construction contracts is concerned with the timing of payments, receipts of payments and the consequent balance of cash remaining due to these transactions. Construction contractors know that there can be a significant lapse in contractual time from the point at which they are granted a project, incur labour, material and other costs ("cash-out"), to the time they are actually paid for completed work ("cash-in"). Cash flow in construction consists of the following important components (Kenley, 2003): goss cash flow- consisting of inward cash flow and outward cash flow; net cash flow- consisting of the balance between inward ("cash-in") and outward (cash-out) flow; organisational cash flow- consisting of the overlaying of the organisation's individual project net cash flows; and strategic management of cash flow- consisting of the policy and strategic framework for managing the cash flow for the entire organisation, including non-construction projects or investments.

Several factors affect cash flow to a contractor working on a project. These factors include (i) duration of the project (ii) retention conditions (iii) times for receiving payments from clients (iv) credit arrangement with suppliers, equipment rentals etc and (v) times of payment to subcontractors (Park, Han and Russell, 2005). Other factors affecting cash flow forecasting include the type of client, size of the project, the procurement route, type of the project, among others (Kaka and Khosrowshahi, 1996). Thus, the need for forecasting the cash requirement of a project at the right time, in order to determine when and where to borrow or redirect funds cannot be over emphasised.

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In an attempt to assist contractors and employers forecast their cash requirements, several researchers have made efforts to develop cash flow forecasting models. The approach of early studies may be characterised as nomothetic- the studies attempted to discover general laws and principles across categorised or none categorised groups of construction projects (Kenley, 2003). Some of the techniques used for modelling cash flow forecasts include polynomial regression (Balkau, 1975; Bromilow, 1978; Peer, 1982), Weibull-linear model (Tucker, 1986), Logit models (Kenley and Wilson, 1986, 1989), neural network (Boussabaine and Kaka, 1998; Boussabaine *et al.*, 1999) and fuzzy logic (Boussabaine and Elhag, 1999; Chen *et al.*, 2013). The nomothetic approach adopted by early researchers has gained fewer acceptances because of several shortcomings that resulted in the inability of the models to produce typical value curves. These short comings emanated as a result of the uniqueness of construction projects arising from difference in payment conditions (Chen *et al.*, 2005), time lag between billing and actual payment (Park *et al.*, 2005), type of project (Boussabaine *et al.*, 1999), procurement route (Kaka and Khosrowshahi, 1996; Kaka and Price, 1991), type of client and several other factors.

This paved way for the introduction of the idiographic approach- the search for specific laws pertaining to individual projects. Researchers have shown that models developed using the idiographic approach, are more accurate than the nomothetic models (Kenley and Wilson, 1986; Kaka and Price, 1991; Boussabaine *et al.*, 1999). Despite these improvements, forecasts by existing models continue to vary considerably with actual cash flow (Odeyinka *et al.*, 2002; Odeyinka *et al.*, 2008, Ross *et al.*, 2013, Zayed and Liu, 2014). According to recent researches (Ross *et al.*, 2013; Odeyinka *et al.*, 2013; Zayed and Liu, 2014) the variation between the forecasts and the actual is as a result of non-consideration of risk factors inherent in construction by the models developed. Hence more researchers are advocating for understanding and evaluation of the influence of risk factors on cash flows. Zayed and Liu (2014) in a comparative study of risk factors impacting on cash flow forecasts in North America and China showed that the risk factors had regional dimensions. Results from their study showed that the extent of impact of the risk factors is regionally endemic owing to geotechnical, cultural, attitudinal and other regional issues.

In Nigeria, authors have linked project abandonment to delays associated with payments (Aibinu and Jagboro, 2002; Olawale and Ming, 2009; Lawal and Onohaebi 2010, Olusegun and Michael, 2011). These delays, according to the authors, were caused by cash flow management problems and other factors like procurement route, availability of credit facilities, interest rates, retention rates, time lags between billing and actual payment, project type, type of client (public or private), among others. The cash flow management issues that have been linked to project abandonment in Nigeria are mostly risk factors influencing cash flow forecasts-interest rates, availability of credit facilities, procurement route, project complexity and the likes. Despite these evidences from literature a comprehensive investigation of the risk factors impacting on cash flow forecasts in Nigeria has not been carried out. Similarly, existing researches on risk factors on cash flow forecasts available in literature have failed to consider some risk factors. Some of the risk factors not captured include charging of 'land dues' by locals (illegally), change in government officials, bureaucracy in processing payments (giving bribes to "speed up" payment), change in activities' start time, among others. The purpose of this study is to assess the impact of the risk factors on construction contractors' cash in forecasts, including the erstwhile neglected risk factors.

LITERATURE REVIEW

Financial management of the business of construction is as important as the management of the technical rudiments. This is especially as the competition in modern construction business has become very high. Contractors' financial successes have been attributed more to their background in business and finance rather than construction itself (Kaka, 1990). The number of projects that a firm is able to accommodate in the short-run in order to remain operational is determined by the skills and foresight of its management. The management decision is often propelled by the skills available to the firm. The effect of the failure of one project can be very damaging to the overall survival of a firm.

The effect of managerial decisions on the survival of individual firms and consequently a country's construction industry are numerous (Kenley, 2003). The relative content of labour and materials that must be decided by management varies from project to project. This necessitates the different ratios of labour and materials being used in the built-up cost index applied in a firm's financial planning. Such planning if appropriately executed ensures the survival of construction companies. The need to invoke strict financial management techniques has long become apparent especially for construction projects. During the periods of high inflation some large projects tend to double in cost.

Four major factors were identified as the reason for construction company failure generally; inadequate funding, underestimating costs, inadequate cost accounting, and poor management (Nunnally, 1998). The construction industry experienced a proportionately greater number of bankruptcies than other industries in recent years (Kenley, 2003). Compared to other industries, the construction industry is not capital intensive, because it is able to support a relatively high turnover in relation to capital employed. The traditional interim payments available to contractors and the delays of payment to subcontractors, suppliers and other creditors can reduce the required working capital to considerably low levels (Kaka, 1990). The low level of capital employed usually enables contractors to operate with very low profit margins on investment and high level of risk, since most of the finances required come in form of interim payments and credit facilities (Kaka, 1990).

Researchers and businessmen have long appreciated the prevalence of risk in businesses. Researchers in the construction industry have attempted to define risk and suggest management strategies for containing risks. Healey (1982) defined risk as "an exposure to economic loss or gain arising from involvement in the construction process". However, Moavanzadeh and Rossow (1976) regarded risk as "an exposure to loss" only. Perry and Hayes (1995) defined risk as "the chance of exposure to the adverse consequences of future events". It is generally recognised that participants within the construction industry are continually faced with a variety of situations involving many unknown, unexpected, frequently undesirable, and often unpredictable factors (Fong, 1987). Flanagan and Norman (1993) asserted that risks are associated with uncertainties but uncertainties, in contrast to risks, might be defined as situations in which there are no historic data or previous history relating to the situation being considered by the person making a decision. The more the thought that is given to risks and uncertainties, the more the inclination to accept risk as the more important term in the building industry (Flanagan and Norman ,1993). The aim of a construction firm should be to identify, analyse, evaluate, and operate on risks. Risk, if contained properly in businesses, can be used as an instrument for gaining advantages (Khosrowshahi, 2000).

Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in the Nigerian construction industry. The study revealed that shortage of material/manpower, variation orders, strikes, civil unrests and inclement weather were inimical to smooth project

delivery in the country. Subsequent researchers identified the same as risk factors affecting cash flow forecasts.

Odeyinka, Lowe and Kaka (2002) argued that despite several attempts by researchers to develop cash flow forecasting models for contractors and clients in the construction industry, many of the models failed to consider and analyse the risk factors responsible for the considerable variations in the modelled cash flow profiles. Consequently the researchers set out to identify and assess the risk factors responsible for variations in the construction cash flow profiles. The result of the analysis conducted revealed the major risk factors affecting cash flow forecasting relates to "changes in design or specifications", "contract conditions pertaining to cash flow", "interim valuations" and "certificates and construction programming" issues such as "inclement weather". However, the study was conducted in the UK where the researchers identified as having "a stable economy". The research further emphasised the geographic dimension of risk factors impacting on cash flows and cash flow forecasts.

Kaka, Lewis and Petros (2003) studied the effects of variability of project planning on cost commitment curves. One real project was used as a case study while employing four different planners independently to prepare work programme for the same project. The four programmes produced were analysed and converted to cost flow curves using a single data base of productivity and unit cost rates. The result showed a minimal variation in cost flow as a product of the difference in planning. Other factors were suggested to be of more effect in the variability - size of the project, duration of the project, experience of workers, availability of labour and plant.

Dantata (2007) in a study of the general overview of the Nigerian construction industry identified key factors affecting the growth of contractors in the Nigerian construction industry. The researcher identified skilled manpower shortage, high cost of materials, unstable prices of materials, delay in payment by clients, frequent social tensions and bureaucracy in processing payments (i.e. having to bribe officials) as key factors inhibiting contractors from growing. Dusai (2011) also identified bureaucracy in processing payments, change in government leadership and informal charging of "land dues" by locals as important factors affecting contractors' progress in the Nigerian construction industry. Although neither of the two researchers tagged the factors as "risk factors to cash flow forecasts", it is quite apparent that they are.

Enshassi, Al-najjar and Kumaraswamy (2009) carried out a study of Gaza strip (Palestinian authority) to determine delays and cost overruns in the construction projects. The study was prompted by the special conditions available in the region (Gaza strip frequently undergoes civil unrest as a result of dispute between Israel and Palestine). A combination of contractors, consultants and owners in the construction industry were randomly selected for the study. The findings from the research are that strikes and border closures, material related factors, lack of materials in markets, and delay in material delivery to site contribute majorly to time delays. While cost overruns are caused majorly by price fluctuations of construction materials, contractor delays in material and equipment delivery, and inflation. The factors identified by the study are direct risk factors influencing cash flow forecasts.

Buertey *et al.* (2010) developed a model for predicting construction cash flow in Ghana through a case study of a group of flats under construction by the government. Analysis of data gathered through a questionnaire survey of consultants, contractors and client's representatives 18 factors were identified as significantly affecting cash flow forecasts for contractors in Ghana. The factors include contractual specification for maximum amount valuation, availability of credit facility, advance payments, interval between two certificates,

period of honouring certificates by client, rate of retention, interest rates, front/back end loading, accuracy of measurements etc.

Mbachu (2011) investigated the sources of contractors' payment risks and cash flow problems in the New Zealand construction industry. Data was collected from project teams as to their perception of the risks contributing to payments in New Zealand. The result identified payment delays, high interest rates, inflation, government regulations, complexity of projects and claims as significantly affecting cash flows.

An analysis of the impact of negative cash flow on construction performance in Dubai carried out by Al-Jabouri *et al.* (2012) showed that there were negative cash flows for up to 70% of project duration. The study also revealed that adjustment of activities' start time and relationship between contractor and owner were major risks in forecasting cash flows.

Odeyinka *et al.* (2013) identified eleven significant risk factors impacting on cash forecasts for contractors in the UK. By studying 26 risk factors via a questionnaire survey of contractors, the researchers were able to conclude that the eleven factors impacted cash flow forecast more in UK's "stable" economy. The study revealed a regional dimension to risks in cash flow forecast. Ross *et al.* (2013) also revealed "activities' start time", "estimating errors", "dates of interim payment", and "retention percentage" as being crucial to expenditure forecasting practice by construction contractors.

McClain *et al.* (2014) discovered that poor communication, geotechnical issues and problems with foundation were prominent risk issues associated with cash flow forecasts. Also, delay in payment by employer, delay in honouring certificates, change orders and nominated subcontractors fault were identified as significant contributors to decisions to delay claims in construction contracts executed in India (Chaphalkar and Iyer, 2014).

Zayed and Liu (2014) emphasised on the impact of location on factors affecting cash flow forecasts. Data for the study was collected from North America and China. A total of 43 factors affecting cash flow forecasts were used for the study. 33 and 67 questionnaires were collected from North America and china respectively seeking respondents to rate the impact of each identified factor on cash flow forecasts. Result from the survey showed a significant difference in the impact of the following risk factors in the two locations- "contractor's personal relation with the consultant team", "contractor's personal relation with the owner", "lack of skilled labour", "change of progress payment duration", "change of labour and staff wages", "delay of making payments to suppliers", and "number of claims".

Evidently, several researchers have attempted to highlight the influence of risk factors to cash flows in different locations of the world. Hence, the current research seeks to explore, analyse and document these factors in the specific context of the Nigerian construction industry. An understanding of the factors will help contractors manage their finances properly and thus finish their projects on schedule.

RESEARCH METHOD

This research developed a list of 40 risk factors influencing "cash-in" forecasts from extant literature. The risk factors identified formed the focal point of the research. A questionnaire survey was conducted amongst responding contractors who were classified according to the types of projects they executed (Table 1), to assess risk factors that they deemed to have high level of occurrence in the Nigerian construction industry**.** The questionnaire was divided into two parts (sections A and B). This was done to make the questionnaire easy to understand and very clear to the respondents. Section "A" requested general information from the respondents. These include mainly information about the respondents such as name of

organisation, type of projects commonly executed, position of the respondent in the organisation, the average duration of projects executed, average value of project executed, the procurement route commonly adopted in projects executed, the annual turnover of the organisation and the nature of the client served. The provision of the 'other (please specify)' option was included to in each category of the questions to reduce rigidity which may artificially constrain the responses (Fellows and Liu, 1997). These pieces of information were to enable the grouping of the responses provided by the respondents.

In section B of the questionnaire, table 1 consisting of 40 risk factors derived from literature as potentially affecting "cash-in" flow forecasts were listed. Respondents were then requested to provide opinions regarding the likelihood of each factor occurring. Respondents were asked to score their opinion on a 0-5 Likert type scale, zero being included so as to accommodate the instances where the risk factor was not applicable (Holt, 1997). The highest likelihood of a risk factor occurring was assigned a score of 5.

Probability sampling technique was adopted for the study, owing to the fact that the size of the population was already known. Cochran's (1977) table for determining minimum returned sample size for a given population size for continuous and categorical data was used for determining the appropriate sample size for this study. A total sample size of 370 was identified to be sufficient for the study. A list of registered contractors was obtained from Corporate Affairs Commission (CAC), the government establishment saddled with the responsibility of registering and ensuring continuity of construction and other contractors in Nigeria.

The data obtained from the questionnaire survey were of numerical nature. The numerical data were compiled and entered into the Statistical Package for Socials (SPSS version 21) Software. The analysis of the data involved both descriptive and inferential statistical operations available in the SPSS software. The quantitative data were analysed and results of descriptive statistics obtained include frequency distributions, measures of central tendency (means) and standard deviation.

Table 1: Type of Projects Executed by Respondents

Types of Project	Frequency	Percent	Cumulative Percent
Commercial Buildings	64	40.8	40.8
Hospital Buildings	23	14.6	55.4
Residential Buildings	7	4.5	59.9
Public and Community Buildings	63	40.1	100.0
Total	**157**	**100.0**	

In spite of the provision for "others (please specify)" in the questionnaire, no other type of buildings was captured. The prevalence of commercial and public/community buildings can be explained by the fat that government pays more attention to these building types than any other. As government is the major client in the Nigerian construction industry, it is not surprising that residential buildings, mostly owned by individuals, had the least patronisation.

From table 2, the risk factor whith the highest occurence is Delay in Receiving Retention. This is followed by Accuracy of Estimates, Change in government Officials, Bureaucracy in Processing Payments (giving bribe to "speed up" payment files movement), and Increased Duration of the Project. These represent the top 5 risk factors that occur in construction projects in Nigeria. Client's Insolvency, Civil Disturbance, Large RetentionPercentage, Labour Strikes and Subcontractor's Insolvency were the last five amongst the 40 risk factors. The positions of the first five does not come as a surprise as corruption has become common-place in Nigerian Government coffers. Change in government Officials and Bureaucracy in Processing Payments (giving bribe to "speed up" payment files movement) are manifestations

of corrupt practices in Government parastatals saddled with the responsibility of paying contractors at the required time. Changes in officials handling government issues results mostly in the abandonment of an existing policy to give way for the selfish interest of the new officials.

The ressults obtained have variations with those obtained from previous studies. Zayed and Liu (2014) identified change of progress payment, payment duration, financial position of the contractor, project delays and poor planning as the most significant factors affecting congtractors' forecasts in North America and China. The similarities with that and those observed in this study appear only in project delays juxtaposing with increased duration of the project, while payment duration juxtaposes with Bureaucracy in Processing Payments (giving bribe to "speed up" payment files movement)/ Delay in Receiving Retention, although the reason for that in America and china was not related with corruption. Other factors like Accuracy of estimates and Change in government Officials do not seem to be as important in China and North America.

Table 2: Probability of Occurence of Risk Factors Affecting "cash-in" Forecasts

Risk Factors	Mean	Rank
Delay in Receiving Retention	4.72	1
Accuracy of Estimates	4.61	2
Change in Government Officials	4.57	3
Bureaucracy in Processing Payments (giving bribe to "speed up" payment)	4.36	4
Increase in duration of the Project	4.27	5
Delay in Payment from Client	4.25	6
Delay in Releasing Advance Payment	4.20	7
Withholding Tax	4.13	8
Discount on Materials Purchased	4.06	9
Delay in Paying Creditors	3.97	10
Dispute Between Contractor and Owner	3.84	11
Variations	3.68	12
Under Valuation	3.68	13
Changes in Activities' Start Time	3.50	14
Change in Interest Rates	3.38	15
Production Time Slippage	3.32	16
Changes to Initial Design	3.25	17
Geotechnical Issues	2.97	18
Inclement Weather	2.95	19
Long Interval Between Two Certificates	2.76	20
Overheads	2.66	21
Problems with Foundation	2.64	22
Replacement of Defective Work	2.48	23
Bad Relationship Between Contractor and Consulting Team	2.16	24
Compliance With New Regulations	1.99	25
Unavailability of credit facilities	1.75	26
Incompetent Consulting Team	1.72	27
Back/Front end Loading	1.54	28
Bad Relationship Between Main and Sub Contractor	1.52	29
Bad Relationship Between Contractor and Owner	1.50	30
Change Orders	1.43	31
Period of Honouring Certificates	1.23	32
Listed Buildings	1.23	33
Contractual Specification of Minimum Amount Valuation	1.16	34
Receiving Advance Payment	1.13	35
Client's Insolvency	1.10	36
Civil Disturbance	0.99	37
Large Retention Percentage	0.87	38
Labour Strikes	0.82	39
Subcontractor's Insolvency	0.46	40

In a study of risk factors affecting construction cash flow forecasting in the UK, Odeyinka et al. (2013) identified changes to initial design, inclement weather, variation to works, labour shortage and production time slippage as the 5 top-most risk factors occurring. The same factors ranked 17th, 19th, 12th, 39th and 16th in the present study. Incidentally, Client's insolvency, Labour Strikes, and Civil Disturbance ranked very low in both studies. This implies that the civil unrests and labour strikes rarely pose a great danger to construction contractors in both the UK and Nigeria. More importantly though is the fact that the most significant factors occuring in Nigeria are either rating low or totally absent in the UK construction industry (e.g. change in government officials). Another related study by Chaphalkar and Iyer (2014) in india indicated delay in payment from employer, delay in honouring claims, change order and nominated subcontractor's insolvency as being more critical. In comparison, the present study rated all but delay in payment by employer, low.

CONCLUSION

The importance of this research was based on the relevance of risk factors impacting on cash in forecasts to construction contractors. Previous researches on cash in forecasts had failed to capture some risk factors. This study conducted an industry-wide questionnaire survey of contractors operating in the Nigeria construction industry by capturing the identified risk factors impacting on cash in to contractors. The study reveals that different categories of contractors agree that the risk factors that have the highest occurrence in the industry are client (i.e. government) related- delay in receiving retention with a mean 4.72, followed by accuracy of estimates (4.61), change in government officials (4.57) and beauracracy in processing payments (giving bribe to 'speed up' payment) (4.36).

It can be concluded that the major risk factors impacting cash-in forecasts are client related. The major clients in the country are the federal and state governments. It then means that the government is responsible for most of the risk factors influencing "cash-in" forecasts. These risk factors, if properly addresed will likely enhance timely "cash-in" for construction contractors and thus eliminate project delays. Further studies need to be undertaken to determine the impact of these risk factors on the cash-out forecasts and to model the risk factors.

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Assessment of Factors Affecting Buildability and Maintainability of Construction Projects in Abuja, Nigeria

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ABSTRACT

Buildability and maintainability also known as constructability is the optimum use of construction knowledge and experience in procurement, planning, engineering and field operations to achieve the overall project objectives. There is a need to understand its underlying importance because of frequent building collapse, high cost of maintenance, disputes arising from variation in material and specification of building projects in order to minimize their occurrences. This paper evaluates the factors that affect buildability of construction projects in Abuja. The study employed survey questionnaire generated through a systematic random sampling of one hundred and twenty (120) contractors, consultants and client, out of which ninety (90) was found valid and applicable for the study. This constitutes 75% of the sample size. The data collected were subjected to statistical analysis using simple percentage, Relative Important Index (RII) and Severity Index (SI). The results indicated that low budget at the pre-tender stage, wrong procurement method during contract administration, poor workmanship at the construction stage were major factors affecting buildability and maintainability of construction projects. Other factors were omission or faulty architectural design, poor contract planning and management, lack of motivation for staff and complexity of the project. The study concluded that for an enhanced performance of construction industry, complete working drawing, strict adherence to specification and other contract documents by construction professionals should be followed. It was recommended that professionals should harmonize the implementation of national building codes to enforce buildability and maintainability of construction projects.

Keywords: Buildability, Construction projects, Factors, Maintainability

INTRODUCTION

The construction industry in Nigeria is one of the biggest industries and any extra cost means huge losses to the contractor and higher expenses to the client (Achuenu & Kolawole, 1998 and Obiegbu, 2004). To avoid such losses in construction rework; cost overrun, time overrun and dispute, extensive research need to be carried out on factors that affect the performance of the construction project in Nigeria, and Abuja in particular. Also buildings should be constructed with least variation to design, cost and to give maximum satisfaction to all the stakeholders in the design and construction team. It is believed that the use of skilled construction knowledge from the conception stage to the completion stage of the project will provide benefits and solutions that will achieve the design intent in a cost effective and timely manner. But construction projects executed in Nigeria are faced with problems such as poor site accommodation, delay in construction work, poor workmanship, use of inferior material, formwork failure, idleness of mechanical plant on site, poor design and unplanned construction method during project execution (Bamisele, 2004, Kunya, 2006, Otti, 2012 and Otali & Adewuyi, 2015). Most of the construction projects were not completed as designed due to partial use of cost planning techniques, adaptation of engineering specifications, use of right procurement methods and field operations to achieve the overall project objectives. This leads to building abandonment, high cost of maintenance, disputes among the stakeholders, variation in material specification, escalation of cost and time of project and if care is not taken, building collapse when contractors are forced to complete the project.

Another factor recognized in the sector was lack of cohesion between designers and contractors and the ability of both parties to see the whole construction process as one (Aina

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& Wahab, 2011). Contractors asserted it was the designers' fault and responsibility that the cost of buildings is high, and that the building designers were not enabling the clients to obtain the highest possible return/value on their investment. Designers equally blamed the contractors for not being able to realize their design objectives in the best economical way. Such a polemical argument has encouraged the research effort into approaches that will identified the root cause of the problem in order to bring design and construction professionals to work more closely together. Also the study into the Implementation of buildability and maintainability to meet client's satisfaction was a siege that will promote the performance of construction projects, especially in Nigeria (Obiegbu, 2004, Bamisele, 2004 and Aina & Wahab, 2011).

LITERATURE REVIEW

Buildability and Maintainability in the Construction Industry

In 1983, the Construction Industry Institute (CII) an association of owners, contractors, academic institutions, and other construction professionals was officially established at the University of Texas at Austin (Construction Industry Research and Information Association (CIRIA, 1983). The mission of the CII is to improve construction industry cost-ineffectiveness, and provide continuing research in construction. One area of research funded by the CII is the interface between design and construction practices, for which it has designated a Buildability Task Force. Two primary objectives of the buildability task force are to promote the benefits of buildability to industry professionals, and to provide a package of concepts for improving the construction industry in general (Russell, Gugel & Radke, 1992, Arditi, Elhanssan & Toklu, 2002, Pulaski Horman & Riley, 2006 and Mohd et al., 2009).

Buildability in the United Kingdom, is the extent to which the design of a building facilitates ease of construction subject to the overall requirements for the completed building (CIRIA, 1983). According to Jergas & Van (2001), buildability is a relationship between designers and contractors. In the United State of America, Buildability is known as constructability, is defined as the optimum use of construction knowledge and experience in planning, engineering, procurement and field operations to achieve overall project objectives (CII, 1983). Maintainability on the other hand is defined as the design characteristic which incorporates functional accessibility, reliability, ease of services and repair into all active and passive system components to maximize cost benefits of the expected life cycle value of the facility (Ahmad, 2003, Lavy & Shohet, 2004, Daling, Cloete & Horak, 2006, and Flores, Colen & Brito, 2010). Buildability and maintainability attribute is the term used to describe buildability characteristics in optimizing integration of construction knowledge in the building process (Gray, 1990).

According to this research, buildability and maintainability is the optimum use of construction skill, experience and knowledge in planning, engineering, procurement and in construction to achieve the overall project objectives of cost, quality, function accessibility, reliability and ease of services or repair of the completed building component to maximize cost benefit of the expected life cycle value of the facility.

On this note, a framework for buildability and maintainability analysis have extensively been developed and applied in some countries such as the United State of America(USA), United Kingdom(UK), Malaysia, Australia and later in Hong Kong. The studies in these countries have demonstrated that improved buildability and maintainability leads to significant savings in both cost and time required to complete construction projects and also improved project performance (Russel, Gugel & Radke, 1992). Some of these countries have reached the advanced stage of the framework for the implementation of buildability and maintainability

with the enforcement of the application of Building Information Modeling (BIM) which was implemented and enforced in Australia, USA and UK from January 2016. These developments in the construction industry highlight the importance and relevance of buildability and maintainability analysis if adequately carried out during the design stage of the project. Also proper and timely consideration of buildability and maintainability of building project enhance the final design outcome to meet all the performance criteria. It is on this note that Trigunarsyah, Bakti, & Majid, (2011) stated that early implementation of buildability and maintainability can oblige the builder and engineer to finish construction projects on time and within the budget. Also in view of this, several other authors have buttress the usefulness of buildability and maintainability studies in their research. This include works by Russell, Gugel & Radke, (1992), Salau, (1996); Oyekan (1996), Arditi, Elhanssan & Toklu, (2002), Obiegbu, (2004), Pulaski, Horman & Riley, (2006), Bamisele (2004), Mohd et al.,(2009), Aina, & Wahab, (2011) and Bakti, & Majid, (2011).

Russell, Gugel & Radke, (1992) and Shen, (1997), claimed that the implementation of buildability management can lead to significance quantifiable improvements in project performance in terms of time, cost and quality. In addition to the quantifiable measures, buildability management can also lead to qualitative improvements in the project process as well as the building project.

Achuenu & kolawole, (1999) and Obiegbu (2004), stated that proper implementation of buildability and maintainability of construction work at the early stage of the project will avoid loses in construction rework; cost overrun, time overrun and dispute.

Aina & Wahab (2011) carried out a research work on buildability problems in the Nigerian construction industry. The research report that complexity of project, faulty and defective working drawings, resistance of client to buildability programmes, budgetary limitation and non-standardization of design are the major problem of buildability in Nigeria. The study concludes that working drawings, specifications and other contract documents must be prepared by construction professionals. They also added that construction professionals should be aware of the likely impacts of buildability problems on their finished projects. They summarized by promoting communication skills among construction stakeholders at all stages of construction projects.

A seminar paper presented on structural failure: causes, effects and remedies for structural stability of building and civil engineering structures in Nigeria pointed out that poor technical knowledge of designer, construction error and the use of sub-standard materials are the major cause of building failures (Oyekan, 1996). All this can be corrected with proper implementation of buildability and maintainability during the design and conception stage of the project.

In a related view, Salau (1996) stressed that structural failures in buildings are as a result of non- adherence to good construction practice, codes and specifications. Among the building indentified to have failed due to this factor includes skyline mega apartment building in Fair Fax County, Virgina and United State of America (USA) in July, 1983; Quebec Bridge in the United State of America (USA), a multi-storey building in Madrid, Spain, the collapse of Rhein Bridge in Germany and the failure of the Bedford Town Hall in the United State of America (USA) (Russell, Gugel & Radke, 1992 and Pulaski, Horman & Riley, 2006). In Nigeria the collapse of the Synagogue church of All Nation (SCOAN) church building in 12th September, 2014 was credited to non- adherence to good construction practice, codes and specifications as reported by Leadership Newspaper of 15th September 2014. Structural failures in buildings are in four stages of the building life, namely, at the planning, design,

construction and service stages which can be reduced with the introduction of enabling laws to back the implementation of buildability and maintainability in Nigeria.

Some construction stakeholder in Nigeria use incompetent hands, in a bid to cut cost of construction management or supervision (Bamisele 2004 and Aina & Wahab, 2011). Most clients make use of bricklayers in the place of professionally trained Builders to manage the construction production process while Decree 45 of 1989 constitution spelt out clearly who should manage the physical construction process on site as inscribed in Act CAP B13 of 2004 LFN. It is only those who are registered by the Council of Registered Builders of Nigeria (CORBON) that are qualified to be engaged as builders. They are the ones that have been trained in the act of construction management. And they will adhere to the construction practice as spell out in the national building code. They know how building materials work and are skilled in construction management. Most of the building that have failed in Nigeria in particular did not engage a resisted CORBON builder to carry out the oversight function of supervising the actual construction on site (Chucks, 2014).

The concepts for improving buildability and maintainability of projects vary from one country to another and it depends on the nature of the construction projects to be carried out. However in the Nigerian construction industry, research into buildability and maintainability assessment is not well developed. There is lack of available sources and reliable documentation that explain buildability and maintainability concepts and guide their application in Nigeria context. Nigerian Builders, Architect and Engineers and other professionals engaged in building production have a disadvantage by not knowing, when and how they should enhance the project buildability and maintainability compared with the engineers in more developed countries (Bamisele, 2004). These motivate the research into the factors that affect the implementation of buildability and maintainability of construction project in Nigeria.

Importance of Buildability and Maintainability Analysis of Construction Projects

Encourage innovative/efficient construction

Buildability and maintainability encourages the use of efficient and innovative construction methods like the use of modular coordination in prefabricated buildings, tube in tube for high rise buildings, visualization and simulation of building component before actual construction, use of graphical design like revit, google sketch, archCAD to produce 3Dimensions (3D), 4D and 5D models (Koo & Fischer, 2000 and Kaner et al., 2008). It also aids the practice of lean construction and cost/value engineering to assess building cost. Softwares to est*i*mate project cost and duration are not left out as all this improve the quality and safety program of construction projects (Trigunarsyah, Bakti & Majid, 2011).

Clear and complete design information

Buildability and maintainability consider the co-ordinating of drawings and specifications to remove ambiguities or misunderstandings that may occur during the planning stage of the project. Information on the topography of the soil, soil characteristics, weather condition, hydrological data, geographical site analysis and material test must be accurate and readily available during the design stage of the project to ease construction. All these information are important as no two construction site or project have the same characteristics.

Prefabrication and standardization

Precast or prefabricated buildings with standardized units facilitate a better management of resources and reduce the amount of activities on site (Ting, et al., 2007). Since prefabricated building components are produced under a controlled factory environment, pollution and adverse weather condition are usually eliminated. In the similar view, standardization is manifested in repeated grids, components sizing and connections. It enhanced ease of

construction by increasing project performance and reduces project cost (Griffith & Sidwell, 1995). Site personnel find it easier to acquaint themselves with the repeated working logistics, as it reduces learning time (Griffith, 1989). Standard components size like columns, doors and windows saves time and efforts because of less variation in formwork based on common dimensions which are important of buildability and maintainability assessment of building during the planning stage of construction projects.

Abridge detail and installation

Buildability and maintainability encourages details to be kept as simple as possible to reduce the learning curve effect of site tradesmen and reasonable tolerances as specified (Arditi, Elhassan & Toklu, 2002). In the case of innovative design or composite construction, adequate text is carried out on the material to ascertain their compatibility. It is also good to create a simulation models or erect prototypes of buildings to study the installation process and possible pitfalls before full scale production. Irregular shapes, complex geometrical profiles, complicated installation details and multi-disciplinary designs could burden contractors with additional resources for coordination and site assembly. As such, building designs with simple configurations that will enable works to be executed in a straight forward manner and facilitate ease of construction should be encouraged (Ting, et al., 2007). However, this aspect must be balanced with the aesthetic requirements of clients and artistic aspiration of designers. If complexity is necessarily required, the design process should be coordinated properly to ensure that minimum cross-referencing of documents is required, otherwise expensive errors are prone to occur on site.

Allow construction flexibility and sequence

High adaptability of building elements to buildability saves resources and increase the flexibility for change and comply with the actual site conditions during construction. Buildability and maintainability encourages interchangeable components with vast orientation and universal assemblies that can fit into any positions other than that designated by the design. Also the sequence of installation should not be dictated in design document but left for the contractor to decide. For example, ground floor slabs can be constructed before or after superstructure construction to allow flexibility in the timing of underground drainage works.

Employ visualization tools

The rapid development of information technology has enabled advanced software to be used for preparing design that integrates visualization features (Mahalingam, Kashyap, & Mahajan, 2010). Visualization improves the collaboration between the construction and design teams in solving buildability problems that may arise during the physical construction. It also irons out difficulties that may occur before actual construction commences on site.

Optimum use of labour/skills, materials plant and equipment

Labour and skills requirements vary between one projects and locality. Design must include a realistic assessment of the level of skill likely to be available from appropriately chosen contractors and specialists. Products and materials to be specified during design should be selected with care particularly, when such material have not been accepted within the industry. It is advised that selected products and materials, which have been tested and certified fit for the project is used. In addition, more economical benefit can be gained if local materials are used as they are cheaper and are readily available. Designing for optimum use of plant and equipment and having the knowledge of them and also designing for temporary plant and equipment anchorage in permanent structures are some of the important issues which are addressed with the implementation of buildability and maintainability analysis.

Effective site layout and management
The environment around the construction site has significant influence on the whole development process. The smoothness of construction is susceptible to traffic conditions, especially when pedestrian pavements and vehicular routes are noticed. Temporal fence, stores, site offices, material procurement, material storage, equipment control, equipment transportation model, inventory control, Security, water, services provision, trades men management and waste management are the general project management functions that buildability and maintainability analysis will solve.

Adequate health and safety for workers
Buildability assists the designers in looking at the impact of the design solution on health and safety of workers during the construction process. The use of safety protective aids and early warning signs to control accident on site and the use of charts and direction signs placed at strategic points to control traffic in the workplace is important. In addition, machines, tools and equipments are encouraged to be arranged to allow easy accessibility of use and disposal of its waste like the concrete testing machine (crushing machine) in building workshops.

Encourage sustainable construction
With heightened awareness of environmental pollution, natural resource depletion and accompanying social problems, sustainable development and sustainable construction have become a growing concern throughout the world (Pulaski, Horman, & Riley, 2006). Buildings are one of the heaviest consumers of natural resources and account for a significant portion of the greenhouse gas emissions. Conventional on-site construction methods have long been criticized for low productivity, poor quality and safety records, long construction time, and large quantities of waste in the industry. The implementation of buildability and maintainability assessment of any building structure will reduce the negative environmental impacts of the projects and enhance its sustainability.

Factors Affecting the Implementation of Buildability and Maintainability
Technical factors
Technical factors affect buildability and maintainability during planning / condition survey, design stage, construction and maintenance phases of the projects (Lateef, 2009). Building condition survey provide information on the building age, building/green area ratio, information on nearby structures, structural condition of the building, height, location, proposed use of the building, current building performance, available services, structural type of the building, energy use in the building and the pre determined life span. Design related factors are faulty architectural design, consultant experience to scrutinize the design and simulation of the design approach. While construction related factors include staff competency, tradesmen training, re-training of staffs, level of supervision, allowable tolerance and test carried out to determine the standard of work been carried out. Lastly maintenance factors include provision of adequate maintenance check list, maintenance policy, recruitment and training of maintenance staff, motivation of maintenance personnel and feedback for further buildability and maintainability analysis.

Building characteristics and design defects mostly arise due to the need for extension of initial three principles of integration, construction knowledge and team skills (El-Haram, 2002). Construction and maintenance related issues occur when buildability and maintainability knowledge and methodologies are not incorporated in the design and construction phase of the project (Souponitski et al., 2001 and Kalamese, 2002). Also getting to know corporate objectives of clients will improve better maintenance and its implementation on facilities and having a realistic buildability and maintainability analysis

for the entire project will reduce the amount of reworks that will result from fast technological advances on construction projects (El-Haram, 2002 and Williams & Clark, 2010).

Managerial factors

Managerial factors are grouped into three categories of project management factors, economical and financial factors and resource management factors. Project management factors includes, incomplete construction documents, conflict among stakeholders, late sustainability issues consideration, organizational policy constraints, poor relationship and communication with worker, site management, unclear decision making process and well developed construction program. Economical and financial factors includes inadequate budget, high cost of material, plants and equipment, high cost of labour, high cost of capital, high rate of inflation and inadequate cost planning and control (El-Haram, 2002 and Lam, 2007). Resource management factors includes, equipment and materials procurement and control, poor workmanship, lack of motivation, lack of supervision and manpower training (Lam, 2007 and Lateef, 2009). Having efficient and a well developed project specifications will enhance economical and financial aspects of buildability, operability and maintainability implementation.

Political and legal factors

Political and legal factors occur when government restricts the use of standards, and contract agreement to executed projects. Political and legal factors are caused by political inconsistency, adaptation of ambiguous legislation framework, variety of standards, and delay in Legal implementation and political manipulations of procurement acts turning all contract to turnkey model in Nigeria (Lateef, 2009). All this result in an inefficient and ineffective project management process that hinder planning and programming of the projects and restricting the use of buildability and maintainability (Lavy & Shohet, 2009).

Environmental and biological factors

Environmental and biological factors are also source of problem during buildability and maintainability phases of infrastructure projects. These factors include control of climatic change, environmental degradation, environmental pollution, deforestation, Indoor and outdoor environmental changes and erosion. Review of buildability and maintainability analysis on environmental factors of a project is a good way of resolving negative impact of environmental factors on total project objectives. It also facilitates successful delivery of construction projects.

Health and safety factors

This includes safety and security of end-users, health and safety issues, faulty use of facility, unclear current or future usage, distractions from neighbouring users and high expectations from the facility that affect the implementation of buildability and maintainability of construction projects. Having an effective health and safety plan incorporated into the planning stage of construction project will go a long way to achieve the corporate objectives and project aim of the entire stakeholder involved without ambiguity or compromise.

METHODOLOGY

In order to adequately capture respondents perception on existing factors militating against the implementation of buildability and maintainability analysis within Nigerian construction industry, a case study of Abuja, one hundred and twenty (120) structured questionnaire were randomly distributed to contractors, consultants and client, out of which ninety (90) was found valid and applicable for the study. Among the respondents are Architects, Builders,

Engineers and Quantity Surveyors selected across small, medium and large scaled construction firms. Questionnaire response rate amounted to 75% which was adequate for the sample size.

The data derived was subjected to descriptive statistical analysis using simple percentage, Relative Important Index (RII) and Severity Index (SI). The framework for this study is as presented in Figure 1.

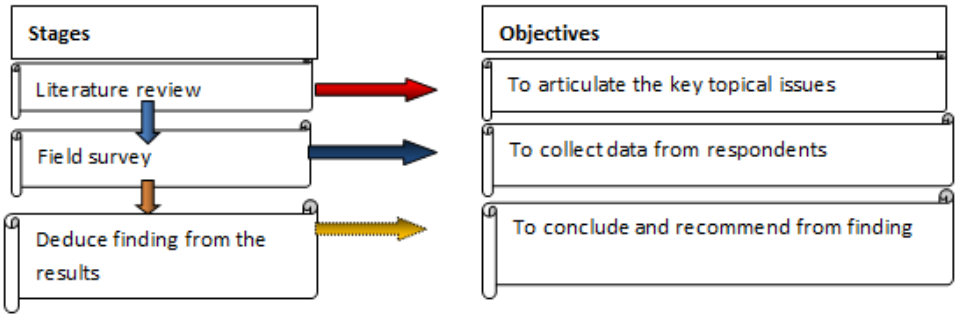

Figure 1 Research Framework

FINDINGS AND DISCUSSIONS

From table 1, the majority of the respondents are builders with 34.4% and was closely followed by 31.1% quota, represented by the engineers and the least was estate surveyors with 07.8%. The professional membership status of the respondents shows that 44.4% are corporate members, 22.2% are graduate members while 12.2% of them are associate members of their respective professional bodies. As for the years of working experience of the respondents, it can be seen that 25.6% fall within 6-10 years of experience, 24.4% of the respondent are within 1-5 years of experience while 23.3% falls within 11-15 years of experience. The last category of 21 years and above accounted for only 5.0% of the respondent. Also analyses in table 1 revealed that majority of the respondents are B.Sc. / B.Tech. holders with 55.5% and this is followed by respondents with M.Sc./ M. Tech. qualification representing 20.0% while PGD came third, representing 17.8% of the respondents. Six of the respondents have a Ph.D as their highest qualification and it translate to 06.7%. Table 1 also shows that 46.7% of the respondents are working in a building construction company, 33.3% are working in real estate development companies while 20% are working at civil engineering companies. Also in addition, 51.1% of the respondents' works in a small construction firm, 35.6% worked in a medium construction firm while only 12.3% worked in a large construction firm. Information supplied by these categories of respondents are considered to be adequate and reliable for this study as this set of respondents have executed and commissioned several construction projects in their organization.

Table 2 shows the level of occurrence of factors affecting the implementation of buildability and maintainability of construction projects in Abuja Nigeria. Low budget at pre tender stage was ranked first with mean score of 4.2778, Use of wrong procurement method during contract administration with mean score of 4.1889 was ranked second while poor workmanship at the construction stage was ranked third with mean score of 4.1778. Others are faulty or omission in architectural design, poor contract planning and management and recruitment, training and motivation of personnel's during construction stage.

The result is in agreement with Aina & Wahab (2011) findings that stated that Use of wrong procurement method during contract administration normally brought about buildability factors in the construction stage. The report is also in agreement with the work by Bamisele (2004) which says that stakeholders in the Nigeria Construction Industry should pay more

attention on poor workmanship at the construction stage of projects to mitigate the occurrence of buildability and maintainability problem. In the same vein, the findings concurred with Shen, (1997) work that stated that faulty architectural design normally have serious difficulty in carrying out maintenance work on a structure. Also when a design is very complex; there is likely hood of buildability factors. Therefore unqualified staff should not be used as consultant as the engagement of quacks as consultants normally hinder the implementation of buildability and maintainability of construction project. When a site cannot be managed properly there is likely hood of buildability problems which will eventually lead to maintainability problem. Also when they is poor planning on the part of the consultant or contractor implementation of buildability and maintainability analysis becomes a problem. From the result also, the use of wrong procurement method at the management level hinders the implementation of buildability and maintainability. Unqualified contractors should not be given contact, either due to favoritism or corruption in the system. Lastly when there is shortage of trained manpower and inadequate plants, equipment and material in the Industry many work will move in a slow pace which will hinder the implementation of buildability and maintainability analysis.

Table 1: Demographic Information of the Respondent

Background Information	*Freg.*	*%*	*Cum. %*	*Background Information*	*Freg.*	*%*	*Cum. %*
Profession of respondent				*Nature of Company*			
Architects	13	14.4	14.4	Building construction	42	46.7	46.7
Builders	31	34.4	48.8	Civil engineering	18	20.0	66.7
Estate surveyors	7	07.8	56,6	Real estate development	30	33.3	100
Engineers(Structural, Mechanical and Electrical)	28	31.1	87.7				
Quantity surveyors	11	12.2	99.9				
Total	*90*	*100*	*100*	*Total*	*90*	*100*	*100*
Highest Qualification				*Company size*			
OND	9	10.0	10.0	Small	46	51.1	51.1
HND	11	12.2	22.2	Medium	32	35.6	86.7
B.Sc. / B.Tech.	30	33.3	55.5	large	12	13.3	100
PGD	16	17.8	73.3				
M.Sc/ M. Tech	18	20.0	93.3				
Ph.D	6	06.7	100				
Total	*90*	*100*	*100*	*Total*	*100*	*100*	*100*
Years of Experience				*Professional membership*			
1-5	22	24.4	24.4	Trade membership	9	10.0	10.0
6-10	23	25.6	50.0	Associate	11	12.2	22.2
11-15	21	23.3	73.3	Graduate	20	22.2	44.4
16-20	19	21.1	94.4	Corporate	40	44.4	88.8
21 and above	5	05.6	100	Fellow	10	11.1	99.9
Total	90	100	100	Total	90	100	100

From Table 3, high cost of construction project ranked first with mean score of 4.3556 and building collapse ranked second on the table with mean score of 4.2889 while abandonment of project ranked third with mean score of 4.0667. Project tends to be abandon when it is perceived to be complex with inadequate construction methodology. Extension of construction duration ranked last among the ten (10) listed problems caused by the non-implementation of buildability and maintainability with mean score of 2.8422. Though insignificance as it may be, it is a problem that must be given proper attention if buildability and maintainability of construction project is to be minimized on construction projects in

Nigeria. Sick building, litigation among stakeholder, material shortage during construction, unemployment/layoff of construction workers, valuation and fluctuation of materials and equipments are all factors that need adequate attention to reduce the current malice.

Table 2 Factors Affecting the Implementation of Buildability and Maintainability of Building Construction Projects

	Mean	*SI*	*%SI*	*Rank*
Low budget at pre tender stage	4.2778	0.8556	85.56	1
Use of wrong procurement method during contract administration	4.1889	0.8378	83.79	2
Poor workmanship at the construction stage	4.1778	0.8356	83.56	3
Faulty or omission in architectural design	4.1333	0.8267	82.67	4
Poor contract planning and management	4.1111	0.8222	82.22	5
Recruitment, training and motivation of personnel	4.1000	0.8200	82.00	5
Complexity of the project	4.0889	0.8178	81.78	7
Non implementation of standards and codes	4.0778	0.8156	81.56	8
Incomplete construction contract document	3.9667	0.7933	79.33	9
Conflict among stakeholders	3.9444	0.7889	78.89	10
Lack of construction program	3.9000	0.7800	78.00	11
Inadequate cost planning and control	3.8444	0.7689	76.89	12
High cost of material plants and equipments	3.7778	0.7556	75.56	13.5
High cost of labour	3.7778	0.7556	75.56	13.5
Staff incompetency	3.7667	0.7533	75.33	15
Poor supervision	3.7556	0.7511	75.11	16
Poor communication or relationship with workers	3.7444	0.7489	74.89	17
Poor site management	3.7333	0.7467	74.67	18.5
Constrain on organizational policies	3.7333	0.7467	74.67	18.5
Late consideration of sustainability issues	3.7111	0.7422	74.22	20
Adaptation of ambiguous legislative frame work	3.6778	0.7356	73.56	21
Un-adherence to Health and safety policies	3.6667	0.7333	73.33	23
Access to available services	3.6667	0.7333	73.33	23
Inadequate maintenance checklist and policy	3.6667	0.7333	73.33	23
Recruitment, training and motivation of personnel's	3.6556	0.7311	73.11	25
Security of users	3.6111	0.7222	72.22	26
Political administration inconsistency	3.4000	0.6800	68.00	27
Ambiguous decision making process	3.3778	0.6756	67.56	28
Environmental pollution and degradation	3.0222	0.6044	60.44	29
Delay in legal justice	2.9333	0.5867	58.67	30
Structural condition of the building	2.9000	0.5800	58.00	31
Faulty use of facility	2.8556	0.5711	57.11	32
Unable to control climatic change	2.7222	0.5444	54.44	33
Distraction of neighboring buildings	2.6667	0.5333	53.33	34

Table 3: Problems Associated with Non - Implementation of Buildability and Maintainability

	Mean	*SI*	*%SI*	*Rank*
High Cost of Construction Project	4.3556	0.8711	87.11	1
Building collapse	4.2889	0.8578	85.77	2
Abandon project	4.0667	0.8133	85.77	3
Complexity of project	3.4000	0.6800	68.00	4
Sick Building	3.2778	0.6556	65.56	5
Litigation among stakeholders	3.2000	0.6400	64.00	6
Material Shortage during Construction	3.1556	0.6311	63.11	7
Unemployment/ Layoff of construction workers	3.0778	0.6156	61.55	8
Valuation and Fluctuation of materials and equipments	3.0333	0.6067	60.66	9
Extend Construction Duration	2.8422	0.5684	56.84	10

Table 4 shows the various ways of improving the use of buildability and maintainability among the ninety (90) respondents surveyed in the cause of carrying out this study. Full implementation of National Building Code (NBC) was ranked first with mean score of

4.5889, coordination of design and construction team was ranked second with mean score of 4.4778 while engagement of professionals at all stages of the project rank third with mean score of 4.4111. Minimization of complex construction projects was ranked least among the fourteen (14) listed precaution to full implementation of buildability and maintainability on building projects with mean score of 3.1111. Other important precautions are complete preparation of detail drawings and specification at the planning stage, preparation of complete contract documents before award of contract and provision of sufficient budgetary allocation for building construction projects. These subjections and opinions will go a long way in enhancing the implementation of buildability and maintainability of building construction projects.

Table 4: *Precaution factor for the implementation of buildability and maintainability*

	Mean	*SI*	*%SI*	*Rank*
Full Implementation of the National Building Code(NBC)	4.5889	0.9176	91.7600	1
Coordination of design and construction team	4.4778	0.8954	89.5400	2
Engagement of Professionals at all stages of the project	4.4111	0.8822	88.2200	3
Encourage complete preparation of detail drawings and specification at the planning stage of the project	4.3778	0.8754	87.5400	4
Preparation of complete contract documents before award of contract	4.3667	0.8732	87.3200	5
Sufficient budgetary allocation	4.3444	0.8688	86.8800	6
Introduce effective communication skill among the various stakeholders	4.3333	0.8666	86.6600	7
Encourage accurate Design and supervision of Building projects	4.3222	0.8644	86.4400	8
Encourage training and development of productive construction workers	4.0333	0.8066	80.6600	9.5
Discourage Client resistance to the use of buildability and maintainability assessment programs	4.0333	0.8066	80.6600	9.5
Strict implementation of policies relating to buildability and maintainability by government agencies	3.9222	0.7844	78.4400	11
Reduction in cost and time overrun of projects	3.9111	0.7822	78.2200	12
Uses of non - ambiguous Maintenance Policies	3.5222	0.7044	70.4400	13
Minimize complexity of construction projects	3.1111	0.6200	62.0000	14

CONCLUSION, RECOMMENDATION AND CONTRIBUTION TO KNOWLEDGE

Assessment of factors affecting the implementation of buildability and maintainability analysis is an important issue that needs to be tackled in the construction industry to enhance the performance of building project. This phenomenon will continue to reoccur unless construction stakeholders takes vital action to control the factors that lead to implementation of buildability and maintainability right from the design stage to construction stage and finally to the maintenance stage of building projects. The study was carried out on stakeholder of construction projects in Abuja, Nigeria. Low budget at pre tender stage, use of wrong procurement method during contract administration, poor workmanship at the construction stage, faulty or omission in architectural design, poor contract planning and motivation of personnel's during construction stage are the major factors affecting the implementation of buildability and maintainability of building construction projects in the study area. Also the study revealed that high cost of construction projects, building collapse, abandonment of project, unhealthy building, litigation among stakeholder, material shortage during construction and layoff of construction workers are all problems caused by non-implementation of buildability and maintainability of building construction projects during the design and planning stage. The study concluded by making the following recommendations:

i. Government at all levels should approve the implementation of National Building Code;
ii. Design and construction team should be coordinated to work together in harmony;

iii. Professionals should be engagement at all stages of building construction projects;
iv. Consultants should be encouraged to prepare complete set of detail drawings and specification at the planning stage of the project;
v. All contract documents should be available before awarding construction contracts;
vi. Sufficient budgetary allocation should be made for construction projects;
vii. Effective communication skill should be encouraged among the various stakeholders;
viii. Training and development of productive construction workers should be encouraged;
ix. Client should be encouraged to use buildability and maintainability assessment programs;
x. Maintenance policy of building projects should be simple, straight forward and non-ambiguous.
xi. All stakeholders in the construction industry should take the responsibility of making use of the preferred solutions to mitigate the effect of buildability and maintainability on construction projects.

Contribution to Knowledge

i. The implementation of this research work will significantly benefit design and construction of future projects by reducing the total cost of the project from design through operation and maintenance.
ii. From the research, it was deduced that failure to implement buildability and maintainability during the design and construction stages of building projects produce facilities that are difficult to maintenance therefore increasing the cost in use.

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Techniques for Spreadsheet-driven Scenario Analysis in the Measurement of Property Portfolio Performance

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ABSTRACT

Scenario analysis has been used over the years to provide forecasts of possible outcomes of changes in multiple input variables. The use os spreadsheet packages have since facilitated the efficient construction of scenarios. Although the deterministic application of spreadsheet-driven scenarios has been adopted over the years for quantitative investment decisions, there has been a knowledge gap on the techniques for the application of this artifact to the domain of property portfolio performance measurement. Approached from the perspective of design research method, hypothetical data and formula audits for measurement of property portfolio performance were used to construct scenarios of Time Weighted Rate of Return (TWRR), Money Weighted Rate of Return (MWRR), Internal Rate of Return (IRR), and income yields of a property portfolio. Results from the application of "What-If Analysis" tool of Microsoft® Excel® indicated that the purchase or sale of underlying properties would lead to a marginal increase in the IRR above the base case. The study further unraveled one of the main strengths of spreadsheet-driven scenario analysis to include proactive timing of acquisition and disposal of underlying property assets for optimal portfolio returns. The value of this article is anchored on the scenario construction as an entry-level analytical tool for Monte Carlo simulation of property portfolio returns which have not been addressed in literature from the forecast perspective.

Keywords: Formula audit, Performance measurement, Property portfolio, Scenario analysis, Spreadsheet

INTRODUCTION

Over the years, scenarios have been used to improve the analysis of investment and capital budgeting decisions (Dayananda, Irons, Harrison et al., 2002; Park & Tippett, 1999). Facilitating this process is the application of spreadsheet packages (Bodie, Kane, & Marcus, 2003; Feibel, 2003). Scholars have argued that the process of real estate portfolio construction and management is indeed continuous and draws upon relative improvements in theories, methodologies, and analytical decision making techniques used in appraising alternative investment media (Banfield, 2005; Brown & Matysiak, 2000; Hall & Hargitay, 1984; Hargitay & Yu, 1993; Hoesli & MacGregor, 2000). Consequently, a number of early texts on the subject provided an evolution of measures for the assessment of property portfolio returns comprising Time Weighted Rate of Return (TWRR), Money Weighted Rate of Return (MWRR), and a portfolio's Internal Rate of Return (IRR). (Hall & Hargitay, 1984; Hall, 1983). Furthermore, the demand for computerization of property portfolio management led to the closing of knowledge gaps in the application of spreadsheets to measure property portfolio returns (Dixon, 1986; Dixon, Hargitay, & Bevan, 1991), as well as property portfolio selection (Byrne & Lee, 1994) which were fraught with some limitations at that time because most spreadsheets were not built to handle sophisticated tasks. Although spreadsheet software has been used over the years for computing the performance of property portfolios, very little is known about its utility in the construction of scenarios for TWRR, MWRR, and IRR. The question now is: How can scenario analysis of property portfolio performance be constructed using spreadsheet tools?

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This paper aims to unravel the techniques for the application of spreadsheets in constructing scenarios of performance measures that could assist portfolio managers in making rational timing decisions for the sale or purchase of underlying property assets. Specific objectives of this paper include to:

i. identify the input data for the measurement of a typical property portfolio performance;
ii. examine the techniques for constructing scenarios of property portfolio performance measures in a spreadsheet environment; and
iii. evaluate the likely outcomes of the scenario analysis.

A cursory examination of related studies and texts comprising Brown and Matysiak (2000); Hall and Hargitay (1984); Hall (1983); Hargitay and Yu (1993); Hoesli and MacGregor (2000) indicates that the techniques for measuring portfolio performance which were originally developed from the field of investment and finance have been successfully adapted to the analysis of property portfolio performance leaving behind a gap on how scenario construction (which has hitherto been applied to capital budgeting) can be deployed in analysis of measures of property portfolio returns. Hence, it is imperative to examine scenario construction process within the context of property portfolio performance measurement and analyze the impacts arising from the acquisition and disposal of underlying property assets. The value/originality of this article is anchored on the scenario construction as an entry-level analytical tool for Monte Carlo simulation of property portfolio returns which have not been addressed in any existing literature from the forecast perspective.

LITERATURE REVIEW

The concept of property portfolio

A portfolio is a pool of multiple investments designed to diversify risk across each investment class and provide the investor with returns (Hargitay & Yu, 1993). Specifically, property portfolio is a collection of property investments held and let by an investor in expectation of regular returns on capital invested and capital appreciation (Banfield, 2005). For a property portfolio, it is pertinent to say that a two-asset scenario comprising property and cash is usually the norm. In other words, some properties within the portfolio can be disposed and the proceeds of the sale is held as cash, which can be deposited in a bank account to generate interest pending the allocation to properties that might likely enhance portfolio returns and at a minimal risk profile.

Purpose of property portfolio performance measurement

Institutional investors are interested in the financial stewardship of their property portfolios for the purpose of asset-liability matching or profit optimization. Hargitay and Yu (1993) identified four purposes for the appraisal of property portfolio performance to include monitoring the direction of invested capital, monitoring of relative performance (herd instinct of portfolio investors), analysis of past performance for future decision-making, and evaluating the performance of portfolio managers (attribution analysis). First, performance measurement is deployed to unveil the temporal appreciation and depreciation in the portfolio's capital value. Secondly, it might be used to sustain an investor's desire to maintain the lead on the league table of vibrant performing portfolios. Thirdly, it provides a basis for forecasting ex-ante acquisitions and disposals of underlying property assets, while availing portfolio managers with data for optimizing portfolio returns. Finally, it is applicable towards evaluating sources of returns and competence of the portfolio manager on the other hand.

Importance of benchmarks and iterations

Portfolio benchmarks are reference points used by portfolio managers to judge the performance of their portfolios, thus enabling them to track the extent to which the portfolio under-performed or outperformed the various indices (Banfield, 2005; McIntosh, 1997). When constructed, benchmark portfolio should produce an efficient frontier of risk and return. However, with an emphasis on measures of return, scenario analysis could be used to construct a base case performance measure that meets the investor's objectives. Iterations can be run on this base case scenario to show the implication of changes in input variables, on the overall portfolio returns.

Measures of portfolio performance

Performance implies achievement relative to benchmarks and objectives (Banfield, 2005). In quantitative terms, the measurement of portfolio performances reveals the degree of convergence/divergence of a portfolio with/from the benchmark (Banfield, 2005; Hargitay & Yu, 1993). The emphasis of this paper includes total return measures comprising Time Weighted Rate of Return (TWRR), Money Weighted Rate of Return (MWRR), and Internal Rate of Return (IRR). Notwithstanding, income yields of a property portfolio shall be considered given its role as a fundamental analytical tool for assessing portfolio returns at a glance.

Income yield of a property portfolio

Income yield of a property portfolio is the ratio of the net earnings of the portfolio to the capital value (Ajayi, 1998; Wyatt, 2007). Within the context of this paper, there are two categories of this measure of return. The first is the income yield on cost which is the ratio of initial net income of the portfolio to the initial capital value of the portfolio (expressed as a percentage), and named as "Yield 1-Jan." The second is the income yield on value indicated in this paper as "Yield 31-Dec" which is the ratio of current net income of the portfolio to the capital value of the portfolio at the end of the measurement period (expressed as a percentage) (Ajayi, 1998). According to Hoesli and MacGregor (2000), increase (decrease) in income yield of a portfolio is an indication of increase (decrease) in portfolio risk as well as capital value depreciation (appreciation). In other words, income yield is an indicator of expected market risk, value growth and depreciation (Hoesli & MacGregor, 2000; Ifediora, 2005).

Time Weighted Rate of Return (TWRR)

Although Feibel (2003) defines TWRR within the context of an investment fund, its definition within the context of a property portfolio reflects performance of a portfolio which takes into cognizance the portfolio capital value, value changes (appreciation/depreciation), and portfolio income over the entire period that underlying property assets are held (Hall & Hargitay, 1984; Hargitay & Yu, 1993). The calculation of TWRR commences with the calculation of sub-period returns (Feibel, 2003). In other words, the sub-period return, t_i which is a function of capital appreciation and the portfolio income is expressed as the ratio of the capital value of the portfolio at the beginning of the sub-period as indicated in equation 1 below:

$$t_i = \frac{CV_t - CV_{t-1} + I_t}{CV_{t-1}} \qquad (1)$$

Furthermore, the TWRR (expressed as a percentage), is the geometric mean of all the sub-period returns of a portfolio (Ajayi, 1998; Brown & Matysiak, 2000; Hargitay & Yu, 1993; Hoesli & MacGregor, 2000; Ifediora, 2005). It is numerically expressed as:

$$\text{TWRR} = \sqrt[n]{\{(1+t_1)(1+t_2)(1+t_3)\cdots\cdots(1+t_n)\}} - 1 \quad (2)$$

With reference to equations 1 and 2, CV_t is the capital value of the portfolio at the end of a sub-period, CV_{t-1} is the capital value of the portfolio at the beginning of a sub-period, I_t is the net income of the portfolio at the end of the sub-period, t_1, t_2, t_3, and t_n represent the various sub-period returns. Hargitay and Yu (1993) adjudged the appropriateness of this measure of total return for inter-portfolio comparisons because of the inability of portfolio managers to control the timing of a portfolio's cash inflow and outflow.

TWRR provides the basis for comparing returns earned on a portfolio as well as the success or otherwise of portfolio manager's decisions in a given measurement period (Brown & Matysiak, 2000; Feibel, 2003). In other words, an increase (decrease) in TWRR during a given period relative to a benchmark is an indication that:

i. the underlying property assets are (not) performing optimally; and
ii. the decision-making process of the portfolio manager is (not) yielding optimal results.

Money Weighted Rate of Return (MWRR)

MWRR is a performance measure which expresses the sum of capital value appreciation/depreciation and portfolio incomes as a quotient of capital invested in the portfolio (Ajayi, 1998; Ifediora, 2005). The equation for MWRR is expressed as:

$$\text{MWRR} = \frac{Total\ net\ income\ received + Change\ in\ Capital\ value}{CV_{t-1} + (CE_t \times t_e)} \quad (3)$$

Where CV_{t-1} is the capital value of the portfolio at the beginning of the measurement period, CE_t is the capital expenditure during the measurement period, and t_e is the proportion of time for the spread of the capital expenditure, which is pegged at 0.5 on the assumption that funds injected into the portfolio would be distributed symmetrically throughout the period for a bi-annual performance measurement period (Newell, 1986).

Contrary to the opinion of Brown and Matysiak (2000); Hargitay and Yu (1993); Kalu (2001), it would be erroneous to conclude that MWRR is identical to internal rate of return (IRR). This is because MWRR and IRR equates when the underlying assets in the portfolio are held for a single period without any capital expenditure (Ifediora, 2005). Hence, MWRR (expressed as a percentage) is only an approximation of the IRR. According to Feibel (2003), the injection of more capital into the portfolio prior to value appreciation (depreciation), would lead to appreciation (depreciation) of MWRR at the end of the measurement period. On the other hand, Feibel (2003) reiterated that capital withdrawal from the portfolio prior to value appreciation (depreciation), would deflate (inflate) MWRR at the end of the measurement period. In this context, the injection (withdrawal) of capital implies the purchase (sale) of underlying properties in a portfolio. According to Brown and Matysiak (2000), the timing of purchase/sale of underlying property assets is adjudged to be optimal if MWRR > TWRR; otherwise it would not be optimal if MWRR < TWRR.

Internal Rate of Return (IRR)

The IRR is the rate (expressed as a percentage) at which the discounted cash inflow equates to the discounted cash outflow (Ajayi, 1998; Brown & Matysiak, 2000; Ifediora, 2005), such that the net present value of the portfolio equals zero. Similarly, Crean (2005) reiterated that IRR is the calculated discount rate that equates value with price. For the purpose of financial decisions, IRR is the highest cost of capital for which an investor can afford pay for a loan borrowed to finance the purchase of an income yielding investment (portfolio) such that incomes earned from that investment (portfolio) can adequately service the periodic tranches of principal and interest arising from the said loan (Bierman & Smidt, 1975). The framework for calculation of IRR is given as:

$$\sum_{t\geq 1}^{t=n} \frac{\text{Cash outflow}}{(1+IRR)^t} = \sum_{t\geq 1}^{t=n} \frac{\text{Cash inflow}}{(1+IRR)^t} \quad (4)$$

Where *t* in equation 4 represents the tenor for the measurement of portfolio performance. According to Ifediora (2005), IRR is the most favoured measure of portfolio performance because it precisely reflects the size and timing of cash flows; and considers cash flow realized as opposed to expected cash flow.

Fundamental data inputs for measurement of property portfolio performance

Hargitay and Yu (1993) outlined the fundamental data inputs for the measurement of performance to include market capital value and net income of the portfolio at the beginning and end of the period of analysis; net income, capital expenditure of the portfolio (including purchase price of additional properties), and income appreciation/depreciation during the period of analysis, and details of lease structure of underlying property assets. Save for the exclusion of income projections, all these input variables have been captured in this study. In addition, this study gave credence to the treatment of market capital value and net incomes of underlying property assets purchase/sold during the period of analysis.

Application of scenario analysis

Fundamental to the application of scenario analysis is the concept of sensitivity analysis, which is an experiment performed with the intent of determining the effect of a change in individual variables on a single outcome of an appraisal while freezing input variables in the same appraisal at their deterministic values (Ajayi, 1998; Dayananda et al., 2002). Taking sensitivity analysis a step further, scenario analysis entails establishing an array of result of numerous dependent variables arising from changes in numerous input variables of an appraisal at their deterministic values (Park & Tippett, 1999). Notwithstanding these authors' bias for capital budgeting applications, scenarios might be applicable towards forecasting property portfolio performance. It is common practice to see the outcomes of scenario analysis to be expressed in three-folds as base case-, worst case-, and best case scenarios. While base case scenarios represent the current outcome which the investor intends to evaluate, indices and results for worst case-, and best case scenarios in the context of this study may depend on the portfolio benchmarks and expectation of an investor.

Application of spreadsheet software

Morley and Parker (2011) define spreadsheet software as application software typically organized as ledger sheets with rows and columns, which can be used to perform calculations and other alphanumeric operations. Within the context of this paper, Microsoft® Excel® 2007, which is famous among investment analysts, was used to prepare scenarios of property portfolio measurement. Facilitating this analysis within the Excel® environment is the "What-If Analysis" function which ushers the user into the scenario analysis dialogue box (Dixon, 2007; Harvey, 2006). This dialogue box enables an analyst to generate scenarios from multiple input variables for onward comparison. Therefore, questions put forward to address gaps identified in this study are:

i. How can Excel® be used to construct scenarios of property portfolio performance measures?
ii. With reference to a hypothetical base case scenario and given different instances of net income and initial capital value of a portfolio, what would be the outcome of TWRR, MWRR, and IRR (per annum) when:
    a. additional properties are purchased?
    b. some existing properties in the portfolio are sold?

METHODOLOGY

This study is approached from the perspective of the design research methodology, which is directed towards the development and testing of an artifact that solves specific problems (Çağdaş & Stubkjær, 2011). The artifact in this study is a system of scenarios for the analysis of property portfolio performance. Like any other artifact, the development of scenarios draws upon the theories and knowledge from cognate fields of design science, investment/finance, and statistics (Dayananda et al., 2002; Hevner, March, Park et al., 2004; Lee & Lee, 2006). Notwithstanding, scenario construction in this context is anchored on underlying constructs/vocabulary within the domain of portfolio management and spreadsheet analyses. Specifically, the *What-If Analysis* tool of Microsoft® Excel® 2007 was used to facilitate scenario construction for the selected measures of property portfolio performance. This tool generally produces multiple outcomes arising from an array of multiple decisions which an analyst might likely take pertaining to the input variables (Dixon, 2007). In this context, the Philosophy behind *What-If Analysis* is that it unveils an array of likely performance of a property portfolio when input variables assume an array of values arising from the portfolio manager's decision to purchase or sell underlying properties as well as value changes during a performance assessment period.

According to Peffers, Tuunanen, Rothenberger et al. (2008), the six steps involved in a design research include motivation and problem identification, study objectives, artifact design and development, testing, evaluation, and reporting. The design and development of scenarios summarized in the flowchart (Appendix 1) was drawn from these six steps. Four input variable data tables were created. These input variables comprise capital value of portfolio at the beginning, net income of existing properties, capital value of properties sold/purchased and net rent of properties sold/purchased. The development of scenarios in this paper was facilitated by hypothetical data inputs and formula audits for these tables (see Appendix 1). Within the Microsoft® Excel® 2007 environment, the application of scenario analysis begins by clicking the Data menu button as follows: Data > What-If Analysis > Scenario Manager. The Scenario Manager box was populated with changing input variables as follows: Click "Add" > Enter scenario name in the dialogue box > Select the changing input variable(s) > Check the prevent changes box > Click OK to return to the Scenario Manager dialogue box. The process was repeated until the desired numbers of scenarios were created. Ten different scenarios were created using varying initial capital values and the net incomes respectively. In order to view changes in the results, a specific scenario name was selected and the button labeled "show" was clicked afterwards.

The scenario summary for the varying initial capital values and the net incomes was created using the following steps: Within the Scenario Manager dialogue box, click Summary > Check the summary circle > Enter the result cells by selecting the cells where the formula audit of portfolio performance measures were originally prepared and computed in the Worksheet > Click OK. With the copy and paste tool, these results can be used to populate the blank scenario summary that was initially created in the worksheet. The scenario results were saved in different Worksheets to facilitate further analysis and comparisons. Analysis of results was principally based on the difference between returns from each scenario and the base case portfolio returns.

FINDINGS AND DISCUSSIONS

Analysis of the Base case scenario

The data input used in connection with the scenario building process is presented in Appendix 2. With reference to these inputs, a performance analysis table was prepared in the same Appendix 2 on the premise that properties in the portfolio are valued bi-annually.

Results of base cases (Table 1) were generated from Appendix 2; such that the shaded returns in Table 1 can still be traced to the bi-annual portfolio valuation in the same Appendix.

Table 1 Base case of portfolio returns

Parameters	Capital value of portfolio (in ₦ 'million) at the beginning									
	500	**550**	**600**	**650**	**700**	**750**	**800**	**850**	**900**	**950**
Net income of existing	56	56	56	56	56	56	56	56	56	56
Yield 1- Jan	11.20	10.18	9.33	8.62	8.00	7.47	7.00	6.59	6.22	5.89
Yield 31-Dec	11.50	10.43	9.54	8.79	8.15	7.60	7.12	6.69	6.31	5.98
TWRR	8.51	7.74	7.10	6.56	6.09	5.69	5.34	5.03	4.75	4.50
MWRR	8.60	7.81	7.16	6.61	6.14	5.73	5.37	5.06	4.78	4.52
IRR	8.84	8.01	7.33	6.76	6.26	5.84	5.47	5.14	4.85	4.59

Scenario 1: When additional properties are purchased

For each case of initial capital value and net income, portfolio returns in Table 2 indicate that IRR increases as initial capital value increases, while income yield on value would be higher than income yield on cost.

Table 2 Portfolio returns when additional properties are purchased

Parameters	Capital value of portfolio (in ₦ 'million) at the beginning									
	500	**550**	**600**	**650**	**700**	**750**	**800**	**850**	**900**	**950**
Net income of existing	28.5	30.5	38.4	42.1	47.5	52.5	56	62	68	71
Capital expenditure	86.6	93.1	110.4	125.5	145.0	162.3	166.7	173.	188.3	216.
rent (additional	10.4	11.4	12.16	12.35	12.92	13.3	14.25	14.8	16.15	19
Yield 1- Jan	5.70	5.55	6.40	6.48	6.79	7.00	7.00	7.29	7.56	7.47
Yield 31-Dec	6.79	6.65	7.25	7.14	7.26	7.32	7.37	7.60	7.83	7.80
TWRR	4.54	4.54	5.47	5.60	5.97	6.21	6.28	6.60	6.91	6.96
MWRR	3.81	3.89	4.80	4.95	5.30	5.55	5.67	6.02	6.34	6.38
IRR	4.20	4.27	5.33	5.51	5.95	6.26	6.37	6.76	7.14	7.24

Suffice to say that the purchase of additional properties would not alter the income yield on cost (Table 3). However, income yield on value appreciated marginally when additional properties were added to the portfolio, which is an indicator of increased portfolio risk and capital value depreciation as postulated by Hoesli and MacGregor (2000). Hence, the portfolio would be exposed to additional risks if more properties are purchased.

Table 3 Difference between scenario 1 results and the base case scenario

Parameters	Capital value of portfolio (in ₦ 'million) at the beginning									
	500	**550**	**600**	**650**	**700**	**750**	**800**	**850**	**900**	**950**
Net income of existing	28.5	30.5	38.4	42.1	47.5	52.5	56	62	68	71
Capital expenditure	86.6	93.1	110.	125.	145.	162.	166.	173.	188.	216.
rent (additional	10.4	11.4	12.1	12.3	12.9	13.3	14.2	14.8	16.1	19
Yield 1- Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yield 31-Dec	0.94	0.97	0.71	0.53	0.35	0.20	0.25	0.19	0.16	0.22
TWRR	1.56	1.46	1.33	1.20	1.10	0.99	0.94	0.86	0.81	0.86
MWRR	0.71	0.71	0.57	0.48	0.37	0.29	0.30	0.26	0.23	0.28
IRR	1.06	1.05	1.03	0.96	0.94	0.90	0.90	0.89	0.92	1.02

TWRR increases within the range of 1.56% and 0.86% for lower and higher bands of portfolio capital values when additional properties are purchased (Table 3); implying that the underlying property assets are performing optimally or that the decision of the portfolio manager would contribute towards optimal portfolio performance relative to the base case scenario as postulated by Brown and Matysiak (2000) and Feibel (2003). Furthermore, MWRR in Table 3 increased within the range of 0.71% and 0.28% for lower and higher bands of portfolio capital values thereby violating the principle put forward by Feibel (2003) that the injection of more capital (purchase of more underlying assets) prior to value

depreciation would lead to depreciation of MWRR. In practice therefore, asset allocation decision within these bands of input values in Table 2 would not warrant MWRR to fall below a benchmark or a base case scenario.

In view of the decision rule for the comparison of TWRR and MWRR put forward by Brown and Matysiak (2000), all cases of value inputs examined under this scenario (Table 2) indicates that MWRR < TWRR; implying non-optimal timing for the sale of the underlying properties. Drawing from the postulations of Brown and Matysiak (2000) and Feibel (2003) that increase in TWRR (as captured in this scenario) indicates optimally performing underlying property assets, the timing of purchases would not be optimal considering the situation where portfolio capital value would have depreciated by ₦36.17 million.

Scenario 2: When some properties in the portfolio are sold

For each case of initial capital value and net income, portfolio returns in Table 4 indicate that increase in the initial capital values corresponds with increases in IRR when some properties in the portfolio are sold. Notwithstanding, this scenario reveals that income yield on cost would be higher than income yield on value.

Table 4. Portfolio returns when some properties are sold

Parameters	Capital value of portfolio (in ₦ 'million) at the beginning									
	500	**550**	**600**	**650**	**700**	**750**	**800**	**850**	**900**	**950**
Net income of existing	28.5	30.5	38.4	42.1	47.5	52.5	56	62	68	71
Capital value of	86.6	93.1	110.	125.	145.	162.	166.	173.	188.	216.
Net income of properties	10.4	11.4	12.1	12.3	12.9	13.3	14.2	14.8	16.1	19
Yield 1- Jan	5.70	5.55	6.40	6.48	6.79	7.00	7.00	7.29	7.56	7.47
Yield 31-Dec	4.51	4.30	5.51	5.82	6.38	6.82	6.73	7.11	7.42	7.22
TWRR	0.80	1.05	2.25	2.65	3.22	3.70	3.91	4.46	4.87	4.75
MWRR	2.05	2.14	3.22	3.52	4.00	4.38	4.48	4.89	5.21	5.10
IRR	4.20	4.27	5.33	5.51	5.95	6.26	6.37	6.76	7.14	7.24

While the sale of additional properties would not alter the income yield on cost (Table 5), income yield on value depreciates marginally when some existing properties in the portfolio are sold. This marginal decrease in the income yield on value (Yield 31-Dec) indicates a decrease in portfolio risk as well as capital value appreciation which aligns with the fundamental concept of income yield as an indicator of portfolio performance (Hoesli & MacGregor, 2000; Ifediora, 2005). In other words, the portfolio risk is minimized when the appropriate properties are selected and sold. The cash proceed from such sales can be deposited in bank account and channeled into the purchase of properties that would offer enhanced diversification benefits.

With reference to the base case scenario, it can observed in Table 5 that the sale of some properties (at specific prices for each case of sales) would lead to decline in TWRR in the range of 2.18% and 1.35% for lower and higher bands of portfolio capital values respectively. In consonance with the decision rule postulated by Brown and Matysiak (2000) and Feibel (2003), decrease in TWRR either implies that the underlying property assets are not performing optimally or that the decision of the portfolio manager would not contribute towards enhancing portfolio performance relative to the base case scenario (benchmark).

Furthermore, MWRR decreased within the range of 1.05% and 1% for lower and higher bands of portfolio capital values respectively. This finding is contrary to the principle put forward by Feibel (2003) that the further withdrawal of capital (through sale of underlying assets) from a portfolio prior to value depreciation would lead to appreciation of MWRR at the end of the measurement period. In practice therefore, asset allocation decision within these bands of input values in Table 6 would warrant MWRR to drop below a benchmark/base case.

Table 5. Difference between scenario 2 results and the base case scenario

Parameters	Capital value of portfolio (in ₦ 'million) at the beginning									
	500	**550**	**600**	**650**	**700**	**750**	**800**	**850**	**900**	**950**
Net income of existing	28.5	30.5	38.4	42.1	47.5	52.5	56	62	68	71
Capital value of	86.6	93.1	110.4	125.5	145.0	162.3	166.7	173.2	188.3	216.5
Net income of properties	10.45	11.4	12.16	12.35	12.92	13.3	14.25	14.82	16.15	19
Yield 1- Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yield 31-Dec	-	-	-	-	-	-	-	-	-	-
TWRR	-	-	-	-	-	-	-	-	-	-
MWRR	-	-	-	-	-	-	-	-	-	-
IRR	1.06	1.05	1.03	0.96	0.94	0.90	0.90	0.89	0.92	1.02

In view of the decision rule for the comparison of TWRR and MWRR as postulated by Brown and Matysiak (2000), all cases of value inputs examined under this scenario (Table 4) indicates that MWRR > TWRR; implying an optimal timing for the sale of the underlying properties. Based on the assertions of Brown and Matysiak (2000) and Feibel (2003) that a decrease in TWRR relative to a benchmark indicates under-performing properties or ineffective portfolio management, the timing of sales would still be optimal notwithstanding the ₦36.17 million depreciation in portfolio capital value. The divergence in choice of decision criterion might be settled in favour of MWRR if an investor intends to optimize portfolio risk by selling those underlying property assets that do not offer enhanced diversification benefits.

For both scenarios, it is generally observed that the purchase or sale of underlying properties would lead to a marginal increase in the IRR. This implies that a portfolio investor could borrow money at a rate higher than the base case (initial) IRR if the re-structure of underlying property assets in the portfolio becomes imperative. When compared with the base case, the sale of existing properties coupled with a depreciation in the capital value of underlying properties would reduce TWRR, MWRR and income yield on value unless capital value appreciates beyond a threshold necessary to compensate for loss of initial portfolio returns.

DISCUSSION OF RESULTS

Findings of this study have been isolated and discussed here on the basis of the study objectives. For the first objective, it has been identified that the input data for the measurement of property portfolio performance include market capital value and net incomes of underlying property assets sold or purchased during the period of analysis, allocations for capital improvements, income changes during the period, details of lease structure and the capital value and net income of the portfolio at the beginning and end of the measurement period, which are consistent with the specifications outlined by Hargitay and Yu (1993). These data are further required as inputs for the construction of scenarios within the spreadsheet environment.

In consonance with the second objective of this research, the technique for constructing scenarios of property portfolio performance measures in a spreadsheet environment is anchored on six system design steps among which are problem definition, design specification, data definition and entry, and the deployment of the scenario manager box in the "What-If" Menu of Microsoft® Excel® to the testing, evaluation, and reporting of the scenarios of portfolio performance measures when underlying properties assets are sold or purchased. Specifically, the essential tools required for constructing spreadsheet-embedded scenarios of portfolio performance measures is the synergy between system design algorithm (Peffers et al., 2008), and the process for "What-If" analysis within the Microsoft® Excel® environment as adapted from Dixon (2007) and Harvey (2006).

Turning attention to the third objective, which is to evaluate the likely outcomes of the scenario analysis; it was found that income yield on value would increase following the purchase of additional underlying property assets. The implication is that such addition of new properties would expose the portfolio to higher degree of risks. Secondly, the sale of some existing properties would reduce the income yield on value of the portfolio to warrant exposure of the portfolio to lesser degree of risk especially when the properties that do not contribute significantly to portfolio returns/diversification are appropriately selected and sold. These results align with the notion that an increase (decrease) in income yield at the portfolio level is an indication of an increase (a decrease) in portfolio risk as well as capital value depreciation (appreciation) (Hoesli & MacGregor, 2000).

In consonance with the decision rule for the comparison of MWRR and TWRR (Brown & Matysiak, 2000), and the reporting of results from the analysis of TWRR (Feibel, 2003), the scenario analysis indicates that the purchase of additional properties into the portfolio would place TWRR ahead of MWRR to warrant enhanced performance of underlying assets in the portfolio but with an attendant problem of wrong timing of the purchase of these additional properties. On the other hand, results from the scenario analysis indicates that the sale of existing properties would place MWRR ahead of TWRR to warrant under-performance of underlying property assets in the portfolio; notwithstanding the optimal timing of sale indicated by virtue of this result.

The scenario analysis for property portfolio performance measures in this paper further indicates that the IRR of a portfolio would increase irrespective of whether the decision of sales or purchase of underlying property assets is taken by the portfolio manager; implication of which is the possibility of the investor to accommodate optimal borrowing rates for capital within the limits of the higher IRR arising from the portfolio re-structuring plan.

Lastly, scenario analysis has revealed that the withdrawal of capital from a portfolio (sale of underlying property assets) prior to value depreciation, would lead to depreciation of MWRR at the end of the measurement period, while the injection of more capital into the portfolio (purchase of additional properties) prior to value depreciation, would lead to appreciation of MWRR at the end of the same measurement period. This result is found to be contrary to the assertion of Feibel (2003) concerning portfolio transactions in the context of value appreciation/depreciation.

RECOMMENDATIONS

The following recommendations are put forward in support of scenario construction process for property portfolio performance measurement:

i. In the absence of sophisticated simulation software packages, the portfolio manager can avail himself/herself with scenario analysis in order to examine an array of ballpark measures of portfolio returns arising from possible acquisition and/or disposal of underlying property assets; and
ii. Portfolio managers should attempt generating scenarios for a portfolio's Internal Rates of Return when they intend to know their threshold of borrowing rates for the funding of more property acquisitions.

CONCLUSION

Spreadsheets are software packages that facilitate efficient application of quantitative tools for investment decisions. It may be recalled that this article sought to find answers to the question of how scenario analysis of property portfolio performance can be developed using spreadsheet tools. Within the context of this paper, the construction of scenarios for property portfolio performance measures in a spreadsheet environment was anchored on the synergy

between system design procedure and the deployment of "What-If" analysis tools within the Microsoft® Excel® environment. It was found that portfolios with TWRR higher (lower) than MWRR are characterized with underlying property assets that are (not) performing optimally but with a snag (an advantage) of non-optimal (optimal) timing of capital injection/withdrawal. Although the scenario building technique examined in this paper might be used to facilitate proactive monitoring of portfolio performance in relation to the timing of acquisition and disposal of underlying property assets, further research on this topical area might scale up the methodology towards Monte Carlo simulations with a view to provide a robust dimension to the results obtained in this study. Finally, this paper has shown that the portfolio manager can translate intuition into scenarios of portfolio performance measures that portray potential benefits derivable from rational investment decisions.

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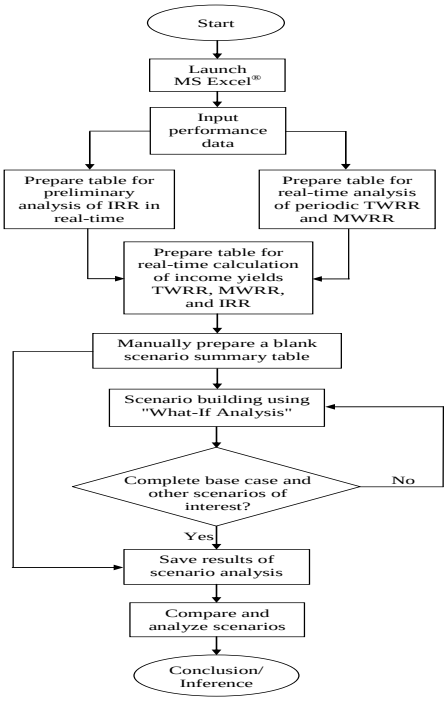
APPENDIX

Appendix 1



Flowchart for spreadsheet-driven scenario analysis

Appendix 2

Bi-annual performance analysis data and preliminary analysis

(A). Input data for the base case

	N '000,000
Value of property portfolio as at 1st January, 2014	800
Net income (per annum) of property portfolio as at 1st January, 2014	56
Appreciation in capital value as at 27th June, 2014	23.15
Value of properties purchased/sold as at 1st July, 2014	0
Net income of (per annum) properties purchased/sold on 1st July, 2014	0
Depreciation in capital value of portfolio on 31st December, 2014	36.17

(B). Preliminary analysis of bi-annual performance measures

Details	Income	Value change	Capital expenditure	Capital value
	N	N	N	N
1st half (January - June 2014)				
Value at start of the year 01/01/2014				800.00
Net income	28.00			
Capital value appreciation		23.15		23.15
Capital expenditure			0.00	0.00
Capital value as at 30th June, 2014				823.15
2nd half (July - December 2014)				
Capital value as at 30th June, 2014				823.15
Add (Less) Value of properties purchased (sold)			0.00	0.00
Value at the beginning of 2nd half of the year				823.15
Net income of existing properties	28.00			
Add (Less) net income of properties purchased (sold)	0.00			
Total net income	28.00			
Value depreciation		-36.17		-36.17
Capital expenditure			0.00	0.00
Value of portfolio as at 31st December, 2014				786.98

Assessment of Public Land Acquisition Process in Ondo State, Nigeria

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ABSTRACT

Acquisition process usually leaves in its trail a number of unresolved problems after its completion. This is often complicated through political interference leading to compensatory problems, inability to take successful possession of the acquired land and consequent delay in project executions. This paper assesses the process of acquisition in Ondo State in order to identify gaps between the set standards and the existing practice. To achieve this, the actual output of the process in some selected acquisitions vis-a-vis set standards in the acquisition process was gotten from the Ondo State Land Records Bureau. The result of the analysis revealed that 60 working days is the average time required for processing an acquisition for land of less or equal to 30 hectares. The least possible time for proper acquisition is 33 working days with an average of 62 official table exchanges from the least officer to the State Governor. Nine Acquisition projects were considered between 2010 and 2014. It was observed that only three of the projects were concluded which is inconsistent with the set standard. On the general assessment; site identification, perimeter survey, release of funds, title clearance and payment of compensation were identified as possible policy targets to improve on to enhance effective public land acquisition process in the study area. Inflation of the cost of acquisition projects, increase in hostility from the affected community, increase costs and stifling of Government remedy projects due to unresolved appeals were implications of the deficiencies in acquisition process. The paper recommends a critical attention to the procedures of public acquisition aimed at achieving the level of efficiency required by the masses to derive optimum benefits from government investments and minimizing waste of time and money.

Keywords: Acquisition, Acquisition Process, Ondo State Nigeria, Processing Time, Public Land

INTRODUCTION

Land acquisition is a legal and bureaucratic procedure which the government uses in acquiring any land without the willing consent of its owner or occupant in order to benefit the public (Kakulu, Bryne and Viitanen, 2009). This power is often necessary for social and economic development (Nuhu, 2008). The incidence of rapid urbanization in many parts of Ondo State has led to many urban problems such as road congestions, poor quality environment and inadequate social amenities. The State government therefore requires the provision of housing, widening of roads, hospitals, institutions of higher learning and other infrastructure in its urban areas. In order to generate employment large agricultural projects is also developed in many non-urban areas.

Preceding the provision of such infrastructural facilities, public works and development is the acquisition of appropriate land by government (Food and Agricultural Organization, 2008). Like any other part of the country, land acquisition in Ondo State is plagued with so many problems which have hindered its successful implementation. Ineffectiveness and lack of transparency in the processes of public acquisition could also attract enormous economic, social and political costs as it usually takes time-consuming. According to Larbi (2008), weeks or sometimes years elapse before the Acquisition process is completed and ready for development. From the time the notice of acquisition was duly served to the time the compensation was paid, anything can happen to prolong an already projected time for the whole acquisition process (Huggins, Roach and Jessemy 2009). The risk of not meeting the purpose for public acquisition becomes high when the acquisition time cost is high (Cernea,

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2000). Incidence of price inflation on project may result in postponement or abandonment of government project, thus tying down the acquisition (Observer Research Foundation, 2010). Change of Government or political instability usually associated with governance in developing countries also makes the acquisition process to linger, sometimes proving very costly to all parties (Anthony, 2011).

Hence, this study assesses acquisition process in Ondo State, Nigeria with a view to identifying the gap between the set standards and the existing practice with a view to recommending means of cutting down costs in acquisition projects and at the same time increasing dividends of government's investment to the people.

LITERATURE REVIEW

General Overview of Public Land Acquisition Process

The procedure of land acquisition is based and driven by the provisions of country specific acts, decrees and other relevant statutory enactments guiding the process (Nuhu, 2009). For instance, in Nigeria it is a statutory process under the Land Use Act 1990 (Sections 28 (1); 2 (a), (b), (c); 3(a), (b), (c), (d) and (4)). This framework usually dictates the basis and methods of assessment, as well as the procedures (Nuhu, 2009). Land acquisition and compensation matters are therefore entirely products of statute (Xavier, 2001). The basic principles and processes in compulsory acquisition and compensation are perceived to be quite similar even though the practice may vary in different nations (Viitanen and Kakulu, 2008). Procedure of compulsory acquisition is critical if government's exercise of acquisition power is to be efficient, fair and legitimate. However, according to Nuhu (2008), the Land Use Act No. 6 of 1978 on compensation for compulsory acquisition has generated feeling of dissatisfaction and resentment which has discredited the compensation procedure in compulsory acquisition of Land.

The Land Acquisition process at times can be very long and drawn out. Most times individuals are unaware of their role and function in the process (Huggins, Roach and Jessemy, 2009). Certain activities of Ministries and State agencies in Acquisition process often lead to compensatory problems for the affected property-owners later in the process. In many cases the acquiring authority has acquired and utilized private properties long before compensating the land owner. Claimants have to wait for decades before they are compensated while others still await compensation (Huggins, Roach and Jessemy 2009). A well-defined procedure for expropriations should therefore provide clarity, transparency, and predictability (Asian Development Bank, 2007). Where the process is designed or implemented poorly, the economic, social and political costs may be enormous.

Factors Affecting Processing Time

Land acquisition always involves the passing of time. Weeks or sometimes years elapse before the Acquisition process is completed (Dundas and Evans, 2001; Azuela and Herrera, 2007 and Omar & Ismail, 2009). According to Observer Research Foundation (2010), a large number of projects are held up because of procedural delays relating to land acquisition. This is also the root cause of cost overruns, mass resistance and sometimes violent protests. And further creates an anti-developmental attitude in the society. The following however are often the main obstacles:

Physical Factor

Location identification seems to be the most sensitive aspect of the process as it is usually the early step in the process of providing facilities and infrastructures. In some cases, several locations could be suitable for a project but not feasible due to physical terrain. Accidents of Land officers and Land Surveyors in difficult terrains may result in delays or slowing down

of the whole process (Food and Agricultural Organization, 2008; Huggins, Roach and Jessemy, 2009; German, Schoneveld and Mwangi, 2011).

Technological factor

Where there is shortage of land surveyors, there are undue delays in the completion of survey plans and at times the survey order has to be contracted (Huggins, Roach and Jessemy, 2009). This is often due to absence of modern or advanced equipment like Unmanned Aerial Vehicles (UAV) for data capturing during enumeration. This could prolong the processing time of acquisition assignments. Lack of these instruments may prolong the period of field work which is also subject to all kinds of manipulations and dangers as some places remain inaccessible to the enumerators.

National Economy/Inflation

Dwindling or unpredictable national economy may affect eventual compensation sum arrived at for a particular acquisition. Government may become jittery when the cost of acquisition is too much or almost outweighs the proposed cost of the public projects.

Legal Factor

Most people are unaware of their correct role and function and the law as it pertains to the Land Use Act. These have caused delays, even from the onset in an acquisition process (Ojikutu, Bennett, and Groenendijk, 2012). If notices are not well served, affected land owners are entitled to go to Court to obtain injunctions against the Government (Larbi, 2008). This can halt the whole process.

Administrative Factor

Acquisition as a project involves the institutional managers in the acquiring Ministry. The acquisition project manager is the Estate Surveyor who is usually the Director of Lands Services. The success of the project depends on his managerial skills. Any incompetency from the acquisition manager could therefore disrupt the acquisition process. Huggins, Roach and Jessemy, (2009) also confirmed lack of synergistic cooperation amongst personnel to cause inadequate delays in the acquisition process and untimely compensation of affected land owners. Availability and adequacy of the personnel, materials and funds that would be used in carrying out the project can eliminate bureaucratic bottle necks that can affect process time. Effective supervision and commitment of persons are required for civil service performance.

Social Factor

The level of mobilization and the prevailing political conditions can affect the efficiency and effectiveness of the machinery put in motion for acquisition. Though, the issue of prompt social mobilization is always the same, motivations can be varied. Lack of communication between Government and the people may lead to breakdown of law order during acquisition exercise (Larbi, 2008).

Political Factor

Setting of goals for public acquisition; choosing of location; issuing of warrant to release funds; and approval of compensation of values are often subject to political manipulations. Furthermore, change of government or political instability usually associated with governance in developing countries also makes the acquisition process to linger sometimes proving very costly to all parties (Observer Research Foundation, 2010).

Climatic Factor

Different Vegetation belts in Ondo State have different people, culture and climatic conditions that can affect acquisition process time differently. The coastal regions during the

raining seasons presents unpredictable conditions that require the experience of the acquisition officer when budgeting for enumeration project.

METHODOLOGY

In assessing each stage of land acquisition certain parameters such as the specific definition of the task(s) involved, its measurability and time limits will enable the acquiring managers to know the efficiency and the effectiveness of their operations. Also jobs or tasks required in each stage which includes field work and verification of claims must be accurate and realistic. Quality implementation strategies in the process must also minimise waste of time or money. To investigate this, 13 land officers of the Ondo State Land Records Bureau were purposively selected for an in-depth interview. They were purposively selected because of their professional qualifications and year of experience as senior officers. The interview session was part of the qualitative data targeted at capturing actual output of the public land acquisition process vis a vis the set standards in the Ondo State Land Records Bureau, the government agencies involved in land administration; so as to deduce the level of realisation of a wanted result in respect of public set goals and also examine whether implementation strategies are qualitative in terms of minimizations of waste of time or money. Structured questionnaires which was closed ended in nature was also administered to the 13 purposively selected land officers to explore their perspectives on factors affecting the effectiveness and efficiency of acquisition process *(see appendix I)* and the implications of the deficiencies regarding land acquisition implementations in Ondo State, Nigeria.

FINDINGS AND DISCUSSIONS

Table 1: Summary of average required time and personnel at different acquisition stages

Acquisition Stages	Required time < 30 Ha (t days)		Personnel		Average time required (< 30Ha)	Average required personnel
	Min.	Max	Min.	Max.		
Choice of Site	3.0	10.0	3.0	5.0	6.5	4.0
			3.0T	4.0T		3.5T
Sensitization (I)	1.0	3.0	3.0	5.0	2.0	4.0
Perimeter Survey	7.6	13.5	6.0	13.0	10.55	9.5
			8.0T	13.0T		10.5T
Preparation of Notice	1.25	2.5	6.0T	9.0T	1.875	7.5T
Publication of Notice	0.6	0.6	2.0T	2.0T	0.6	2.0t
Sensitization (II)	0.5	5.0	3.0	6.0	2.75	4.5
Service of Notice	0.4	3.0	3.0T	4.0T	1.75	3.5T
Enumeration & Valuation Exercise	1.5	2.0	3.0T	4.0T	1.75	3.5T
Issuance of Enumeration Certificates	0.2	0.3	4.0T	7.0T	0.25	5.5T
Computation of Compensation Payable	2.15	1.75	6.0T	7.0T	1.95	5T
Compensation Value Approval & Cash Backing	9.0	25.0	4.0T	4.0T	18.0	4.0T
Claimant's title clearance by Ministry of Justice	1.5	3.5	3.0T	4.0T	2.5	3.5T
Preparation of Cheques	0.4	2.0	2.0T	5.0T	1.2	3.5T
Rejection/Acceptance of offer of compensation	0.5	4.0	3.0T	4.0T	2.25	3.5T
Management of Post Compensation Stage	0.7	5.5	3.0T	6.0T	3.1	4.5T
Issuance of Certificate of Title	3.5	7.0	3.0T	4.0T	5.25	3.5T
	33.8	88.6	50T	74T	61.225	62T

Table 1, shows the Acquisition procedures, minimum and maximum time required per hectares in days and the minimum and maximum number of personnel involved in public acquisition in the Ondo State Land Records Bureau (the Acquiring agency). From the table, **t** represents number of working days required while, **T** represents number of officials involved in a given task. The average time required for processing an acquisition for land of less or equal to 30 hectares of land was about 60 working days. The least possible time for proper acquisition is 33 working days. This required an average of 62 official table exchanges from the least officer to the State Governor. The time lines for personnel and material deployment and meetings is as shown in appendix I.

Table 2: Selected acquisition projects (2010-2014)

Project	Purpose of Acquisition	Location	Area (ha)	Acquisition	
				Begin	End
1	Wealth Creation Agency WECA (Millennium Agric. Village)	Auga-Akoko	444.788	2011	Not completed
2	PHCN 2KV Transmission Station	Oba-Ile	22.15	2010	2012
3	Trauma Centre (TC), Gani Fawehinmi- Extension	Ondo	63.12	2011	2012
4	Film village (FV)	Ikota	60.09	2010	Not completed
5	Forward Operational Base (FOB)	Agadagba Obon	4.634	2011	Not completed
6	Beach Sport Complex (BSC)	Igbokoda	0.3719	2011	Not completed
7	Gboluji Grammar School Ext.(GGS)	Ita-Olodo, Ile-Oluji	51.511	2012	Not completed
8	Millennium Park (MP)	Akure	4.03	2010	2012
9	Cultural Village (CV)	Aponmu	2.191	2010	Not completed

Source: Ondo State Land Records Bureau, 2014

Table 2, shows nine Acquisition projects in Ondo State between 2010 and 2014. It further highlighted the purpose of acquisition, location, area in hectares, commencement and status of completion of acquisition projects as at 2014. It was observed from the Table that only three of the projects were concluded in 2012. This is inconsistent with the set standard of the 33 working days as the least possible time for acquisition in the study area. Hence, the findings is in consonance with the findings of Larbi (2008) that the entire process of acquisition is often very long and winding.

Table 3: Comparison of actual output with expected standards of output

Project	Site identification	Perimeter survey	Publication	Service of notice	Field work	Computation	Release of funds	Title clearance	Payment of compensation	Assessment
WECA	<	=	=	=	<	=	>	=	0	B
PHCN	>	<	=	=	>	=	>	=	>	G
TC	=	<	>	>	=	=	>	<	=	F
FV	<	<	=	=	=	>	0	0	0	F
FOB	<	=	=	0	0	0	0	0	0	B
BSS	<	=	=	=	=	>	0	0	0	B
GGS	>	>	>	>	>	>	0	0	0	F
MP	>	>	>	>	>	>	>	>	>	G
CV	<	=	0	0	0	0	0	0	0	B
General Assessment	F	F	G	G	G	G	F	B	B	

From Table 3, >, < and = signs represents 'average time limit', 'below average time limit' and 'average time limit' respectively while G, F, B represents 'good', 'fair' and 'bad' respectively. The Table compared actual output with expected standards of output for each of the projects via acquisition stages. From the Table only two of the acquisition projects was

rated good. On the general assessment; site identification, perimeter survey, release of funds, title clearance and payment of compensation were identified as possible policy targets to improve on to enhance effective public land acquisition process in the study area. This also corroborates the findings of Dundas and Evans (2001) that compulsory acquisition is often associated with persistent widespread dissatisfaction with the process and compensation extending over long number of years.

Table 4: Implications of Deficiencies in Acquisition Process

S/N		Mean	Ranking
1.	Inflation of the cost of acquisition projects	3.46	1
2.	Increase in hostility from the affected community	3.38	2
3.	Increase costs and stifling of Government remedy projects due to unresolved appeals	3.38	2
4.	Undermining of Government's legitimacy	3.15	4
5.	Disaffection between government and the affected community	3.31	5
6.	Institutional hoarding due to abandonment of government project	3.00	6
7.	Tenure insecurity and reduced acceptability of land as collateral	2.62	7
8.	Precarious situation of the affected urban poor remain unabated	2.54	8
9.	Housing deficit problem compounded in the affected urban area	2.38	9
10.	Causes psychological imbalances to impoverished claimants	2.23	10
11.	Loss of lives arising from disappointments of under-compensation	2.00	11

Table 4, shows the implications of deficiencies in acquisition process. 'Inflation of the cost of acquisition projects was the most important consequence of deficiencies in acquisition processes. This was evident from its mean score of 3.46, while 'increase in hostility from the affected community' and 'increase costs and stifling of Government remedy projects due to unresolved appeals' ranked second with the mean scores of 3.38. 'Loss of lives arising from disappointments of under-compensation' is least popular although it remains as one of the implications of deficiencies in acquisition process. Observer Research Foundation (2010) noted that delays and cost overruns in public land acquisition projects is a direct consequence of flawed acquisition procedure.

CONCLUSION

This study has established various processes in land acquisition. Generally an established work flow pattern that guarantees a fair acquisition process is in place in Ondo State when there is no undue meddling from the political class. It has equally revealed that where the process is executed poorly, the economic, social and political costs may be enormous. Attention to the procedures of public acquisition is therefore critical at achieving the level of efficiency required to making sure that the masses derive optimum benefits from government investments. Therefore, procedures that meet acquisition demands must ensure that processes are not delayed. In view of this, the study recommends the following:

i. Time is crucial. Hence, everyone should have a proper understanding of their role and function in the Land acquisition process so that things would move faster.
ii. To ensure that all affected landowners are aware of the project, timely notice should be publicised as widely as possible.
iii. A clear time-limit should be placed to ensure that acquisition process is not unduly long.
iv. There is need to achieve increasing organizational effectiveness through heightened structural capacities. The Directors in the Lands Services department should be given maximum freedom and flexibility to operate.
v. The Land Services department should adopt management principles and techniques that bring effective results and build the personnel in the course of their operations.

vi. The State Government should always set expected standards of output before commencing an acquisition process. To make it effective, a system of costing the inputs and outputs of any acquisition job and prompt funding should be devised as it is in the case of the private sector.

vii. The State Government should adopt ICT at different stages of the Acquisition process. Technology has bolt from the stable and the State need to keep abreast. Each personnel should be able to interact via the use of the web or some government portal operating data sheets to assist in a timelier management of the process.

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Appendix: 1

Time lines for personnel and material deployment and meetings

Acquisition stages	Phases	Required time /ha(t days)		Personnel		Remarks
		Min.	Max	Min.	Max.	
1. Choice of site	-physical inspection	1.0	3.0-7.0	3.0	5.0	Others other than state officials join in
	-report/findings					
	-approval of recommendation before	1.0	2.0-3.0	2.0t	3.0t	inspection when other tiers of government are
	perimeter survey	1.0	5.0	1.0t	1.0t	involved.
2. Sensitization (i)	-visit to host community and acquisition site	1.0	2- 3	3.0	5.0	The frequency of visit depends on size of acquisition and receptiveness of the host community
3. Perimeter survey	-traversing	1.0	1.0	3.0	5.0	Cutting traverses requires many labourers
	-establishment of survey pillars	2.0	4.0	3.0	8.0	depending on terrain. T stands for tables of/or
	-collation of field works					
	-cartography	0.8	2.0	2.0t	3.0t	personnel to pass
	-vetting	0.6	1.5	2.0t	3.0t	through to achieve
	-photolithography	1.0	2.0	1.0t	2.0t	tasks. Use of UAV for
	-survey approval	1.0	1.0	1.0t	2.0t	survey may reduce time
	-survey description	0.5	1.0	1.0t	1.0t	duration
		0.5	1.0	1.0t	2.0t	
4. Preparation of notice	- draft preparation	0.5	1.0	1.0t	1.0t	Lands dept. Has
	-typing	0.3	0.5	1.0t	1.0t	problem of erratic
	-vetting	0.25	1.0	1.0t	2.0t	supply of electricity.
	- approval by state commissioner (4copies)	0.2	0.3	3.0t	5.0t	This sometimes slows down pace of work.
5. Publication of notice	-national dailies	0.3	0.3	1.0t	1.0t	Printing and publication
	-state gazette	0.3	0.3	1.0t	1.0t	of the legal notice in daily newspaper and Ondo state gazette
6. Sensitization (ii)	Visits to community where the acquisition site is large	0.5	5.0	3.0	6.0	Frequency of visit may depend on host's receptiveness
7. Service of notice	-community meeting	0.4	3.0	3.0t	4.0t	
	-acquisition site					
8. Enumeration & valuation exercise	-physical inspection of claimant's	0.5	1.0	2.0t	3.0t	
	-site/properties data entries	1.0	1.0	1.0t	1.0t	
9. Issuance of enumeration certificates	Issuance of enumeration certificates in duplicates	0.2	0.3	4.0t	7.0t	Admin/ lands officials

10. Computation of Compensation payable	-data collation/computation in valuation sheets	0.25	0.50	1.0t	2.0t	
	-summary of values and recommendation	0.20	0.25	1.0t	1.0t	
	-approval of chief valuation officer/ director of lands	0.10	0.20	1.0t	1.0t	
	-recommendation of approved values to mr governor/ executives for payment to claimants.	0.30	0.40	2.0t	2.0t	
	- approval/ disapproval with comments	0.30	0.40	1.0t	1.0t	
11. Compensation value approval and cash backing	(a) -governor's approval sent to ministry of finance for release warrant.	2.0	5.0	2.0t	2.0t	Ministries and state agencies tend to cut corners and this usually lead to compensatory problems for the affected land owners and other state entities later in the process (Huggins, Roach and Jessemy 2009).
	-payment of funds into ministry account	2.0	5.0	2.0t	2.0t	
	(b) If state government is not responsible, the acquiring agency (federal/ local government) is contacted to release funds.	5.0	15.0			
12. Claimant's title clearance by ministry of justice	-claimant's interview	0.5	1.5	1.0t	2.0t	
	-report of interview	1.0	2.0	2.0t	2.0t	
13.preparation of cheques	-writing of cheques	0.2	1.0	1.0t	1.0t	
	-creation of ledgers	0.2	1.0	1.0t	2.0t	
14.rejection/acceptance of offer of compensation	-signing indemnity certificate	0.1	1.0	1.0t	2.0t	
	-collection of cheque/rejection	0.2	1.5	1.0t	1.0t	
	-request for resettlement option	0.2	1.5	1.0t	1.0t	
15. Management of post compensation stage	-compilation of record	0.1	2.5	1.0t	2.0t	
	-reconciliation of account	0.3	2.0	1.0t	2.0t	
	-re-issuance of defective cheques	0.3	1.0	1.0t	2.0t	
16 issuance of certificate of title	-request for survey & description	1.5	2.0	2.0t	2.0t	
	-engrossment of certificate of title	2.0	5.0	1.0t	2.0t	

(**t** = number of working days required while, **T** = number of officials involved in a given task)

A Study of Developers Speculative Activities in Lagos Urban Fringe

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ABSTRACT

The use and misuse of land resources in and around urban fringe is one of the principal issues that call for urgent attention particularly in rapidly growing areas where there are land use shifts, market distortions and increase in land acquisition. This study investigated developers' activities in Lagos-Ibadan Express way and implication in the study location. The study is purposive in nature, employed both qualitative and quantitative techniques. Population for the study was the 128 registered members of Real Estate Developers Association of Nigeria (REDAN) out of which the sample size was systematically drawn. The selection of the study area allowed for an understanding of the roles of developers in Lagos urban fringe. Mean Item Score (MIS) and factor analysis was used to isolate critical factors germane to developers' activities in relation to land speculation. The study established that there is a significant relationship between developers' activities and land speculation as the bulk of land acquired was subdivided for on-ward sale. Furthermore, analysis showed that finished products (housing) of most of the developers are often times beyond the reach of the common man (low class). Based on the finding, further investigation needs to be conducted to establish the nature of developers' speculative activities as well as institutionalizing systematic and prompt approach such as Land Value Tax (LVT). It is further expected that this study would draw the attention of the appropriate authority to the dysfunctional activities of developers in the urban fringe areas for land control.

Keywords: Agricultural land, Developer, Lagos, Speculation, Urban fringe

INTRODUCTION

Speculative demand and pressure force changes in the property market due to some inevitable external forces that simultaneously shape urban fringe areas besides government policies. Moreover, Problems of urban fringe in developing countries are quite similar according to Masum (2009). Furthermore, land use change from predominant agricultural use to residential development is common across the world as noted by Holtslag-Broekhof, Beunen, van Marwijk and Wiskerke (2014) as one million hectares of agricultural land are converted and developed for residential use annually in Europe. The urban fringe is viewed as a multifunctional environment, but often characterized by essential service functions; a dynamic environment characterized by adaptation and conversion between uses; a low density economic activity including retail, industry as well as an untidy development pattern, (Scott et al., 2013). Kombe (2005) further noted that an unprecedented growth of informal settlements as well as land speculation in most sub-Saharan countries has continued to generate fears about imminent haphazard development including lack of basic infrastructure services in the rapidly densifying urban fringe settlements. Moreover, problem stemming from institutional decadence, conventional tools inherited from the colonial masters such as master plans and structure plans for regulating and directing urban land use development are no longer potent instruments for promoting planned land use development especially in the urban fringe areas of sub-Saharan countries. The outcome is daunting and seen in cases of unregulated land subdivision and transactions. Some authors including Monkkonen, 2013; Ding and Zhao, 2014; Kombe, 2005; Holtslag-Broekhof, Beunen, van Marwijk and Wiskerke (2014) noted that speculation is common to every investor as they embark on it as a means of attaining profit under conditions of uncertainty. This is as a result of lack of ineffective

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government intervention in land markets, the patterns of ownership and uncertainty. In addition, Triantafyllopoulos (2010) and Ding and Zhao (2014) suggests that land speculation may be regarded as a socially embedded action which follows a particular social behavior and consequently leads to an overall inefficient land market. As such, speculation is said to be a fundamental cause of both micro-economic and macro-economic disturbances due to delay in development or best use for future anticipated price increase and in order to earn profit.

Oftentimes speculation in the property market is termed to be almost synonymous with investment in the equities and capital market where investor expectations are sometimes shaped in an inaccurate way. Although, speculation could be encouraged in the stock and commodity market where a speculator renders a public service by increasing production where it is needed but not with land because the stock of land is fixed. However, it is considered to be a destructive and destabilizing force in progressive economies as such, when purchased land is kept vacant without improvement, thus realizing "unearned increment" or delay development until the uncertainty about the most profitable use is clear. The latter clearly shows the weakness of planning and development control.

Speculation is essentially referred to as social epidemics and it is associated with economic bubbles (Bogle, 2012). This occurs when the price of landed properties exceed its intrinsic value by a significant margin. Speculative bubbles are characterized by rapid market expansion driven by word-of-mouth. This brings about initial rise in price, attraction of new buyers and subsequently generates further inflation.

Some of the negative implications of speculation include the following: (1) restriction of access to immediate land use; (2) reduction in housing stocks with less supply, high demand and high price for the quantity available; (3) limiting land tax revenues when the land acquired remain undeveloped; (4) speculation is associated with market manipulation; (5) speculation push prices higher than reasonable levels. That is price moves are often exaggerated; (6) acquisition of asset exclusively for sale motivated solely by anticipation of capital appreciation and gain; lastly, speculators play on market psychology rather than productive enterprise.

Speculation is not caused by a shift in demand due to change in taste and fashion, a shift in consumption demand, a change in supply or a shift in certain fundamentals (Knittel & Pindyck, 2013). However, a shift in fundamentals can certainly cause a change in price but not a determinant for land market speculation.

The high rate of increase in land prices in metropolitan centres in most sub-Saharan countries is an indication that the supply of land does not correspond to the increase demand for land (Rukwaro & Olima 2003). Accordingly Ezenagu (2000) affirmed, the major housing problem confronting Nigeria as a nation is the inadequacy of housing stock to meet the high demand of her teeming population. This has placed the urban fringe areas under intense pressure to meet the ever increasing need for shelter provision, Nigeria included. Nigeria has been faced with the challenges of planning and development of its urban neighbourhoods most especially the urban fringes (Oduwaye, 2009). Moreover, housing strategies geared towards the provision of complete housing units for the ever increasing population have not achieved the expected results due to lack of adequate funding (Nubi, 2015). Due to the inability of government to meet the high demand for housing provision, the emergence of land developers ensue which has attempted to sporadically increase residential landscape. This process involves the purchase of land parcels sub-division of plots as well as carrying out residential developments.

However, close observation of the developments in urban fringes reveal predominant haphazard development which could be as a result of non adherence to residential development guidelines on the part of the developers (Wrenn & Irwin, 2015). Furthermore, Wrenn and Irwin (2015) affirmed that non adherence to control is as a result of delay in residential sub-division approval and profit loss to developers. Several authors including Rukwaro and Olima (2003); Kombe (2005); Lawanson et al., (2012) explicitly observes that causes of haphazard development is clearly a case of ineptitude and negligence of government authorities entrusted with responsibilities of planning order and control as well as developers having disregard for building codes and guidelines during the development stages, especially for areas such as road networks, building setbacks, sewerage systems as well as recommended building materials for health and safety of occupiers. Participants involved in speculative practices have been grouped into three levels by Triantafyllopoulos (2010) as informed speculators- these are informed speculators with both public and private information. They are otherwise known as public officials in charge of land plot allocation. Secondly; un-informed speculators- these are individuals who only have public information, they are otherwise known as either investors or developers and thirdly; private purchasers who are individuals who are not information driven. However, bought land but could not develop within 2-5 years of purchase.

Land use ought to be subject to government control but such regulation seems not evident in most of the urban fringe areas where sprawl-like development and completely undeveloped or partially developed land abound. This may be due to inadequate infrastructure provision or susceptibility of land itself to speculative activities of traditional land owners, investors and sometimes government agencies. Accordingly, the land hunger emanating from housing shortage and the efforts of developers and investors to meet the shortfall is seen as one of the possible drivers of speculation in the fringes coupled with the surge in demand for land and home ownership which is now prompting land subdivision and sale by installments in the area, remains an issue of concern. Moreover, the motivation behind the ownership patterns of private individuals is yet unknown, probably representing mixture of reasons and associated with speculation, business expansion or family ties. However, hardly are there any studies on land speculation, its effects and responses to controls if any. Yet, urban fringes are places of strategic importance for formal expansion, growth control, land use transition, infrastructure development and agricultural stability (Kombe, 2010 & Potsiou, 2007).

This study aims at investigating developers' speculative activity in Lagos urban fringe, as such, a number of wide ranging questions arise in the mind of the researcher. These include the following: - Does speculation exist in urban fringes of Lagos; what is the motivation behind the land acquisition patterns in Lagos urban fringe? And what are the factors responsible for land speculation in the study area? The quest for improved knowledge and empirical understanding of land speculation has become more necessary given its multifunctional and dynamic environment characterized by adaptation and conversion between uses. As such, this study will broaden an understanding of underlying motives and effects of land speculation. Moreover, urban fringes are seen to be the raw material for housing subdivisions, industrial estates and mobile home parks in the UK Scott et al., (2013). However, this needs to be regulated for effective use and reduction of conflicts.

Urban Fringe Growth

Urban fringe has many different expressions in the literature in terms of its meaning, features and delimitation. As such the area of transition from agricultural zone to urban area, rural urban fringe, urban fringe, pre-urban fringe, rural fringe of the city, pre-urban areas and metropolitan fringe are used sometimes with recognized gap but usually in synonymous way overlap each other strongly suggesting similar connotations (Masum, 2009). However, the

apparent simplicity of the phrase ”Urban fringe” belies the complexity of processes and actors involved in what essentially is a zone of physical interface and human – environment. As such, it is a zone of transition with potential for disruption, uncertainty of tenure; boundary conflict and other opportunity that transition entails. Furthermore, same definition was ascribed to urban peripheries and fringes of the cities affirming that there is no precise definition of urban fringe, there is however, a common understanding that fringe is an area of transition where urban and rural land uses intermix. Urban fringe is therefore dynamic as it continuously shifts outward from the city. Moreover, it is not only a transition of land from rural to urban use but also complex in nature as it involves change in land ownership pattern, land transfer, regulatory measures, enforcement mechanisms and types of development.

With increasing improved transportation and communication, urban fringe areas have undergone diverse structural changes. The simultaneous changes in socio-economic structure and high land value systems in urban centres' affected the location preference of urban fringe areas. Moreover, the demographic and structural changes of the city have serious implications on the quality of life in urban settlement as such the low income earner and sometimes middle workforce tends moving outward. This pattern of outward movement is not homogeneous in nature and is determined by various pull and push factors in various countries (Masum, 2009).

Consequently, location choices of different sectors in the urban centre inevitably changed and urban fringe development areas have spread out into rural areas. Government planning policies and regulation are expected to control this new pattern of development to prevent land speculation and haphazard development. These problems vary from spontaneous development of land with inadequate services and facilities as well as non formalization of land titles.

In addition, urban fringe is the leading edge of urban growth and often implies weak planning control on land sub division which often times may be due to lack of effective laws and regulations supporting planning, the good will and determination of government officials. Ozge Balta and Eke (2011) affirms that the following factors propel spontaneous development of urban fringes; they include macro economic factors, micro economics factors, demographic factors, housing/ location preferences, inner city problems, transportation and regulatory frame works.

Furthermore, Ozge Balta and Eke (2011) affirmed that haphazard development in urban fringes has many effects such as increased traffic congestion, negative environmental effects such as reduced air and water quality, loss of open space and other natural resources and agricultural land, higher public costs for new facilities and services for the newly developed areas (e.g. road constructions, sewer, water systems), more expensive infrastructural services, priority given to personal gain rather than public/ community benefit and of course land speculation. With this, speculation is a valid investment view from the perspective of the investor but the effect on the public is what matters which need urgent attention.

The Property Developers

Developers are investors that initiate and carry out land development projects. They play an active and leading role in the development of urban fringes. Thus, they are perceived as the prime sculptors of spatial structure in any open space (Maruani & Amit-Cohen 2011). Furthermore, Jonas and Wilson (1999) refer developers to growth machine as well as other auxiliary players such as the media, university, banks and professional groups. As such, the combination of activities of this groups increase the value of land and revenue stream for

growth. This has often times been the case for urban fringe foundation, its processes of growth and development.

A variety of tactics and methods are used including placement of advertisements in news papers and property journals, sponsorship of jingles and other efforts that may raise the profile of the urban fringes to property purchasers. However, often time, activities of the various developers suggest "propaganda projects" since most of the infrastructural improvement earmarked and listed may not be achieved for years afterwards. Scott et al., (2013) noted that many agencies and developers do not have a particular view on the fringe space except when it is part of an actual project. This is exacerbated by the prevalence of the quest for securing economic growth outcomes and prosperity which is seemingly taking precedence over physical and environmental concerns.

Developers' have further been referred to as the key decision makers in the residential development process, most times in relation to private sector development. Furthermore, a property developer is one who transforms certain element of production, notably labour, capital, materials and land into some form of development such as commercial, residential or industrial. This function can be undertaken by private individuals, multi-national construction companies, local builders and contractors, cooperatives or local housing associations e.g REDAN amongst others.

Focusing solely on residential development activities, the role of the property developer is to produce or supply new housing. In practice; these encompasses variety of roles which includes: initiator of development, coordinator of factor of production, builder and salesman. Moreover, when operating in the private sector, he is largely a free agent.

The property developers overriding motive often times is profit motivated. Whether operating in the private or public sector since residential development is regarded as a commercial venture. The profit motive is waived only in very special circumstances e.g. in a crisis where avoidance of risk is essential to ensure the survival of the firm or where a decision is taken to forego profit in a goodwill gesture designed to enhance the firm's reputation or relationship with government authority.

Moreover, emphasis on the profit motive prompts comment on the developer's speculative activities. But in real sense, a speculator can be anyone engaged in a commercial operation which incorporates the possibilities of risk and profit. Yet when applied to developers, it often becomes an emotive term conjuring up images of "self interested"; passion for low income housing". Awareness of this general criticism may explain the defensive stance often adopted by developers. Although, they are always quick to express their "social welfare" motivation which may reflect the honest personal response of the individual respondent. However, the desire to be (or at least appear to be) socially responsible is primarily a cosmetic or promotional screen behind which commercialism remains the driving force. For the developers, land represents both a source of financial gain and a means of ensuring continuity of production source (Abdul- Aziz et al., 2014). A developer's profitability and survival is often determined by: his foresight and astuteness in identifying the promising localities and groups of potential consumers, the accuracy of his chosen method as well as his ability to "follow through" with decisive action.

THEORETICAL FRAMEWORK

Land transaction during Land use change has also been studied by Holtslag-Broekhof et at., (2014) and Zhang and Skitmore (2015) using game theory. It was affirmed that the theory builds on the assumption that decision-making is an interaction process which relies on three basic concepts to describe decision making; the players, referring to the developers making a

decision; strategies referring to developers actions; and pay offs, referring to the value that the result of a decision gives. In addition there are three agents which determine the development decision model which include (i) the developers who initiate development plans (ii) the government institution saddled with approval of such plans and (iii) the public, whose demand for residential and occupational areas drives development (Mruani and Amit-Cohen 2011). Subsequently, the outcomes of the interaction between the three agents will eventually determine the attributes of the urban fringe areas as well as spatial pattern of developed areas.

The role of each agent in this model may be characterized by its contribution to the process, in terms of leadership, strategies and dominance. Developers play a leading active and dominant role in urban fringe development decision making most of the times they are the first player on site. This is not suppose to be, as government agency are suppose to be the first player on site to plan, design and subdivide the area for take-off of building development.

Developers start up the process by initiating development plans taking active steps to promote the plans towards approval by the planning authority, using among others political and economic influential connections. Developers are dominant in the Lagos urban fringe in the sense that they often stir up formulation of the propose project attributes such as opening up accessible route as well as striving for maximum financial profit. They have also established mechanism of land transaction in which potential buyers pay in instalments. The price is paid over few years, mostly by monthly instalments; sometimes potential buyers make a one-off payment. The land title instrument often times is general in nature that is a global C of O as such, legal ownership is granted after full payment. However most of the developers promise to be responsible for the provision of utility services which are part of the advertisement and profit making strategies of the developers are left unfulfilled. Whereas, such land use plans are required to conform to the planning requirement as well as control haphazard development. Most of the times, illegality of land conversion, violation of the design standard tenure insecurity and the current spatial pattern development that do not follow land use regulations of urban fringe areas poses critical challenge for government and her agencies (Morshed, 2014).

Government institution (Town Planning Authority) tends to be more reactive Oduwaye (2009) that is, responding to developers planning initiatives than being active. This seems to be a major setback for adequate spatial planning as well as control mechanism for larger acquisition of land in the urban fringe area. Out of the three agents, the public is the least active as they often times have access to land sold to them by developers through subdivision of parcel of land for development purpose.

METHODOLOGY

Lagos State remains the industrial and commercial nerve centre of the country with a population of 9,113,605 in 2006 census and total land area of 3671km^2. The projected population in 2015 is 12,427,000; 14,162,000 and 15,810,000 in 2020 and 2025 respectively (UN-Habitat, 2010). Thus, it is one of the world's megacities (Lawanson et al., 2012; Oduwaye, 2015). It has an estimated growth rate of 3.2% and population density of 2725/km^2 (Lagos State Government, 2013). The implication of these increasing population pressure arising partly from continuous migration not only increases the demand for land derivatives but also indirectly increases the need for effective regulatory framework to avoid squatter settlement, haphazard development and enforcement of sustainable building codes and control.

The case study area is the Lagos Ibadan Expressway comprising of Isheri, Opic, Magboro, Arepo, Warewa, Mowe, Ibafo, Shimawa and Shagamu interchange area respectively. The study area was selected because of its rapid growth and diverse built forms that are being erected. It is low, middle class and a fast developing estates that is being developed by plot purchasers who bought land from developers as well as Omo-Onile (family Heads) in the various urban fringe.

Data Collection Technique

Data was collected through a combination of methods including survey, questionnaires, direct observation and in depth interviews. The REDAN membership strength of Lagos (southwest zone) was made available comprising of 128 members who have duly paid their dues. This therefore, forms the population from which the sample size was systematically drawn. Sample size for the study is 43 while 36 developers granted interview as well as filled the questionnaire, representing 83.72% responses. Semi structured interview guide and questionnaires was used to collect data from developers. The selection of the study area allowed for an understanding of the roles of developers in the Lagos-Ibadan Express way axis. The study employed descriptive statistics, mean item score and factor analysis to isolate critical factors germane to developers' activities in relation to land speculation in the study area.

Data Analysis and Presentation

This section examines the characteristics of the respondents, motivations as well as implication of developers' activities in the Lagos urban fringe.

Table 4.1 motivational factors

Motivational factors	Motivate	Do not motivate
Profit seeking	26(65.0)	14(35.0)
Achieve orientation	24(60.0)	16(40.0)
Desire for power	3(7.5)	37(92.5)
Ideological motivations	9(22.5)	31(77.5)
Preference for proximity to urban land uses	25(62.5)	15(37.5)

Respondents were asked to tick their motivational factors and the outcome is presented by table 4.1. The table shows that the major factors that motivate the respondents were profit and preference for proximity to urban land uses. Other factors were indicated not to have been major motivational factors at least for 92.5% (for desire for power) and 77.5% (for ideological motivations) It can be deduced from this outcome that developers develop in areas where they perceive to get optimum return from investment.

Table 4.2 reason why large land is acquired

	Std. Deviation	Mean	Rank
Investment seeking	.7457	4.51	1
Future sales	1.08542	4.08	2
Quality life impacts	1.05267	4.05	3
Cheaper land	1.07537	3.85	4
Planning rules	1.02736	3.84	5
Bequest/inheritance motive	1.19773	3.39	6

Table 4.2 presents reasons respondents felt that large land should be acquired. Investment seeking is top of the list with a mean ranking 4.51. Significant also are future sales, 4.08; quality life impacts, 4.05; others are cheaper lands, 3.85; planning rules, 3.84. Bequest/inheritance motive with 3.39 is the least of the reasons for large land acquisition.

Land Acquisitions

The respondents were asked to rate factors that determine the acquisition of their land within Lagos urban fringe. According to the result obtained from the study, there are three major factors that developers considered in acquiring land: proximity to the CBD; availability of large land for development; and availability of infrastructures. This implies that large land closer to CBD is liable to speculative activities of developers.

Source of Finance and Prospective Targets

Finance is a major driver of property development and the research examines the source of the respondents finance and their outcome is presented in table 4.3. It can be deduced from the outcome that despite the availability of C of O on land, few developers used borrowed funds either from friends, families, and financial institution (local and foreign) to erect their building. The most surprising is majority (about 65%) of the respondents gets their finance from equity.

The study went further to examine the prospective targets for subdivision of plot by the property developers. Evaluating the targets by earning power, the study finds out that targets for developers are high income earners, workers earning above 200,000 naira monthly. As this was applicable to subdivision of plots as well as finished products when available

Table 4.3 Source of finance and target respondents

		Frequency	Percentage
Source of finance			
	Savings/equity	24	64.9
	Borrowed from friends	5	13.5
	Nigeria financial institution	6	16.2
	Foreign banks	1	2.7
	Others	1	2.7
	Total	**37**	**100**
Targets after subdivision of plot			
	Workers below 50,000	3	7.9
	between 50,000-100,000	12	31.6
	101,000-150,000	8	21.1
	151,000-200,000	2	5.3
	Above 200,000 monthly	13	34.2
	Total	**38**	**100**
Targets after construction of houses			
	Workers who earn below 50,000	3	7.1
	Between 50,000-100,000	10	28.6
	101,000-150,000	5	14.3
	151,000-200,000	7	20.0
	Above 200,000	10	28.6
	Total	**35**	**100.0**

DISCUSSION OF FINDINGS

This study verifies the earlier assumption of the researcher that several other persons are involved in development activities in the urban fringe other than professionals in the built industry. Over 40% of the developers' affirmed they were lawyer, accountant or economist and business administrations. The supporting factors show that they have either worked in a construction company, have former experience, relevant knowledge and skills, acquaintance with other developers as well as connection within the relevant institutional system.

This study has also confirmed empirically that developers perceive housing to be a normal market good which could be compared with other commodities in the market. However, this is not true. A higher percentage of developers surveyed (65%) affirmed profit seeking is a major motivation for land acquisition in the urban fringes followed by the preference for

proximity to urban land uses. Alexander (2014) noted that landed property are not normal market goods as they often do not share the defining characteristics of the goods and services that are the object of competitive market transactions. Since housing is said to be a "merit good", there is need to control developers' activities in the Lagos urban fringes.

Furthermore, some of the identified drivers of land acquisition as affirmed by the respondents is the "desire to own my business (investment purpose); future sales, availability of cheaper land as well as inheritance motive. Some others affirmed "job loss" while others affirmed it s a passion and ideological motivation that man should have access to adequate housing. However, the original motivation to provide housing is not often achieved. Hence land sub-division. Subsequently, developers were asked to rate factors determining acquisition of land in Lagos urban fringe. Response shows that proximity to the CBD (Central Business District); availability of large land for development as well as availability of infrastructure. This implies that large land closer to the CBD is susceptible to speculative activities by developers.

This study further established the speculative activities of developers by asking the year of land purchase and the year allocation of title was actually granted. This study shows that 5 (five) years after allocation of title construction has still not commenced, rather land subdivision. This is sometimes carried out even before title processing. In addition, some developers who affirmed to have completed title processing since 1987 still have the land vacant. Majority of the respondents acquired the land in the early ninety's but still have the land vacant while some have divided for on-ward sale to ensure profit maximization. However, developers in the study area affirmed that several challenges were encountered after land purchase from local land agents such as lack of integrity of the local land agents leading to re-sale of land, frequent interference by land thugs popularly called "omo-onile" and dispute within members of the land owning families. While lackadaisical attitude of government officials towards perfection of land document is sometimes encountered during title processing as such impede the process and time elongation which may affect further development on site

Prospective Targets

In evaluating the target market through their earning power, the study revealed that target market for land sub-division as well as housing unit purchase are workers earning above 200,000 Naira monthly ($1000) using 200 Naira to a dollar. Very few developers affirm their target markets are those earning below 50,000 Naira to 100,000 Naira. This calls for urgent attention as the minimum wage in Nigeria is 18, 000 Naira monthly ($90). As such, the low income earner would hardly have access to land let alone adequate housing.

Development Control and Planning

This study largely adduced the uncontrollable acquisition of urban fringe land to weak government control in the fringes resulting in negative environmental effects such as reduced air and water quality, loss of open space and other natural resources as well as traffic congestion and haphazard development. In addition, the lack of political will of government to tax vacant land is also an issue of concern. However, none of the developers surveyed agreed to land value tax (LVT) as a form of control. Where the difference between the prices at which the investor sells his undeveloped land and the sum of his acquisition and holding cost accrues to the government and community as a whole, not to private individuals. Since the enhanced value of urban fringe land are largely due to government infrastructure and works and services.

CONCLUSION

The property developers' overriding motive is profit oriented; whether operating in the private or public sector. However, emphasis on the profit motive with urban fringe land

portends a major risk factor. As such, coordination of diverse existing planning and development control rules with new development areas need to be encouraged as a way of overcoming negative effects of weak control in the Lagos urban fringe.

This study therefore recommends LVT; joint venture of real estate development between public and private investors; the use of available technologies for prompt dissemination of land information to avoid a particular group taking advantage over individuals and community at large. In addition, state decentralization is encouraged to ease complex system of both policies and regulation of urban fringe land management. As such, a systematic and prompt approach should be institutionalized for ease of land formalization. Lastly, Participatory planning between public and private sector should be encourage as well as creating environmental consciousness of developers' activities and implication on the fringes to the general public.

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Effect of Contractor's Selection Criteria on Cost Performance of Civil Engineering Projects

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ABSTRACT

This study reflects the view of clients, consultants and contractors about the relationship between contractor's selection criteria and cost performance of civil engineering project. Data collected through questionnaire were analyzed using regression method. Results show that positive relationship exists between contractor's selection criteria and cost performance of civil engineering project. However, criteria for contractor selection influence cost performance of civil engineering project at varying degree. The impact of contractor's selection criteria on cost performance of civil engineering project is also at varying degree. It concludes that contractor's background, reputation, environmental, socio-political and financial ability impact greatly on cost performance of civil engineering project while the entire criteria for contractor selection impact on cost performance of civil engineering project at most, more and less significant impact levels. Hence, cost performance of civil engineering project depends mainly on these criteria for contractor selection. In addition, these criteria for contractor selection are the driving force for cost performance of civil engineering project. It is therefore recommended that clients and consultants, supposedly saddled with the responsibility of determining the cost performance of civil engineering project, should concentrate on non-financial criteria while selecting the contractor to handle the delivery of civil engineering project.

Keywords: Civil Engineering Project, Contractor, Cost, Criteria, Performance, Project, Relationship

INTRODUCTION

Infrastructural facilities are provided in other to meeting man's needs for shelter and convenience (Zavadskas, Vulitiene, Turskis and Tamosaitiene, 2010). It comprises building, civil engineering, and heavy/industrial engineering (Akinmusire and Ariyo, 2010). Consequently, Civil engineering can be defined as a broad field containing many subdivisions. These divisions include transportation engineering, environmental engineering, geotechnical engineering and construction engineering with different kinds of civil engineering projects emanating from them. The civil engineering projects include roads, buildings, airports, dams, bridges, water supply, and sewage systems. However, civil engineering projects is a professional engineering discipline that deals with the design, construction and maintenance of physical and natural built environment. Despite this, civil engineering projects are distinct and differ from other construction project categories in terms of type, nature, complexity and resource requirements (Barbara, 2004; Oforeh, 2006 and Lake, 2008). Oforeh (2006) further opines that civil engineering works are complex in nature. Evidently, contractors to handle these aspects of construction are usually screened and selected based on a number of selection criteria (Ogunsemi & Aje, 2005; Salama, Abd, EL & EI, 2006; Puoy, 2011). This is done by investigating contractors in terms of past performance, business location, technical capability, financial soundness, resources, quality assurance among others (Ogunsemi and Aje 2005; Zavadskas, Vilutiene, Turskis Tamosaitiene 2010 and Puoy 2011). This is absolutely aimed at prejudging contractors' capability and competence towards ensuring that selected contractor is suitable and capable in all ramifications to successfully execute projects regardless of its nature and magnitude (Aje, 2012).

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Managaveni and Zunzhi (2001) argue that there can be no successful realization of construction works without achieving reasonable success, most importantly, at design and construction stages of the project. Oyegoke (2008) submits that construction projects are successful when completed within predetermined cost. Corroborating this view, Ng and Aminah (2006), Tran (2009) and Azian and Ismail (2010) believe that construction project is adjudged successful if completed within estimated cost, reasonable time and required quality. Therefore, choosing a contractor to undertake the construction of a project require diligence and must be carefully thought out since a wrongly chosen contractor posses a lot of danger to successful project completion (Ramus, Birchall and Griffiths, 2006). Ogunsemi and Aje (2005) reveal that the selected contractor is expected to be capable to successfully deliver project within a predetermined cost. Failure to achieve this has been identified as the principal cause of the low performance rating ascribed to Nigerian construction industry (Oyegoke, 2008). Research results show that a lot of efforts have been made to modify the present contractor selection process which has not yielded the expected positive result (Ogunsemi and Aje 2005). Furthermore, contractor selection process is costly to both client and contractor. According to Ng and Skitmore (2001), money is spent by clients on defining the standard for assessment, preparing and printing of prequalification documents. They reveal other cost components to include, obtaining information, storing the information, interpreting the information, finding and summarizing useful information. In addition, applying the information to the assessment model, analyzing and assessing information, and making decisions also contribute to the cost of contractor selection process. On the part of the contractor, the cost aspects of contractor selection process include collecting the required information, reorganizing information to required format, planning, checking, typing, presenting, printing, submitting and explaining the information to the client. These can be summarized into bid documentation, collection, submission, evaluation, reporting and final selection.

The Nigerian construction industry still performs below expectation despite its contribution of about 70% to the nation's fixed capital formation (Arazi & Mahmoud, 2011). However, Tran (2009) admits that cost overrun is peculiar and often occurs in construction projects even in the global world. The study carried out by Ng and Aminah (2006), Rathsayam (2009), and Azian and Ismail (2010) indicate that construction projects, building and civil engineering, often fail to meet cost target. Supporting this view, Le (2011) agrees that initial and final construction project cost rarely tally. The study carried out on cost, time and quality performance of construction projects by Ng and Aminah (2006), Azian and Ismail (2010) and Puoy (2011) show that cost is central to judging the performance of construction projects. Sloboan (2006) admit the complex nature of civil engineering projects and that civil engineering projects are affected by a number of factors that render their completion within predetermined cost difficult. According to Othman, Torrance and Hamid (2006), performance of civil engineering project in terms of cost is affected by delays and project characteristics. These often lead to delivery of civil engineering projects out of budget. Therefore, the study assessed the effect of contractor's selection criteria on cost performance of civil engineering projects.

LITERATURE REVIEW

The Nigerian construction industry, like any other construction industry in the world, is crucial to the development of the nation by contributing significantly to her economic growth (Arazi and Mahmoud, 2011). Arazi and Mahmoud (2011) opine that the construction industry contribute about 70% to the fixed capital formation of Nigeria. This shows the immense contribution of the construction industry to the gross domestic product of the nation. According to Civil Contractors Federation (2010), civil engineering industry produces civil

engineering projects that play crucial role in meeting infrastructural needs of the people. Consequently, the economy of a nation relies on the contribution from the construction industry for growth. Ogunsemi and Aje (2005), and Zavadskas *et al* (2010) stress the strong relationship between the construction industry and the economy of a nation to the extent of revealing that there can be no meaningful economic development in any nation without active participation of the construction industry. The task of construction product delivery within budgeted cost is that of project stakeholders (client, consultants and contractor). Ng and Aminah (2006) posit that most construction projects are bedeviled with unexpected additional cost due to faulty designs and poor contract administration in addition to the uncertainties that are peculiar to construction projects. Moreover, Rathsayam (2009) and Le (2011) agree that construction projects are hardly completed within the cost predetermined by client and consultants. The reason for this is attributable to peculiar uncertainties that may positively or negatively affect construction cost (Sameh 2008). The study conducted by Rathsayam (2009) trace the reasons for construction project cost overrun to poor project conception, planning, construction and closing phase, and wrong choice of contractor. The factors responsible for poor cost performance of construction projects include economic problem, politics, legal problems, design, contractual, inflation, change in government regulations, technical problems, delay and contractor incapability (Lee, 2011).

Consequently, cost is one of the three essential project success/performance measurement criteria (Adnan; Sherif, and Saleh, 2009; Ogunsemi and Aje, 2005; Barbara, 2004; Roshana and Akintola, 2002; Azian and Ismail, 2009; Puoy, 2011 and Aje 2012). Part of the primary objectives of construction projects, according to Tran (2009) and Rathsayam (2009), is to be completed within cost based on the standard and specifications. According to Doan (2011), the only way to make clients happy is to deliver products that meet cost target. This implies that clients expect projects to be completed without paying extra money (Nguyen, 2012 and Aje, 2012). Construction projects vary in type and complexity and depends on the purpose for which it is needed (Barbara, 2004). In Barbara (2004) and Oforeh (2006), civil engineering projects are generally complex requiring vast resources and usually take longer time to put them in place. Lake (2008) opine that civil engineering projects encompasses roads/highways, railways, canals, airports, harbours, docks, water supply, drainage, flood and erosion control, bridges, tunnels, pipelines, dams, irrigation systems, among others. According to Sloboan (2006), the success of civil engineering projects require adequate knowledge of civil engineering production, its complexity and project specifics. Moreover, civil engineering project specifics are portrayed in the uniqueness, character of work and inseparability of the product from its location (Sloboan, 2006). Construction project developmental stages include design, tendering, tender evaluation and reporting, contractual arrangement, and award of the contract. Hence, these stages of project development process are unique, sequential and require unique team to design and construct. According to Pierre (2003), civil engineering projects are to be planned, designed and constructed/realized. These project phases involve different tasks with corresponding skills to be performed by different professionals. Consequently, planning of civil engineering projects is rendered difficult by their complexity and their production that involves a lot of participants (Sloboan, 2006).

Ajayi and Ogunsanmi (2012) opine that most client prefer adoption of selective tendering in the selection of contractors for their construction projects. The reasons ascribed to this are prevention of default from contractors including associated contractors' overhead costs, easy assessment of contractors' liability, competence and potential contractors' capability and minimization of potential project risks. Arazi *et al*. (2011) and Xiaohong (2011) consider the process of selecting the most suitable contractor to handle the delivery of construction project as an uneasy task. They opine that contractor selection is vital to the overall construction

project success. On the other hand, construction involves putting resources together with resultant costly product according to Zavadskas *et al*. (2010). They further opine that selecting a contractor is an important part of construction process that should be handled with great care. This is as a result of the dangers of extra financial burden inherent in erroneous choice of contractor (Ng and Skitmore, 2001; and Ogunsemi and Aje, 2005). This usually lead to waste of resources and hostility between the client and the contractor which can lead to litigation or arbitration that can prevent the project from seeing the light of the day (Ogunsemi and Aje, 2005). Customarily, the aim of contractor selection process is to ensure the emergence of the most suitable contractor and making the choice of same successful contractor (Ajayi and Ogunsanmi, 2011). As a result of the sensitivity of contractor selection process, Salama *et al*. (2006) consider this to be very important to the client and his advisers/representatives. The result of the study conducted by Banaitiene and Banaitis (2006), revealed in Ajayi and Ogunsanmi (2011), identify unsuitable criteria, inappropriate importance attached to the criteria, wrong contractor evaluation and selection as the principal cause of erroneous choice of contractors. Nonetheless, incompetent contractor pose a lot of threat to both the project and all stakeholders. Contractor selection process is incomplete without tender/bid evaluation. The study carried out by Khamidi; Khan, and Idrus (2011) and Capital Works Management Framework (2011) indicates that contractors are evaluated based on price and non-price criteria. As far as price criteria is concerned, emphasis is on the tender price submitted by the contractors and other documents such as evidence of financial stability turn over, profit, obligations, amount due and owned financial funds, meant to appropriately evaluate the financial stability of the bidders (Xiaohong, 2011). However, Xiaohong (2011) agree that the price offered by the bidders is the most paramount criteria considered during bid evaluation and forms the basis for the award of the contract. However, Queensland (2007) believes that cost is one of the principal project objectives that determine the choice of the criteria for contractor selection.

In view of this, Khamidi *et al*. (2011) and Arazi *et al.* (2011) posit that cost is a crucial instrument for measuring the performance of construction project as well as major determinant of client's satisfaction. They describe construction cost as the total amount of money expended on a construction project from inception to completion including costs arising from variations, modification and all legal claims. Furthermore, Khamidi *et al.* (2011) categorizes construction project cost into direct, indirect and overhead costs. According to (Khamidi et al., 2011) construction cost is a cumulative of these costs which eventually becomes the cost baseline for the project. The cost of any construction project is usually predicted and established through an estimate which is to be targeted and controlled to ensure that the project is completed within the estimate (Barbara, 2004). In the construction industry, the cost of a particular construction project is usually agreed by both the client and the contractor early enough in the life of the project. This constitutes the budget and it is expected to be sufficient to execute the project from start to finish. In Le (2011), construction projects are hardly completed at or within the agreed cost despite client's and consultants' efforts towards this. The circumstances surrounding the difficulty in achieving construction project of same initial and final cost, according to Ali and Kamaruzzaman (2010) and Le (2011), is basically the risky nature of construction projects. This is particularly the result of wrong estimate, design changes, inflation, site condition, poor contractor's technical, managerial and financial capability, poor site management as well as poor financial capability by the client. Construction project cost performance is affected by project manager's competence, top management support, project manager's coordinating and leadership skills (Iyer & Jha, 2005). Other factors are monitoring and feedback by participants, decision making, coordinating among project participants, owner's competence, social condition, economic condition and climatic conditions.

Rathsayam (2009) and Arazi *et al*. (2011) admit that several projects experience unexpected cost overruns despite the fact that factors contributing to this are avoidable. This problem is traced to faulty project conception, planning and controlling/monitoring. Arazi *et al*. (2011) further show that cost overrun occurs when the total amount of money expended on construction project exceeds the initial estimated cost of the project. The cost of a project needs careful determination bearing in mind that it must be sufficient to completely execute the project without subjecting the client to extra financial burden (Barbara, 2004). The effect of cost overrun as revealed in Khamidi *et al*. (2011) includes financial loss to client and contractor as well as disputes, unpleasant project progress and remarkable increase in construction project cost. According to Azian and Ismail (2009), construction project cost goes beyond the tender sum. It is the overall cost incurred on the project. This includes cost of variations and any other claims due to the contractor in addition to the tender sum. A comparison between the overall cost and the initial cost of a project will show how much the project is over or under budget. Hence, Salter and Torbett (2003) and Azian and Ismail (2009) opine that cost variance is a vital factor that determines project performance. Khamidi *et al*. (2011) argue that cost overrun brings unpalatable situation to client, contractor and the project itself. Therefore, they suggest cost monitoring of construction projects by consultants so as to keep the cost within the initial estimate. While noting that larger part of construction project cost is spent during construction, Khamidi *et al*. (2011) submit that monitoring of construction project cost as the prime duty of client's consultants. They ascribe construction project performance to the efficiency of the consultants to control the cost so as to ensure completion within the budget. Additionally, comparing the amount expended on construction project with the estimated cost is a better tool for monitoring construction project cost (Khamidi *et al*. 2011). Khamidi *et al*. 2011 therefore believe that construction project is successful if completed within the initial estimated cost. Moreover, before the cost performance of a construction project can be judged; certain factors have to be considered. These factors, according to Adnan *et al*. (2009) include uninterrupted cashflow, completion within budget, material and equipment cost required for the project, labour cost required for the project, amount expended on workers' motivation, cost of variation orders and amount of overhead expended on the project. Other factors are amount of profit realized from the project, cost incurred as a result of material wastage, amount expended on overtime charges and cost incurred as a result of labour resource wastage.

In line with standard practice, construction contractors are chosen based on some selection criteria. These selection criteria are identified in Ng and Skitmore (2001) and revealed in Ogunsemi and Aje (2005). They include past performance, contractors experience, workmanship ability, tender sum, plant and equipment, contractor's reputation, management capability, quality assurance, contract period, health and safety policy, financial standing, project size, location, project type, contractors' current work load, competition, length of time in business relationship with client, and amount of subcontract work. This shows the result of previous researches where it is revealed that contractors can be selected based on financial soundness, technical ability, management capability, safety performance and reputation (Ng and Skitmore, 2001). This list is expanded to include method statement, percentage of advanced payment, schedule of payments, past failures, disputes and claims records and arbitration records (Salama *et al.*, 2006). However, exceptional situation may arise in case of civil engineering projects because of the peculiar characteristics of civil engineering works. Sequel to this, Salama *et al*. (2006), which reveal the contractors prequalification criteria adopted for the parallel runway for Kingsford Smith Airport, indicate additional criteria to those mentioned in the previous researches. They include relevance of experience, size of firm, relationships (industrial relations, occupational health and safety, and claims and dispute history), past failures among others. Moreover, general information or contractor's

background, financial, managerial, technical and safety abilities are common contractors prequalification criteria as indicated in Ng and Skitmore (2001); Puoy (2011); Nguyen (2012); Aje (2012); and Salama *et al*. (2006).

The research conducted by Puoy (2011) and Aje (2012) show that construction project cost performance is affected by contractor selection criteria. Investigation reveals past performance, technical ability and management capability as dominant prequalification criteria affecting cost performance of construction projects (Puoy, 2011). However, emphasis has been on both price-related selection criteria and non-price-related contractors prequalification criteria. Contrarily, Queensland (2011) argues that the price at which a contract is awarded may not offer best value for money. Thus, contractor carrying out work under the supervision of client's representatives is expected to deliver the project within the budgeted cost (Oyegoke, 2008). In addition, how much each contractor intends to execute the project together with consultant's estimate is uncovered during bid evaluation. The pre-estimated budgeted cost is used as reference to judge contractors' bid performance according to Salama *et al*. (2006). Investigations show that contractors are, in most cases, selected based on bid price or tender sum only at the expense of other crucial contractor's financial soundness criteria (Salama *et al.,* 2006). As a result of this, the lowest bidder usually emerges victorious. Admitting this view, Xiaohong (2011) argue that contracts are often awarded to the lowest bidder who usually finds it difficult to successfully execute such contract because of the attendant problem of financial bottleneck the contractor would eventually face. Aje (2012) consider this as a major contributory factor to construction project failure because such contractor is prone to financial difficulty, which may lead to additional financial burden on the client and/or poor quality product in the long run.

RESEARCH METHODOLOGY

This study was carried out by sampling the opinion of construction professionals in both public and private organizations in Ondo and Lagos states. These include Quantity Surveyors, Civil/Structural Engineers, Clients and Civil Engineering Contractors. According to Puoy (2011), Quantity Surveyors and Civil/Structural Engineers play significant role towards making the choice of competent civil engineering contractor as well as administration of civil engineering projects. Therefore, the population comprises registered financial professionals and organisations totaling 636 respondents. The figure was scientifically reduced to a sizeable portion of 246, using Yamane's formula. The data were collected from Ondo and Lagos states, Nigeria, through questionnaire survey administered on 246 respondents including Quantity Surveyors, Civil/Structural Engineers, Government ministries and parastatals (dealing in civil engineering projects) and Civil Engineering Contractors. Convenience sampling technique was adopted. This is a non-probability sampling method involving collecting data from easily accessible and willing respondents (Charles and Fen, 2007). Out of 246 questionnaires, 156 were retrieved and found suitable for analysis using regression method. In this case, the independent variable (contractor's selection criteria) with the highest standardized coefficient beta value, t-value and significance level, less than or equal to 5% (0.05) is taken to have significant impact on the dependent variable (cost). The degree of association between the dependent variable (cost) and independent variables (contractor's selection criteria) as well as the causal relationship between the independent variables is shown by the Karl Pearson correlation generated by the regression model.

RESULTS

Table 1 illustrates the correlation between criteria for contractor selection and cost performance of civil engineering project as well as the interrelationship between the criteria

for contractor selection. From the table, a positive relationship exists between cost performance of civil engineering project and contractor's general/background, technical ability, financial ability, management ability, reputation, past performance, health and safety, and environmental, social and political criteria with $r<0.5$. Despite this, contractor's general/background recorded highest correlation ($r=0.456$) with cost performance of civil engineering project. This implies that contractor's general/background have higher tendency to influence the cost performance of civil engineering project relative to other criteria for contractor selection. Contractor's technical ability, financial ability, and reputation also register a remarkable positive relationship with cost performance of civil engineering project ($r>0.3$). This means that they have considerable positive influence on cost performance of civil engineering project. Apart from this, contractor's management ability, past performance, health and safety, relationship, and environmental, social and political criteria recorded noticeable positive relationship with cost performance of civil engineering project ($r>0.2$). This shows that they have noticeable influence on cost performance of civil engineering project. Table 1 further shows that positive interrelationship exists between criteria for contractor selection and cost performance of civil engineering project with $r>0.5$ and $r<0.5$ respectively. This indicates that criteria for civil engineering contractor selection positively related with one another while influencing the cost performance of civil engineering project. However, table 2 reflects the impact and predicting power of criteria for selecting contractors on cost performance of civil engineering project. It is revealed that contractor's general/background have the highest standardized coefficient beta value and t-value of 0.408 and 3.858 respectively. The standardized coefficient beta value of this criterion for contractor selection is substantially high, meaning that it makes most significant impact on cost performance of civil engineering project. This indicates that contractor's general/background have the strongest cost predicting power for civil engineering project over other criteria for selecting contractors. Table 2 further shows that contractor's general/background makes statistically significant unique contribution in predicting the cost performance of civil engineering project at $p\leq0.05$. Moreover, contractor's reputation, environmental, social and political, and financial ability, has standardized coefficient beta value in 0.1 range. Thus, they make more significant impact on cost performance of civil engineering project. Majority of the criteria for contractor selection, representing about 56%, fall below 0.1 standardized coefficient beta values. This comprises technical ability, past performance, health and safety, management ability, and relationship with $p<0.05$. This means that they make less significant impact on the cost performance of civil engineering project. The adjusted R^2 value is 0.206, meaning that about 21% of cost performance of civil engineering project is impacted upon by criteria for selecting civil engineering contractors.

Table 1 - Relationship between contractors' prequalification criteria and cost performance of civil engineering project

	Cost									
Cost	1.000									
General/Background	.456	1.000								
Technical ability	.325	.630	1.000							
Financial ability	.371	.560	.501	1.000						
Management ability	.288	.457	.742	.500	1.000					
Reputation	.349	.443	.678	.616	.715	1.000				
Past performance	.274	.443	.722	.498	.659	.713	1.000			
Health and safety	.258	.449	.505	.527	.447	.555	.648	1.000		
Relationship	.286	.558	.605	.506	.434	.619	.684	.689	1.000	
Environmental, Social and Political	.243	.530	.513	.612	.487	.542	.660	.658	.752	1.000

DISCUSSION OF FINDINGS

The findings in this research indicate that a significant positive relationship exists between criteria for contractor selection and cost performance of civil engineering project. The entire criteria for contractor selection listed in this study positively correlated with one another at varying degree of interrelationship. Also, criteria for contractor selection impact significantly on cost performance of civil engineering project at varying degree. It can be advanced that the resultant effect of inadequate criteria for contractor selection is completion of civil engineering project out of budget. This study shows that contractor's background, reputation, environmental, social and political and financial ability impacts significantly on cost performance of civil engineering projects. It is found that financial ability came last in this group. This shows that cost performance of civil engineering project depends mainly on non-financial selection criteria for contractor selection. However, this result negates the result in Aje: Odusami, and Ogunsemi (2009) and Puoy (2011), which focuses on building and housing construction projects. Here past performance, technical ability, and management capability were found to impact on project cost performance. In view of this, it can be deduced that civil engineering project stakeholders' opinion about the effect of criteria for contractor selection on cost performance differs from those of building project. This can be attributed to the characteristics as well as resource requirement difference that exist between civil engineering and building projects.

Table 2 - Impact of contractor selection criteria on cost performance of civil engineering project

Variables	Standardized Coefficients Beta	t-value	p-value	Adjusted R^2
(Constant)		6.035	.000	.206
General/Background	.408	3.858	.000	
Technical ability	-.096	-.688	.493	
Financial ability	.135	1.250	.213	
Management ability	.010	.080	.937	
Reputation	.181	1.382	.169	
Past performance	.050	.371	.711	
Health and safety	.012	.112	.911	
Relationship	.006	.041	.968	
Environmental, Social and Political	-.154	-1.198	.233	

Dependent variable – Cost
P is Significant at 5% ($p \leq 0.05$)

CONCLUSION

Criteria for contractor selection affect cost performance of civil engineering project. The degree of the impact of the criteria for contractor selection on cost performance of civil engineering project is remarkable. This indicates that no choice of competent civil engineering contractor can be made at the expense of any of the contractor selection criteria. There is significantly positive relationship between criteria for contractor selection and cost, performance of civil engineering project. Thus criteria for contractor selection contribute significantly to cost performance of civil engineering project. Therefore, when the criteria for contractor selection sneeze, cost performance of civil engineering project catches cold. Thus, criteria for contractor selection are critical to cost performance of civil engineering project. Despite this, there is different degree of severity of the criteria for contractor selection on cost performance of civil engineering project. However, non-financial criteria for contractor selection, such as general/background, reputation, and environmental, social and political criteria are more critical to cost performance of civil engineering project than financial criteria. Hence, it can be advanced that they are causal driving force for cost performance of civil engineering project. However, technical ability, past performance, health and safety,

management ability, and relationship criteria impact less on cost performance of civil engineering project. Consequently, cost performance of civil engineering project depend less on these criteria for contractor selection.

RECOMMENDATIONS

Based on the conclusion drawn from the findings of this research, it is imperative to recommend that the choice of the criteria for selecting the contractor for civil engineering project should be based on the importance attached to meeting cost target. Civil engineering project clients and consultants should concentrate on non-financial criteria, such as general/background, reputation, and environmental, social and political criteria for contractor selection rather than financial criteria. Hence, prioritizing the criteria for selecting civil engineering contractor should be in the order of general/background, reputation, environmental, social and political, financial ability, technical ability, past performance, health and safety, management ability, and relationship. Consequently, all clients' and consultants' efforts should be geared towards full implementation of these criteria for contractor selection while making the choice of the contractor to handle the delivery of civil engineering project.

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State of Construction Change Management Practices in Ondo State, Nigeria

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ABSTRACT

This paper assessed the state of construction change management practices in tertiary educational building projects in order to ascertain the practitioners awareness and adoption of the practice while taking into consideration the possibility of challenges facing the practice. 131 questionnaires were administered to key construction stakeholders. 87 questionnaires were returned and found suitable for analysis which represents 66.41% of the total sent out. Percentile and mean item score (MIS) were employed to analyze the data collected via questionnaire survey drawn on a 5-point likert scale. 15 factors, which were rated by the respondents, were significant after analysis with MIS. Kruskal Wallis H test was adopted in testing opinions of the respondents and Cronbach alpha test was also carried out to establish the reliability of the research instrument used for collecting data. The respondents had a convergent view i.e. statistically significant agreement regarding the level of awareness and adoption of construction change management practices while there were divergent views in relation to the challenges facing adoption of the practice. This is not unconnected to uniqueness and peculiarities possessed by each construction projects. The most highly significant challenges facing full adoption of CCM practices in its entirety include resistance to change current practice for a new approach and lack of continuing professional development (CPD) due to insufficient resources. It is recommended that construction practitioners be encouraged to undergo training while professional bodies should organize seminars for their members as this will reorient them in adopting new approach for existing current practice of doing things.

Keywords: Change, Construction, Changes, Management, Practices, Projects

INTRODUCTION

The propensity, at which changes on construction projects are transmogrifying, is alarming, as arithmetical progression is an understatement to quantify it, be it in form of scales, types, quantity and even magnitude (Zhuoyuan, Benson, & Imriyas, 2005). The performance of construction industry in terms of meeting its objectives or goals has been invariably affected by construction changes, thereby making it vulnerable to what has been broadly categorized as time and cost overruns as well as lack of quality products that hardly stand the test of time (Adedokun, Ogunsemi, Aje, Awodele & Dairo, 2013). Based on this, it is highly desirable but hardly feasible to eliminate construction changes completely on projects due to multi-layered contracting nature, which calls for an effective change management for firms' sustained survival (Zhuoyuan et al., 2005). A severe risk contributing to project failure could be ameliorated if changes are resolved through a formalized change management process (Anees, Mohamed & Abdel Rasek, 2013). Changes are to be classified adequately in order to effectively manage them and classifications of changes in general terms apply to changes in construction domain (Hao et al., 2008). Motawa et al (2007) classified changes based on parameters of time, need and effect. In summary, "*based on time, change could be anticipated or emergent, proactive or reactive, or pre-fixity or post-fixity. Based on need, change could be elective or required, discretionary or non-discretionary, or preferential or regulatory. Based on effect, change could be beneficial, neutral or disruptive."* (Motawa et al., 2007).

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LITERATURE REVIEW

Construction Change Management Practices

Construction change management is the application of integrated solutions to coordinate the process, e.g. documentation, drawing, process, flow, information, cost, schedule and personnel of a project from inception to completion by ensuring that disputes; cost and time overruns are managed (Hao et al., 2008). Effectively managing changes on a project can substantially bring about reduction in risk of cost and time overruns, which often times result in disputes and claims (Egan et al, 2012). Despite the fact that implementation of change management processes can aid in the effective management of change, currently, there are no widely accepted industry standards pertaining to change management processes (Bolin, 2013; Egan et al, 2012). Hao et al (2008) suggest that unlike small reworks with minor impacts which do not need to go through a formal change process, changes with noticeable impacts, either reworks or change orders, require the following formal process in change management. The process according Hao et al (2008) is a generic change process model considered to have five stages including (i) identify, (ii) evaluate and propose (iii) approve (iv) implement and (v) review.

Having reviewed the works of several authors such as project change management by the Construction Industry Institute (CII), AACE international's Professional Practice Guide to Contracts and Claims, which includes a number of AACE International transaction papers like Project Trends and Change Control, Change Management for Today's Project-A Process Approach, and Effective Management of Project Change Orders and host of others, Egan et al (2012) summarized some of the practices from these various approaches and outlines the steps that can be taken to effectively manage change on a construction project as follows: (i) Address potential changes in the contract documents. (ii) identify the potential change (iii) create a proposed change order and document the proposed change (iv) review and evaluate the proposed change order timely (v) execute the change order and (vi) document the executed change.

Other guidelines on managing construction changes based on the principles of effective change management model by CII (1994) in Egan et al (2012) are as follows: (i) promote a balanced change culture (ii) recognize change (iii) evaluate change (iv) implement change (v) continuous improvement from lessons learned. Northwestern University Information Technology, NUIT (2011) put forward seven (7) processes involved in change management as (i) Change logging(ii) Change Review (iii) Change Assessment and Plannig(iv) Change Approval (v) Coordinate Change Implementation (vi) Change Evaluation and Closure and (vii) Emergency Change Handling Facilities Operations and Development (2008) suggested (i) identify the change (ii)assess the impacts of the change (iii) develop an action plan to address the impacts of the change (iv) gain acceptance of the action plan and (v) revise the six-year capital plan, (if applicable) on their university projects as change management process.

The works of myriad of authors aforementioned indicated that there is no "one size fits all" process or set of procedures for change management on projects (Bolin, 2013; Egan et al, 2012). Therefore, owner's, contractor's and project specific requirements, contract types, management preferences, and logistical issues are a few of the many factors that may influence the structure of the change management process for a given project (Bolin, 2013). Although there are expected differences in the change process between projects (Bolin, 2013), the following diagram in figure 1 defines the basic elements and processes that are typically expected during the construction phase of the project.

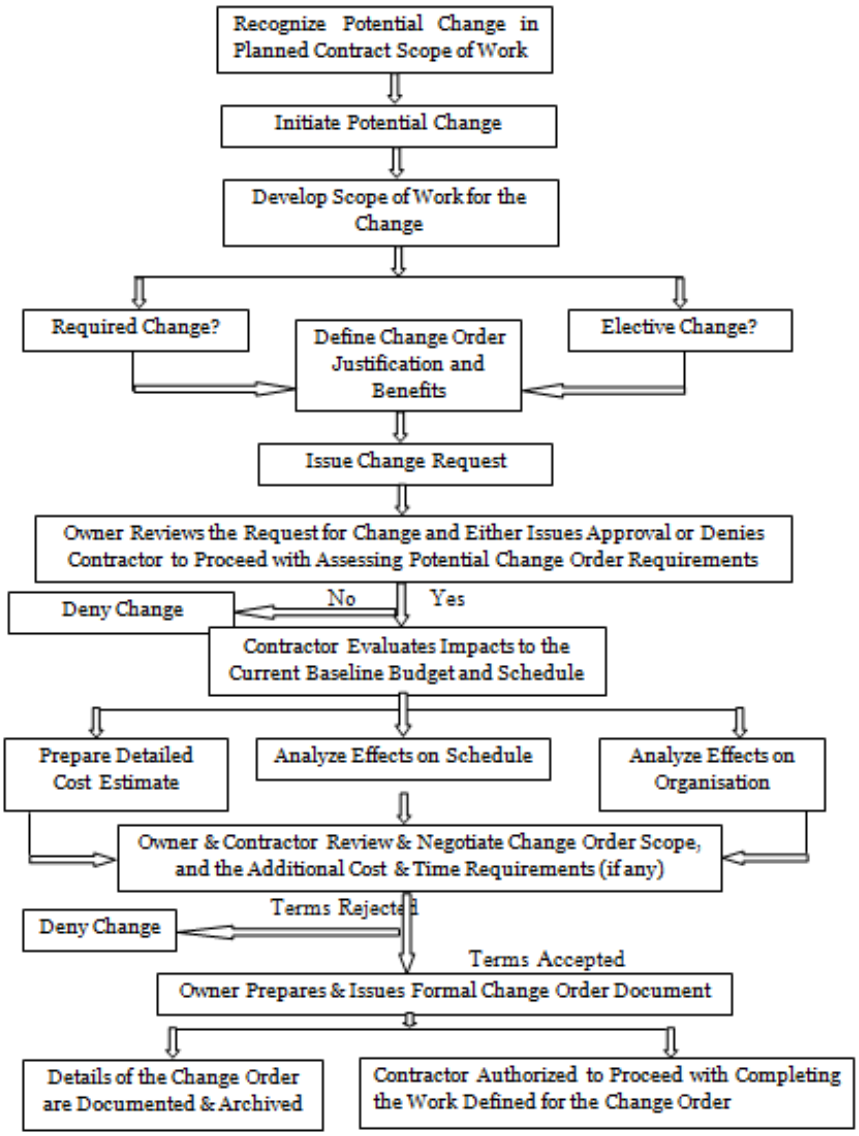

Fig 1: Change Management Process (Bolin, 2013)

Challenges facing Construction Change Management Practices

Hao et al. (2008) opined that developing an effective construction change management process is a challenging task because it requires an integrated solution for coordinating everything involved for the purpose of the change management in question according to Figure 2. Change management is a topic that one can hardly get through any resources unlike project management or construction enterprise management software that are readily available on the market.

Hence, the following are some of the challenges facing construction change management practices (Hao et al., 2008):

i. Unacceptability of new ideas by professionals
ii. Inadequate encouragement as regards learning within the firm
iii. Unavailability of change management unit
iv. Unavailability of time to exchange ideas
v. Insufficient time for after action review
vi. Difficulty in transferring change management knowledge
vii. Unwillingness of staff to share knowledge

viii. Excessive time associated with construction change management
ix. Uniqueness associated with projects which makes knowledge gotten from a project a waste to other projects
x. Variation on nature of projects
xi. Lack of organizing training/ seminars due to insufficient resources
xii. Too much work preventing evaluation of previous work
xiii. Overbearing workload which prevents cross project learning
xiv. Unwillingness to learn by professionals
xv. Resistance to change current practice and adopt new approach

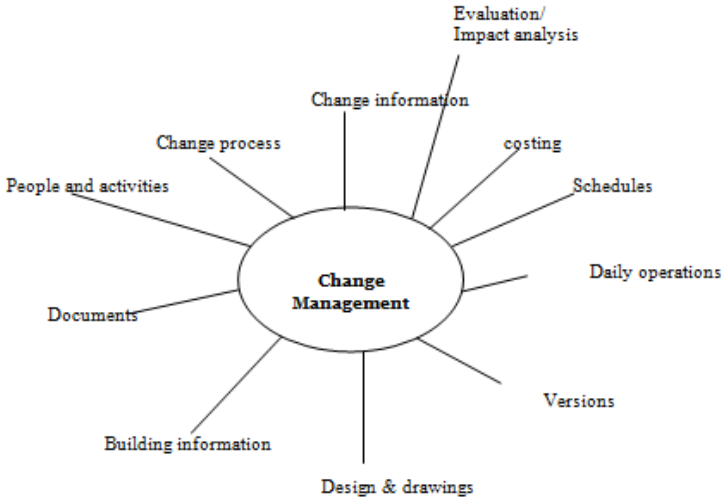

Fig 2: Requirements of an integrated change management system (Hao et al., 2008)

RESEARCH METHODOLOGY

This research employed a qualitative research design in the conduct of the study which involved the use of questionnaire survey administered to key construction stakeholders. The population for this work includes 131 key construction stakeholders comprising 44 Contractors/ representatives, 32 Quantity Surveyors, 28 Architects and 27 Structural Engineers, in the tertiary educational institutions in Ondo state, Nigeria (Tables 1and 2). The construction professionals used are both in-house professionals within the client organisation and the consultants outside the client's organisation but working on client's projects and the contractors executing the projects for clients. The targeted respondents were involved in the completed tertiary educational building projects from 2010 – 2014. The choice of the duration is to enable the respondents to quickly remember the activities that transpired during the course of the projects, knowing too well that records are seldom kept in a retrievable manner (Tarr and Car, 2000), hence considering too long duration is tantamount to guess work.

Table 1: Population breakdown of the respondents

S/N	Institutions	CLIENTS REPRESENTATIVES						Nr. of Ktors/Rep	**Total**
		In-House Professionals			External Consultants				
		QS	Arch	S/Eng	QS	Arch	S/Eng		
1	Tert. Ins. 1	2	2	4	5	4	4	10	31
2	Tert. Ins. 2	3	1	2	4	3	3	5	21
3	Tert. Ins. 3	0	0	0	1	2	2	5	10
4	Tert. Ins. 4	2	2	2	9	7	6	10	38
5	Tert. Ins. 5	0	0	0	0	0	0	0	0
6	Tert. Ins. 6	0	0	0	4	4	3	8	19
7	Tert. Ins. 7	2	3	1	0	0	0	6	12
Total		9	8	9	23	20	18	44	**131**

Key: Tert. Ins. – Tertiary Institution; Nr. of Ktors/ Rep – Number of Contractors/ Representatives; QS – Quantity Surveyors; Arch – Architects; S/Eng – Structural Engineers

The adequacy of a sample is assessed by how well such sample represent the whole population of participants from which the sample is drawn (Kothari, 2009). In order to achieve this, the lists of relevant construction professionals were collected from Physical Planning Unit (PPU)/ Works and Services Department of their respective Tertiary Educational Institutions. Since the target population, as obtained from the Physical Planning Unit (PPU)/ Works and Services Department of their respective Tertiary Educational Institutions, is just 131, it was found to be manageable thus census method was employed which involved the use of the entire population rather than picking a sample which might introduce some level of bias in the study.

Table 2: Population of the respondents

S/N	Respondents	Population
1	Quantity Surveyors	32
2	Architects	28
3	Structural/Civil Engineers	27
4	Contractors/ Representatives	44
Total		**131**

Data Collection Instruments

The research instrument that was used for collecting data from the respondents included a structured questionnaire that was administered using a set of predetermined questions. The questions designed for this research were such that first section dwelt on the background information of the respondents while the other section focused on matters relating to the research study. Questions inherent in the structured questionnaire were multiple-choice type with different checkboxes and tables posed on a 5-point Likert scale for ease and uniformity of response. Its application implies that most part of the data analysis was based on a scoring system.

ANALYSIS AND DISCUSSIONS

Tables were employed in this paper for data presentations while the analyses of the collected data were carried out using percentile, mean item score, factor analysis, Cronbach alpha test and Kruskal Wallis test. The results of the analyses were presented as follows under the various headings

Demographic Information of Respondents

Out of the 131 questionnaires administered, 87 were completed, returned and found suitable for the analysis. The analyzed questionnaires represent 66.41% of the total questionnaires sent out. This is considered sufficient for the study base on the assertion of Aje, Adedokun and Ibironke (2015) that the result of a survey could be considered as biased and of little significance if the return rate was lower than 20-30%.

From Table 3, it can be seen that majority of the respondents in this case are Quantity Surveyors with 43.7% and was followed by 29.9% quota, represented by the Structural/Civil Engineers and least was Architects with 26.4%. The professional membership status of the respondents shows that 41 are graduate members, 44 are corporate/ associate members while 2 of them are fellow of their respective professional bodies with 47.1%, 50.6% and 2.3% respectively.

As for the years of working experience possessed by the respondents, it can be seen that 26.4% falls within 1 - 5, 54% of the respondents are within 6 – 15 years of experience, while 8% falls within 16 - 20. On the average, the respondents have 10 years of working experience and the information supplied by this category of professionals is considered adequate and can

be relied upon. These set of respondents have their establishment in existence for an average of 13 years.

Analysis in Table 3 reveals that majority of the respondents are Postgraduate diploma holder with 40.2% and this is followed by respondents with BSc/ BTech qualification representing 20.7% followed by 19.5% and 18.4% representing HND and MSc/ MTech. Only one of the respondents has a PhD as the highest qualification and this translated to 1.2%.

Having analyzed the demographics of the respondents, it is evident that the respondents had sufficient knowledge and experience to participate in the research. Hence, the data collected from these respondents can be relied upon

Table 3: Demographic information of the respondents

Background Information	*Frequency*	*Percentage*	*Cum. Percentage*
Profession of respondents			
Quantity Surveyors	38	43.7	43.7
Architects	23	26.4	70.1
Structural/ Civil Engineers	26	29.9	100.0
Total	***87***	***100.0***	
Years of experience			
1 – 5	23	26.4	26.4
6 – 10	32	36.8	63.2
11 – 15	15	17.2	80.4
16 – 20	7	8.0	88.4
Above 20	10	11.6	100.0
Mean		**9.*7***	
Total	***87***	***100.0***	
Highest Qualifications			
HND	17	19.5	19.5
BSc/BTech	18	20.7	40.2
PGD	35	40.2	80.5
MSc/MTech	16	18.4	98.8
PhD	1	1.2	100.0
Total	***87***	***100.0***	
Type of firm/ Sector			
Client organization	26	29.9	29.9
Contracting firm	46	52.9	82.8
Consulting firm	15	17.2	100.0
Total	***87***	***100.0***	
Year/ length of establishment of firm			
1 – 5	13	14.9	14.9
6 – 10	23	26.5	41.4
11 – 15	18	20.7	62.1
16 – 20	11	12.6	74.7
Above 20	22	25.3	100.0
Mean		***12.6***	
Total	***87***	***100.0***	
Membership grade			
Graduate	41	47.1	47.1
Corporate/ Associate	44	50.6	97.7
Fellow	2	2.3	100.0
Total	***87***	***100.0***	
Professional body of affiliation			
NIQS	37	42.5	42.5
NIA	21	24.1	66.6
NSE	24	27.6	94.2
Others (NICE, COREN)	5	5.8	100.0
Total	***87***	***100.0***	

Reliability of the research instrument

Reliability according to Kothari (2009) is an important aspect of research instrument and must be considered to ensure that accurate results are obtained. One of the most commonly used reliability coefficients according to Kothari is Cronbach's alpha test (α). Cronbach alpha test was employed in this paper to test the reliability of the questionnaire administered to the respondents during the survey carried out.

Table 4: Test of reliability for measuring scale

Scale of measure	Cronbach ∝-value
frequency of undertaking CCM practice activities	0.961
challenges facing implementation / adoption of CCM	0.800

Table 4 shows that the Cronbach's α value for scale of measures of the research instruments ranges from 0.800 to 0.961. Since the degree of reliability of the instrument is more perfect as the value tends towards 1.0 (Kothari, 2009), it can then be concluded that the instrument used for this research is significantly reliable.

Table 5: State of construction change management practices

	Mean	Remark
Level of Awareness	4.22	Awareness > Adoption
Level of Adoption	3.64	

Table 5 showcases the state of construction change management practices on project in terms of awareness and adoption level. From table 6, respondents are of the opinion that their level of awareness of the practice is high (**Mean Score = 4.22**). It can be seen that the level of adoption is also significant with mean score value of **3.64** but the level of awareness of the practice is far greater than the rate at which CCM practice is adopted on construction projects. The implication of this is that there exist certain factors impeding the full adoption of the practice despite its wide degree of awareness.

Table 6: Test of significance on the level of awareness of CCM on project

	Profession	Group	Mean
Chi-square	86.000	Quantity Surveyors	19.50
Df	2	Architects	50.00
Asymp. Sig	0.000	Structural/ Civil Engineers	74.50

From table 6, Kruskal Wallis test carried out shows that the p value is < 0.05, being 0.000, then null hypothesis which says that there is no significant agreement in the opinions of the respondents, is rejected and the alternate hypothesis is accepted that there is statistically significant agreement in the opinions of the respondents on the level of awareness of construction change management practices. The implication of this is that the respondents have convergent views as to the existence of the practice.

Table 7: Test of significance on the level of adoption of CCM practices

	Profession	Group	Mean
Chi-square	86.000	Quantity Surveyors	42.50
Df	2	Architects	12.00
Asymp. Sig	0.000	Structural/ Civil Engineers	74.50

From table 7, Kruskal Wallis test carried out shows that the p value is < 0.05, being 0.000, then null hypothesis which says that there is no significant agreement in the opinions of the respondents, is rejected and the alternate hypothesis is accepted that there is statistically significant agreement in the opinions of the respondents on the level of adoption of

construction change management practices. The implication of this is that the respondents have convergent views as to the adoption of the practice on projects.

Table 8: State of the activities inherent in CCM practices

Activities/ Tasks	Mean
Addressing potential change in the contract document	3.84
Documentation of the executed change	3.80
Identification of the potential change	3.72
Executing the change order	3.72
Review and evaluate the proposed change order timely	3.70
Creation of a proposed change order and documentation of the proposed change	3.69

Table 8 shows that the respondents are carrying out various tasks under construction change management practices. All of the activities have a high significant mean score values with the least recording 3.69. As a rider to table 5, the implication of these two tables is that the respondents are not only aware of the CCM as terminology but they are also undertaking the activities inherent in the practice during their day-to-day construction exercise.

Table 9: Test of significance on the activities inherent in CCM practices

	Profession	Group	Mean
Chi-square	9.741	Quantity Surveyors	4.17
Df	2	Architects	10.83
Asymp. Sig	0.008	Structural/ Civil Engineers	13.50

From table 9, Kruskal Wallis test carried out shows that the p value is < 0.05, being 0.008, then null hypothesis which says that there is no significant agreement in the opinions of the respondents, is rejected and the alternate hypothesis is accepted that there is statistically significant agreement in the opinions of the respondents on the practice of activities inherent in the construction change management practices. The implication of this is that the respondents have convergent views and not only are the respondents aware of the terminology but actually practicing it in their day-to-day construction works.

Table 10: Challenges facing construction change management practices

Challenges	Mean	Rank
Resistance to change current practice and adopt new approach	3.78	1
Lack of organizing training/ seminars due to insufficient resources	3.78	1
Unwillingness of professionals to share knowledge	3.76	3
Variation on nature of projects	3.72	4
Unavailability of change management unit	3.68	5
Unacceptability of new ideas by professionals	3.64	6
Insufficient time for after action review	3.60	7
Unavailability of time to exchange ideas	3.54	8
Inadequate encouragement as regard learning within the firm	3.48	9
Difficulty in transferring change management knowledge	4.47	10
Uniqueness associated with projects which makes knowledge gotten from a project a waste to other projects	3.45	11
Excessive time associated with construction change management	3.41	12
Unwillingness to learn by professionals	3.34	13
Too much workload preventing evaluation of previous work	3.32	14
Overbearing workload which prevents cross project learning	3.31	15

Of all the numerous significant challenges facing implementation of construction change management practices on projects, table 10 shows that resistance to change current practice and adopt new approach ranked 1st and tied with lack of organizing training / seminars due to insufficient resources (Mean Score = 3.78), this is closely followed by unwillingness of the

professionals to share knowledge and variation on the nature of projects that ranked **3rd** and **4th** with mean score values of **3.76** and **3.72** respectively.

Table 11: Test of significance on the challenges facing CCM practices

	Profession	Group	Mean
Chi-square	2.805	Quantity Surveyors	27.63
Df	2	Architects	20.77
Asymp. Sig	0.246	Structural/ Civil Engineers	20.60

Table 11 reveals that the respondents have divergent opinions on the challenges facing implementation of CCM on projects. The result of Kruskal-Wallis test carried out shows a low chi-square value of 2.805, P value is > 0.05 i.e. **0.246**, hence there is no significant agreement in the opinions of respondents on the challenges facing implementation and this may be due to the fact that each construction project is unique on its own, hence the challenges of one project may require management measure that is quite different from others.

DISCUSSION OF FINDINGS

State of construction change management practices

It is evident from the analysis carried out that construction practitioners (Quantity Surveyors, Architects and Structural/ Civil Engineers) are not only aware of the existence of construction change management practices in the industry but are also adopting the practice on construction projects. This is actually in support of Harrison (2012) and Hao et al. (2008) that need to consciously manage construction changes is now recognized as important practice to improving innovation, construction project performance and client's satisfaction. It is also evident from the analysis carried out that the respondents are significantly carrying out activities inherent in construction change management practices during the discharge of their professional obligation in relation to executing construction projects. Without prejudice, mention must be made that the level at which construction change management practices was adopted was found to be lower than its wide level of awareness. By extension, the implication of this is that the practice still suffers some challenges which is preventing its full adoption on projects.

Challenges facing construction change management practices

Adoption of construction change management practices on projects in its entirety still suffers challenges. Some out of the challenges that are impeding full adoption of construction change management practice and thereby making it lower in level than its awareness include resistance to change current practice and adopt a new approach, lack of organizing training/ seminars as a result of insufficient resources and unwillingness on the part of the experienced professionals to share their knowledge. All these are contrary to the findings that lingering factors are incomplete information, assumptions and the personal experience of the construction professionals, upon which decisions relating to the construction projects are based (Hao et al., 2008) culminated with little understanding of construction change management in practice. Despite the fact that all respondents differ on the challenges facing construction change management practice, yet all factors listed are significant challenges when analyzed.

CONCLUSIONS

The paper explored the state of the art on construction change management practices based on vertical tertiary educational building projects in Ondo state, Nigeria in a bit to enhancing the performance of these projects. Consequent to the forgoing analysis carried out, it can be inferred that;

i. the level of adoption of construction change management practices is significant on projects, yet it is lower than the rate at which construction practitioners are aware of the practice.
ii. resistance to change current practice for a new approach coupled with lack of training/ seminars as a result of insufficient resources are some of the challenges impeding full adoption of construction change management practices in its entirety among others.

RECOMMENDATIONS

In order to accomplish the purpose for which this research was carried out, bearing in mind the magnitude of fund committed into construction projects, the following recommendations are proposed for stakeholders in the construction industry so as to achieve hitch free construction process that ensure minimal construction changes;

i. construction practitioners are enjoined to fully adopt construction change management practices on projects in order to enhance construction performance.
ii. construction practitioners should be encouraged to undergo training; professional bodies should organize seminars for their members as this will change their orientation in order to adopt new approach for existing current practice of doing things.

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An Assessment of the Impact of Public Infrastructure on Residential Property Values in Minna

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ABSTRACT

This study provides evidence on the value capitalization effect of public infrastructure in Minna. It employs rental transactions and datasets constructed from various secondary sources to provide information on geometric and spatial distribution of 4 groups of public infrastructure. Due to aggregation bias in these data sets, we utilize the quartile procedure to construct aggregate indices which capture the effect of the different infrastructure stock component but not infrastructure quality. The quartiles were used to compute location quotients for 12 a priori neighbourhoods, hence providing the basis for grouping and classifying neighbourhoods into low and high infrastructure neighbourhoods. A tenable statistical justification for this neighbourhood split by infrastructure is the Hodges-Lehman point estimate of shift (Δ) at 95.89 confidence level which is (−3.234,−11.072,−0.339) which revealed that the two classified neighbourhoods (low and high) are different . Findings revealed that geometric and spatial distribution of infrastructure is reasonably uneven across the study area. In addition, marked variability exists in quality of infrastructure between low and high-infrastructure neighbourhoods based on respondents' perceptual rating. The conjecture that high-infrastructure neighbourhoods have higher residential property values in contrast with that associated with low-infrastructure neighbourhoods was also found to be plausible. The capitalization effect of public infrastructure is evident in a falling market: high-infrastructure neighbourhoods significantly outperformed low-infrastructure neighbourhoods by N 14470, while in period of soaring property value, high-infrastructure neighbourhoods command N 57305.60 more than the low-infrastructure neighbourhoods. These findings have substantial implications for optimal location of public infrastructure and its capitalization into urban residential property value. To maximize this capitalization effect, policy makers and planners must efficiently allocate public infrastructure across space.

Keywords: Infrastructure Stock, Location Quotient, Neighbourhoods, Property Values, Rents

INTRODUCTION

Public goods such as infrastructure are location-specific and by extension not easily traded across space (Venables, 2009). Against this backdrop, infrastructure has continued to be spatially but disproportionately distributed. Beyond that, urban bias and primate city favouritism due to policy distortions (Henderson and Becker, 2000; Henderson, 2002a, Henderson, 2002b; Saiz, 2006) have further resulted in highly unbalanced infrastructure distribution and quality between urban centres and even within urban neighbourhoods. Majority of research in public economics has however long recognized the connection between public infrastructure investment and economic development. For example, the adequacy of Infrastructure affects quality of life, confers agglomeration benefits and impact on a nation's productivity outcomes and economic competitiveness (See, Röller and Waverman, 2001; Ling and Archer, 2005; Dechant and Finkenzeller, 2013). Globally, infrastructure requirements have been estimated at US$3 trillion per annum, with countries only able to meet one-third (US$1 trillion) of this sum in terms of current spending on infrastructure investment (OECD, 2010; UNCTAD, 2014). Various estimates (AFD and World Bank, 2010; UNDP, 2014) have however shown that, in contrast to the rest of the world, Africa currently has the largest infrastructure deficiency; and would need to invest between US$90-$120 billion annually until 2025 to fill this infrastructure gap. In sub-sahara Africa, expansion of infrastructure stock raises growth rate by 1.20% on annual basis, though reverse causation of infrastructure deterioration concurrently reduces annual net contribution

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to growth rates by 0.50% per year (Calderon and Serven, 2008). Nigeria a country within the sub-sahara region of Africa is not without its fair share of the problem.

Over a long term, passive commitment of public sector to infrastructure investment in Nigeria has precipitated a sharp decline in infrastructure growth in the economy. Further accentuation of this decline is the decrepit condition and benign neglect of existing urban infrastructure (Rioja 2003; Kalaitzidakis and Kalyvitis 2004; Banerjee et al. 2007) with such situations further deteriorating the insalubrious living and housing conditions in most urban centres. Infrastructure however is easily capitalized into house prices. This capitalization phenomenon according to Brueckner (2011) comes from a compensating differential such that increased property value is the resultant effect of urban infrastructure in urban areas where they are adequately provided and efficiently managed.

Against this background, we provide evidence in this paper of the residential property value impact of infrastructure stock and quality in Minna, North-Central Nigeria. In passing, we provide explanations for four (4) fundamental research questions: Is there inequality in the distribution of infrastructure stock across neighbourhoods? Suppose the presence of inequality, can neighbourhoods be classified into low-infrastructure neighbourhoods and high-infrastructure neighbourhoods? Perceptually, does infrastructure quality vary between low and high-infrastructure neighbourhoods based on residents' opinion? How do residential property values differ between high-infrastructure neighbourhoods and low- infrastructure neighbourhoods? Prior studies which used data on stock and quality of infrastructure have employed either principal component analysis (Calderon and Serven, 2004; Calderon and Serven, 2008; Seneviratne and Sun, 2013) or quartile approach (Hulten, 1996; Chong and Calderon, 2001) to construct aggregate indices which capture the effect of such infrastructure. Our paper utilize the quartile approach proposed by Hulten (1996) for only infrastructure stock component, due to paucity of robust data on infrastructure quality. This quartile approach avoids any aggregation bias and non-linear problem as it allows aggregate index to be constructed from data of different infrastructure. Previous studies in this area (Van de Walle, 2002; Duflo and Pande, 2007; Gonzalez-Navarro and Quintana-Domeque, 2010) have shown that selection bias may arise in infrastructure placement, as simple comparison of places with and without infrastructure in observational data might be misleading. Unlike those prior studies, we adopt a simple but intuitively plausible approach by employing location quotient to group and classify infrastructure into high-infrastructure neighbourhoods and low-infrastructure neighbourhoods. The Wilcoxon-Manny-Whitney rank sum test for inequality of samples is then used to compare whether the two groups of neighbourhoods are different. With this result we further conjecture that the distribution of residential property values should vary between high-infrastructure and low- infrastructure neighbourhoods.

LITERATURE REVIEW

Determinants of Urban Location and Property Values

A starting point in assessing the residential property value impact of public infrastructure is the theoretical construct of some underlying theories of urban dynamics. Central to theoretical discussions on location of urban infrastructure is the development of urban residential location choice theory. A useful insight into urban location theory, for instance, was the integration by Hurd in 1903 of Von Thunen theory of agricultural land use with the theory of land rent as formulated by David Ricardo for the analysis urban location activities. The highpoint of Hurd (1903) work was the application of the theory of economic competition to provide explanation for spatial variation in land value across urban landscape. Hypothetically, Hurd surmised that "since value depends on economic rent, and rent on location and location on convenience(infrastructure), and convenience on nearness.....by eliminating the

intermediate steps it can be concluded that value depends on infrastructure and nearness'' Given the assumption of market equilibrium, the optimal location of individual enterprise lies where the net profit is greatest (Losch, 1954). Intuitively, this implies therefore that location is the engine that drives real estate activities and values.

An understanding of the central role of neighbourhood location preference for public infrastructure comes from space-access (bid-rent) theory as postulation by Alonso. The standard access-space model formulated by Alonso (1964) for the analysis of urban land and property markets posits that housing and accessibility are jointly purchased and that it is only abstracting location specific activities, that households would lower their bid price for housing as commuting cost increases from the city centre. A simple modification of the standard access-space model to incorporate infrastructure is to define neighbourhood as the immediate area at any given distance to the centre (Straszheim, 1987). Suppose public infrastructure is exogenous at all locations and available without any charge, the hypothesis that rent gradients decline away from the centre may no longer hold. In such case, the utility function yields equilibrium rents, such that households are indifferent to locations. With better public infrastructure at more distant locations, the infrastructure effect may exceed the cost of friction and by extension the land rent gradient will be positive. This implies that urban residents may value distant locations with better infrastructure higher inspite higher commuting costs. The variation in rents and prices for such sites relative to similar sites is offset by the compensating differential in infrastructure.

A large theoretical body of hedonic literature on residential property market has pointed to the determinants of house prices. Several empirical contributions from this literature are deeply rooted in Rosen (1974) work. Studies by Can (1992), Basu and Thibodeau, (1998) and Paetz et al. (2008) suggest that house price is a function of packages of structural (dwelling size and age), neighbourhood and location (accessibility to service and other attractive points) neighbourhood (public utilities, sea view and school quality) attributes of the dwelling. However, quality location and neighbourhood amenities as aptly indicated by Tse (2002) induce better quality properties to be constructed and contribute to variation in price. The relationship between house price and location factors is the result of unobservable variation in shared infrastructure across properties. In his study, Tse further argued that house prices tend to be spatially autocorrelated because neighbourhood residential properties share public infrastructure and amenities. Such neighbourhood effects will be capitalised into the nearby house price in the house price determination process (Can, 1992; Goodman and Thibodeau, 1998; Kestens et al. 2006; Tu et al., 2007; Paetz et al., 2008).

Conceptual Issues in Public Infrastructure

Infrastructure has been variously defined as the collection of social, economic and physical facilities necessary for productivity and well being of economic units (governments, firms and individuals) of a nation (American Heritage Dictionary Editors, 2000; Nubi, 2002). According to Jerome (2006) infrastructure includes all public services as varied as education and public health to transportation, communication, power and water supply, as well as such agricultural overheads in irrigation and drainage systems. Against the background of this inexhaustible list, infrastructure has been classified under different thematic areas. For instance, unlike Obateru (2005) who grouped infrastructure into physical and social infrastructure, RREEF (2005) and Jerome (2006) classified infrastructure purely into economic (utilities, airports, power stations and pipelines) and social (healthcare facilities, education facilities and correction facilities) components.

In view of the fact that infrastructure is a congestible and non-excludable capital good that produces services for its users (Laan et al., 2000) public involvement in urban infrastructure

provision and management becomes a necessity. In theory, the need for public sector regulation in infrastructure provision is due to the divergence between marginal social benefit and marginal social cost of infrastructure which must not be dictated wholly by the market (Canning, 2006). In the past, governments have employed a traditional approach to infrastructure development by promoting public sector infrastructure monopolies. With this approach, urban infrastructure development has not kept pace with urban population, resulting in infrastructure deficits in most urban settlements (Yan, 2000 and Fay, 2005). Consequently, governments' decision to cut expenditure on public infrastructure in recent times and engage in control of critical infrastructure through variants of privatization schemes has been termed as the contemporary approach to infrastructure development (Canadian Union of Public Employees, 2004).

In spite, the attended level of involvement of government, it is clear that satisfactory solutions have not been found to the deficit of infrastructure services as the governance of infrastructure service features high on the agenda policymakers and economists (Laan et al, 2000). In Nigeria and other developing countries, infrastructure provision and quality have remained a major challenge as a result of government's poor financing and insufficient political will to pull private participation (Otegbulu, 2014). In quest for solution, user groups, workers and the general public have been agitating for renewal and re-investment as public infrastructure crumbles. Most studies have therefore unearthed how communities have been renewing and or improving the dearth and decaying situation of public infrastructure. Jack and Morris (2005) for instance have stressed the concept of community-based networks or organisations; depicting how communities have organized themselves and developed capacity to tackle the complex issues of housing and infrastructure.

METHODOLOGY

The analysis in this study draws on various data sources from Minna Urban. The first is the Niger State Primary Health Care Development Agency, which provides a comprehensive list of public health facilities (hospitals, maternity clinics, primary health care centres and dispensary) and their spread across Local Government Areas (LGAs), political wards and neighbourhoods. The data comprise a sample of 16 health facilities currently owned and managed by the government in Minna. Secondly, Niger State Universal Basic Education Board records data on student enrolment by gender and the number of public primary and secondary schools in Niger State. From this record, an aggregation of 16 primary schools located within the study area was extracted. The data from Parks and Gardens Department of Ministry of Environment and Abuja Electricity Distribution Plc comprise a respective sample of 5 recreation centres and 142 electricity step-down transformers, geographically located across different neighbourhoods. Generally, the data constructed from these sources provide information on geometric and spatial distribution of 4 groups of public infrastructure: primary schools, health facilities, fire service stations and electricity transformers (proxy for electricity distribution capacity) in this study. Finally these datasets, which are mainly secondary in nature, were augmented with 2006 neighbourhood population and household data from National Population Commission. Projection at an annual growth rate of 3.80% (NPC, 2006) was subsequently made for the 9 year time lag covering 2006 to 2015.

Aside the secondary data, a survey based technique involving a designed 11 item structured questionnaire, was employed to obtain primary data on infrastructure quality from household heads (respondents) who are renters in the study area. By adopting cluster random sampling, the study area (consisting of 12 neighbourhoods) for the questionnaire administration was drawn from the *a priori* 25 neighbourhoods in Minna Urban. The selected 12 *a priori* neighbourhoods comprise: Bosso Estate, Tunga Low Cost, Barkin Saleh, Jikpan, GRA,

Limawa, Minna Central, Shango, Tudun Wada South, Agwandaji and Dutsekura. The choice of these neighbourhoods for the study was further premised on the availability of robust data on public infrastructure stock in the Minna Urban. The number of questionnaire to be administered was based on 33871 households in the study area as at 2015. 3372 (10.99%) households were initially drawn from the total households in Minna in 2015. Of these, 1 out of every single household of 5 persons (NPC, 2006) is a household head. In passing, 745 household heads represent the active sample size in the study area.

Subsequently, we controlled for bias in the sample size and concluded that we are 95% confident that this estimate from the total population will be ±10.99% the margin of error (in this case, between 6.99% and 14.99% for a 4% margin of error). However, only 463 of the administered questionnaire were retrieved from the 745 household heads. This proportion of questionnaire retrieved gives an approximate total response rate of 62%. This response rate concurred with those reported by Willimack et al. (2002) for primary data collection. Table 1 shows the breakdown of the questionnaire administered, retrieved and the response rate.

The resulting survey, in addition to sourcing data on rental transactions (proxy for house price) for different residential property types (tenement, bungalow, flat and duplex) as well as demographic characteristics of the respondents, provided a perceptual rating of infrastructural quality in their immediate neighbourhoods. Respondents were requested to rate quality on a 5 point scale (with very poor assigned a score of 1; poor rated as 2; fair as 3; good as 4 and very good rated as 5). Table 2 provides a summary statistics which describe the characteristics of these 643 respondents for the study.

Table 1: Questionnaire Distribution to Household heads in the Study Area

S/No	Neighbourhoods	Household size (2015)	Sample size	Proportion of Household Heads	Questionnaire Retrieved	Response Rate (%)
1	Bosso Estate	447	207	42	42	100
2	Shango	747	254	51	38	74.80
3	Jikpan	2,153	326	65	41	62.88
4	Dutsen Kura	2,244	328	66	56	85.37
5	Barkin Saleh	1,436	303	61	45	74.26
6	Tunga Low Cost	1,059	282	56	34	60.28
7	Agwadaji	3,699	348	70	40	57.47
8	Tudun Wada South	5,283	358	72	42	58.66
9	Limawa	6,786	364	73	8	10.99
10	GRA	848	265	53	28	52.83
11	Minna Central	6,560	353	71	46	65.16
12	Tundun Fulani	2,609	335	67	43	64.18
	TOTAL	**33871**	**3372**	**745**	**643**	**62.18**

A starting point in the methodology employed for data analysis in this paper involves the estimation of location quotients on neighbourhood basis for the 4 groups of infrastructure stock. Location Quotient (LQ) is a quantitative measure of the relative allocation or the degree of concentration of a particular activity in a city and in a region as a whole. An infrastructure's LQ for neighbourhood i is given as:

$$LQ_i = \frac{Q_i}{Q_a} / \frac{Pi}{P} \qquad (1)$$

Where Q_i is the quantity of infrastructure in neighbourhood i

Q_a is the total quantity of infrastructure in all neighbourhoods

P_i is the population in neighbourhood in i

P is the total population in all neighbourhoods

A $LQ > 1$ indicates that the local area is more heavily concentrated in that activity relative to its average across region. If $LQ = 1$, it means that the local area has its faire share in a

particular activity. Although Morenikeji (1995) is one of the few authors in Nigeria, who have empirically demonstrated its application in the study of spatial distribution of social facilities, location quotient has been applied elsewhere in most regional economic base studies (See, Richardson, 1985; Brown et al., 1992; Coulson, 2006).

Before estimating the location quotients, we observe non-linearity and aggregation bias across the measures of infrastructure stock and dealt with this problem by grouping individual measure separately into quartiles. The 1st quartile is ranked 0.25, the 2nd quartile, 0.50 while the 3rd and 4th quartile is ranked 0.75 and 1.00 respectively. With these quartiles, we compute the neighbourhood location quotients for each of the 4 groups of infrastructure stock. In addition, the aggregate index of all infrastructure for a neighborhood is determined by simply averaging the location quotients. This quartile procedure is identical to that employed in Hulten (1996) study, which allows aggregate index to be constructed from data of different infrastructure.

Table 2: Descriptive Summary of Demographic and Socio-Economic Characteristics of Respondents

Variables	Variable Type	Mean	Standard Deviation
PANEL A (Continuous Variable)			
Annual Rent	Continuous	116452.40	**117097.10**
		Ist Quartile	***3rd Quartile***
		30000	***195833.30***
PANEL B (Binary/Categorical)			
		Frequency	**Percentage (%)**
Gender of Household Head:	Binary		
Female		131	**28.30**
Male		318	**68.30**
Missing Response		14	**0.40**
Age:	Categorical		
18-25years		122	**26.30**
26-35years		*171*	***36.90***
36-45years		104	**22.50**
46-55years		35	**7.60**
≥56years		20	**4.30**
Missing Response		11	**2.40**
Length of Stay:	Categorical		
1-5years		26	**5.60**
6-10years		45	**9.70**
11-15years		155	**33.50**
16-20years		193	**41.70**
≥21years		42	**9.10**
Missing Response		2	**0.40**
Occupation:	Categorical		
Artisan		36	**7.80**
Business		56	**12.10**
Farming		46	**9.90**
Civil Servant		266	**57.50**
Professional		39	**8.40**
Student		12	**2.60**
Missing Response		8	**1.70**
	No. of Sample	**643**	

Furthermore, it is plausible to estimate the infrastructure share of neighbourhood i that is excessive (E), since that is the only part of the infrastructure that brings the quotient above 1. This can be expressed as:

$$E = LQ - 1/LQ \qquad (2)$$

Following the logic of the LQ in equation 2, we classify and group the 12 neighbourhoods into low-infrastructure neighbourhoods and high-infrastructure neighbourhoods. With this, we explore further the possibility of whether the neighbourhoods so classified are different because they have different location quotient patterns or that such observed differences are due to random sampling errors in our observations. The Wilcoxon- Mann-Whitney statistic tests the null hypothesis that the shift in location between the distributions of the populations is equal to zero. In other words, do the classified low and high infrastructure neighbourhoods come from population having identical distribution? A rejection of the null hypothesis would suggest that neighborhoods classified as low-infrastructure neighborhoods have more in common with one another relative to those classified as high-infrastructure neighborhoods.

On the basis of this classification, we examine the conjecture that infrastructure quality should vary between low and high-infrastructure neighbourhoods across the study area. Taking a cue from previous studies by Galster and Hesser (1981) and Ame'rigo (2002) that place users satisfaction at the heart of evaluation of quality of urban environment, respondents were asked to respond on the perceptual quality of their respective neighbourhood infrastructure using a five point likert scale ranging from 1 (very poor) to 5(very good). The frequency of responses for the classified low and high-infrastructure neighbourhoods were then weighted for each infrastructure to arrive at the composite(sum) quality score and subsequently, the weighted mean quality score for each infrastructure. Chi-square (χ^2) test was used to determine the relationship between respondents' responses on infrastructural quality across the classified neighbourhoods.

Finally, we applied one-way Analysis of Variance (ANOVA) with post-hoc comparison to test our expectation that high-infrastructure neighbourhoods are associated with higher house prices (proxy by house rents) than that associated with low-infrastructure neighbourhoods. As homogeneity of variance is one of the stringent assumptions underlying ANOVA, we hypothesized that the population variance for house prices would not hold due to the heterogeneity of the property type employed for the analysis. Brown-Forsythe's test for equality of group variance was therefore conducted to determine whether the house price mean for the classified neighbourhoods are approximately equal. On this basis, we applied Dunnett two tailed t-test to examine the individual comparison in residential property values between high and low-infrastructure neighbourhoods after conducting a standard analysis of variance test.

All analyses were estimated using Analyse-it version 4.20 and SPSS version 20 statistical packages.

FINDINGS AND DISCUSSIONS

Neighbourhood Location Quotients of Infrastructure Stock

The results of location quotients for all the 12 neighbourhoods arranged by infrastructure stock are shown in Table 3. These location quotient patterns have spatial manifestations. The first striking observation is that at a disaggregated level, the wide disparity in location quotients for the 4 groups of infrastructure across neighbourhoods did suggest a close relationship between infrastructure allocation and neighbourhood population. Unlike high-populated neighbourhoods, high location quotients are associated with low- populated neighbourhoods. For instance, with regards to the allocation of primary school, Bosso Estate (4.20), Agwandaji (12.01) and Tudun Fulani (16.81) which are less populated exhibit similar quotient pattern compared to densely populated neighbourhoods like Tunga Lowcost (0.38), Barkin Saleh (0.84), Jikpan (0.74) and Minna Central (0.25). Apparently, the geometric and spatial distribution of infrastructure is reasonably uneven across the study area with severe implications for sustainable urban growth. Unplanned residential location patterns,

decentralised urban density and sporadic urban development are some of the spatial dimension to inequality issue in infrastructure distribution

Table 3: Neighbourhoods' Location Quotients for Infrastructure Stock in the Study Area

S/N	Neighbourhoods	Population	Primary School	Health Facilities	Fire Service Station	Electricity Supply	Mean LQ	(E)	Classification
1	Bosso Estate	816	4.20	5.40	16.81	4.54	7.74	0.87	High
2	Tunga Lowcost	9084	0.38	0.97	0.38	1.22	0.74	-0.36	Low
3	Barkin Saleh	8200	0.84	0.54	0.42	0.45	0.56	-0.78	Low
4	Jikpan	9238	0.74	1.43	0.37	1.20	0.94	-0.07	Low
5	GRA	5979	1.15	0.74	0.57	1.24	0.92	-0.08	Low
6	Limawa	5979	1.15	1.47	0.57	1.86	1.26	0.21	High
7	Minna Central	27272	0.25	0.16	0.50	0.41	0.33	-2.02	Low
8	Sango	9084	0.75	1.94	1.51	0.41	1.15	0.13	High
9	Tudun wada south	5979	1.15	1.47	0.57	0.62	0.95	-0.05	Low
10	Agwadaji	856	12.01	5.15	4.00	4.32	6.37	0.84	High
11	Dutsen Kura	9238	1.48	0.95	1.48	1.60	1.38	0.28	High
12	Tundun Fulani	816	16.81	5.40	16.81	9.08	12.03	0.92	High

Secondly, at an aggregated index level, the LQ patterns (third to the last column in Table 3) are nearly identical to the disaggregation. From this, the difference between neighbourhoods with over-concentration and those with less than fair share of infrastructure is straightforward to discern. With this bifurcation, neighbourhoods such as Bosso Estate, Limawa, Sango, Agwandaji, Dutsenkura and Tudun Fulani are tentatively classified as high-infrastructure neighbourhoods. Conversely, Tunga Low Cost, Barkin Saleh, Jikpan, GRA, Minna Central and Tundun Wada South are grouped as low-infrastructure neighbourhoods.

Table 4: Wilcoxon/Manny-Whitney Test of Equality of Means for Location Quotient of Low and High Infrastructure Neighbourhoods

Neighbourhoods	Wilcoxon Statistic	Hodges-Lehman Point Shift	P-Value
Low-High	21.000	-3.234 95.89CL (-11.072 to -0.339)	0.0022

The actual sign of the excess (E) as seen in the second to the last column in Table 3 further provides a tentative support for the classification of neighbourhoods by quotient patterns. However, the results of the Wilcoxon- Mann-Whitney test in Table 4 provide a consistent justification for this neighbourhood split by infrastructure. The Wilcoxon-Mann-Whitney statistic (21.000) with correction for ties indicates that the distributions of location quotients are statistically different between low and high infrastructure neighbourhoods at 5% significance level (P value < 0.05). Since the null hypothesis that the shift in location between the distributions of the populations is equal to zero (H_0: $\Delta = 0$) has been rejected, we extend the Wilcoxon- Mann-Whitney test by estimating the Hodges-Lehman point estimate of shift (Δ median $_{Low}$ - Δ median $_{high}$) to determine the direction and magnitude of such difference. The Hodges-Lehman point estimate of shift (Δ) at 95.89 confidence level which is (−3.234,−11.072,−0.339) further reveals that the median location quotient for low-infrastructure neighbourhoods is stochastically lower than those of high-infrastructure neighbourhoods. Implicitly, the result implies that significant difference in location quotients exist between the two classified neighbourhoods, and by extension, low infrastructure neighbourhoods appears to have considerably low location quotients. This portrays that the two classified neighbourhoods (low and high) are different and therefore their observed LQ differences are not due to any unsystematic oddity in the data. This result sets the stage for the analysis of infrastructure quality as provided in Table 5.

Infrastructure Quality for Classified Low and High-Infrastructure Neighbourhoods

Table 5 shows the frequency of responses on infrastructure quality by neighbourhood class. Aside the evident high response (ranging from 96.33% to 99.57%) in opinion of the 463 respondents, the preponderance of respondents' responses on infrastructure quality oscillate between poor, fair and good perceptual rating.

Table 5: Frequency of Responses on Quality of Infrastructure in Low and High Infrastructure Neighbourhoods

Quality	Very Poor	Poor	Fair	Good	Very Good	Valid Responses	Percentage of Responses
				N=463			
Electricity:							
Low	39	56	95	37	5	232	50.11
High	17	36	100	62	9	224	48.38
Total	56	92	195	99	14	456	98.49
Fire Service:							
Low	36	97	44	29	26	232	50.11
High	28	55	80	42	9	214	46.22
Total	64	152	124	71	35	446	96.33
Public Health Facilities:							
Low	62	69	57	30	10	228	49.24
High	37	55	78	42	11	223	48.16
Total	99	124	135	72	21	451	97.41
Primary School:							
Low	12	36	71	91	26	236	50.97
High	16	21	103	75	10	225	48.60
Total	28	57	174	166	36	461	99.57

With these divergent rating in responses, the weighted means imputed from respondents weighted responses for the classified low and high-infrastructure neighbourhoods, however provide a clear-cut interpretation of respondents' opinion on infrastructure quality as seen in Table 6.

Table 6: Relatedness of Opinion on Quality between Low and High Infrastructure Neighbourhoods

Quality	Very Poor	Poor	Fair	Good	Very Good	Sum	Valid Responses	Weighted Mean	Chi Square (χ^2)	Df	Sig. Level
Electricity:											
Low	39	112	285	148	25	609	232	2.63			
High	17	72	300	248	45	682	224	3.04			
Total	56	184	585	396	70	1291	456	2.83	15.74	20	0.733
Fire Service:											
Low	36	194	132	116	130	608	232	2.62			
High	28	110	240	168	45	591	214	2.76			
Total	64	304	372	284	175	1199	446	2.69	20.89	25	0.699
Public Health Facilities:											
Low	62	138	171	120	50	541	228	2.37			
High	37	110	234	168	55	604	223	2.71			
Total	99	248	405	288	105	1145	451	2.54	26.92	25	0.360
Primary School:											
Low	12	72	213	364	130	791	236	3.35			
High	16	42	309	300	50	717	225	3.19			
Total	28	114	522	668	180	1512	461	3.28	20.92	16	0.182

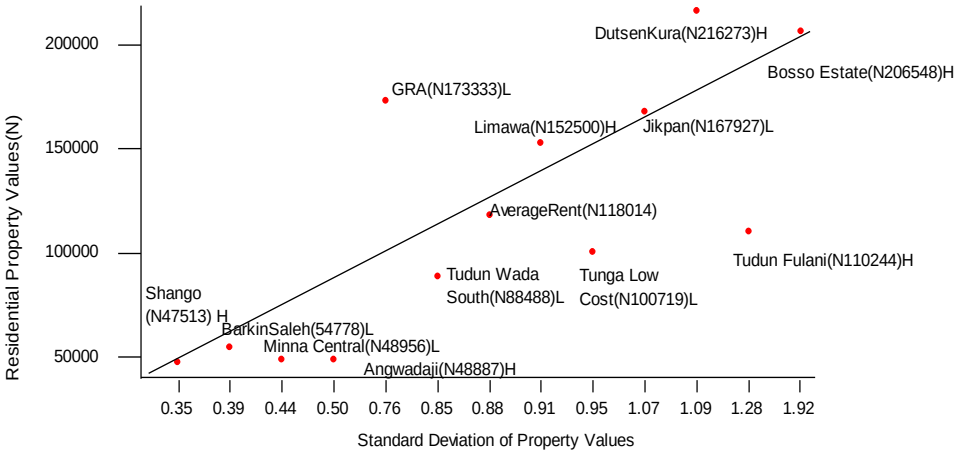
* The weighted responses are derived from the frequency of responses (with very poor assigned a score of 1; poor rated as 2; fair as 3; good as 4 and very good rated as 5).

A cursory look at the weighted mean of respondents' opinion apparently indicates marked variability in quality of infrastructure between low and high-infrastructure neighbourhoods. For instance, while relatively large weighted mean values are confirmed in high-infrastructure

neighbourhoods, all of the weighted means observed in low-infrastructure neighbourhoods are much smaller. We explore whether consensus ratings of these infrastructure as depict by weighted means of the classified neighbourhoods are related in terms of the frequency of responses from the respondents. As evident from Table 6, the reported chi-square (χ^2) values of 15.74, 20.89, 26.92 and 20.92 for electricity supply, fire service, health facilities and primary school have corresponding p-values of 0.733, 0.699, 0.360 and 0.182. Since the p-values in all cases exceed the 5% rejection level, we confidently conclude that there are no significant differences in the respondents' opinion towards infrastructure quality and that respondents in the classified neighbourhoods are largely decided on this issue. Against this background, it can be concluded that infrastructure quality vary between low and high-infrastructure neighbourhoods based on residents percept in Minna.

Distribution and Variability in Residential Property Values for Classified Neighbourhoods

The historical performance of residential property values relative to the average rent and standard deviation across the 12 neighbourhoods is graphically presented in Fig. 1. During 2015 period, property values in 5 residential neighbourhoods (GRA, Limawa, Dutsenkura, Jikpan and Bosso Estate) outperformed the average residential property value (rent) in the 12 neighbourhoods. On the other hand, the average residential property value (₦118014) for all neighbourhoods is far more than the average returns for Shango (₦ 47513), BarkinSaleh (₦ 54778), Minna Central(₦ 48956), Angwadaji (₦ 48887), Tudun Wada South(₦ 88488), Tunga Low Cost(₦ 100719) and Tudun Fulani(₦ 110244).



*Property Values are presented in parenthesis. While L and H signify Low and High-Infrastructure Neighbourhoods

Fig.1: Distribution of Residential Property Values, 2015

Apparently, while residential property values in Shango, Barkin Saleh, Minna Central and Agwadaji are low and subdued, property returns in GRA, Limawa, Jikpan, DutsenKura and Bosso Estate are relatively high and exhibit much more pronounced volatility. This disparity however did not suggest any general pattern or close relationship between property value levels in low and high-infrastructure neighbourhoods. Furthermore, these general observations on property value performance are overly simplistic but can however be given some less hypothetical explanation by employing an empirical test for variability in residential property value across the study area.

The significance of the variability level in property values between the classified low and high-infrastructure neighbourhoods is tested by one-way Analysis of Variance (ANOVA). However, before turning to the ANOVA result, the Brown-Forsythe robust test for null hypothesis of equality of variance shows that the assumption of homogeneity of variance has

been grossly violated. This implies that residential property values for the classified low and high-infrastructure neighbourhoods do not have identical population variance as the F-test statistic of 5.79 is greater when compared with a 5%, F(11,440).

The ANOVA result for variation in residential property values is shown in Table 7. Since the F-statistic of 18.48 is highly significant at 5% level of significance, this implies that high-infrastructure neighbourhoods have higher residential property values in contrast with that associated with low-infrastructure neighbourhoods. The strength of this contrast can be observed from the confidence interval of the mean difference in residential property value. The mean difference in residential property value which is ₦ 35887.80 (95% CL: 14470 to 57305.60) indicates that the true mean difference is between the lower limit of ₦ 14470 and the upper limit of ₦ 57305.60. Suppose a falling residential property market, high-infrastructure neighbourhoods significantly outperformed low-infrastructure neighbourhoods by ₦ 14470 while in period of soaring property value, high-infrastructure neighbourhoods command ₦ 57305.60 more than the low-infrastructure neighbourhoods.

Table 7: Variation in Residential Property Values in Minna

Contrast	Mean Difference	F-Statistic	Simultaneous 95%CL	P-value
High - Low	35887.80	18.48	14470 to 57305.60	0.0011

Neighbourhoods with strikingly differences in mean property values are revealed by the Dunnett 3T post-hoc test for pairwise comparison of residential property values between high and low-infrastructure neighbourhoods in Table 8.

Table 8: Dunnett Two Tailed T- Test for Individual Comparison of Residential Property Values

High Infrastructure Neighbourhood (I)	Low Infrastructure Neighbourhood (J)	Mean Difference (I-J)	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Angwadaji	GRA	-133012.5*	.000	-199295	-66730
Angwadaji	Jikpan	-124197.87*	.000	-188148	-60248
Bosso Estate	Tudun Wada South	122479.09*	.021	9390	235569
Bosso Estate	Minna Central	156509.32*	.000	47678	265340
Bosso Estate	Barkin Saleh	151912.70*	.001	43455	260370
Shango	GRA	-132075.68*	.000	-196595	-67557
Shango	Jikpan	-123261.04*	.000	-185170	-61352
Dutsenkura	Tunga Low Cost	113656.25*	.000	35262	192050
Dutsenkura	Tudun Wada South	133996.95*	.000	69915	198078
Dutsenkura	Minna Central	168027.17*	.000	113000	223054
Dutsenkura	Barkin Saleh	163430.56*	.000	109227	217634

*Mean Difference is significant at 5% level of significance

Out of the 36 possible contrast cases between high and low infrastructure neighbourhoods, only 11 neighbourhoods showed marked significant differences in their residential property values. From the mean difference of the Dunnett 3T test (column 3) in Table 8, it is evident that property values in high-infrastructure neighbourhoods like Angwadaji and Shango vary from those passing in GRA and Jikpan- which are low infrastructure neighbourhoods. Similarly, property values for such high-infrastructure neighbourhoods like Bosso Estate and DutsenKura differ from low infrastructure neighbourhoods of Tudun Wada South, Minna Central and Barkin Saleh. Property value in Dutsen Kura is also markedly different from that of Tunga Low Cost- a low infrastructure neighbourhood. On the other hand, there are no significant variations in property returns for Limawa and Tudun Fulani when compared with all the 6 low-infrastructure neighbourhoods (Result of the non-significant cases is available from the authors upon request).

CONCLUSION

This study has provided evidence on the residential property value impact of infrastructure by employing location quotient to group and classify infrastructure into high-infrastructure neighbourhoods and low-infrastructure neighbourhoods. Infrastructure provision tends to be unequally distributed across the study area. On the basis of this bifurcation of neighbourhoods, perceptual rating of respondents' opinion equally showed marked variability in quality of infrastructure between low and high-infrastructure neighbourhoods. Relatively large weighted mean quality values for instance are associated with high-infrastructure neighbourhoods compared with low-infrastructure neighbourhoods. Furthermore, property values tend to differ between the classified neighbourhoods: high-infrastructure neighbourhoods have higher residential property values in contrast with that associated with low-infrastructure neighbourhoods. Interestingly, these findings have substantial implications for optimal location of public infrastructure and its capitalization into urban residential property value. It is possible to argue for the existence of capitalization effect of public infrastructure in the study area as renter households tend to exhibit the willing to pay (WTP) higher property values in neighbourhoods with high public infrastructure level than neighbourhoods with low level of infrastructure provision. Although there are exceptions to this capitalization effect across residential space, a tenable justification as aptly stated by Duranton and Puga (2004) is the inefficient sharing of indivisible facilities such as local infrastructure.

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Claimants' Classification of Heads of Claims for Oil Spill Damage Assessment in Ondo State, Nigeria

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ABSTRACT

Oil spillage is one of the major causes of environmental pollution and degradation in Nigeria; the impact of which is untold hardship on the residents as evident in substantial loss of means of livelihood. An important step towards awarding equitable compensation for oil spill damage is proper definition of 'heads of claim'. This study assessed the oil spill victims' definition of heads of claim based on Total Economic Value concept in Abereke community of Ilaje Local Government of Ondo State. Out of 368 questionnaires distributed, 247(64%) of the retrieved were found adequate for data analysis. This study employed Relative Impact Index (RII) – an example of descriptive statistics in analyzing data elicited from potential claimants. The results indicate that compensation for loss of fish harvest, other aquatic life, source of drinking water and food/crop production ranked high among the direct use of land and environmental resources. Flood control, biodiversity maintenance and shoreline protection are least among the potential head of claims among the private claimants. The study recommended among others that there is need to redefine heads of claim considered in awarding compensation to oil spill victims to mitigate the effect of oil spill on the claimants and promote peace in oil producing communities.

Keywords: Oil Spill, Compensation, Heads of claim, Claimants, Total Economic Value

INTRODUCTION

Oil exploration and production is an all-important activity in Nigeria upon which the economy of the country rests. Oil exploration in Nigeria dated back to 1938, when Shell D'Archy was granted an exploration license. Since then Nigeria shore has been subjected to various oil activities leading to the influx of many oil companies in the country. Crude oil was first discovered at Oloibiri by Shell British Petroleum (now Royal Dutch Shell); however, the oil exploration activities have spread out to cover nearly all states within Niger Delta Region (**NDR**) of the country. About 90% of Nigeria's foreign earnings are derived from sale of crude oil (Odularu 2008).

Much of the world depends on the production or the trade of oil to drive their economy (Fagbohun 2010). However, its exploration, production and transportation are not without associated mishaps. Prior to the influx of multinational oil companies in Nigeria, the inhabitants of oil rich areas (Niger Delta) depend largely on the ecosystem provisioning services of wetland (Adekola, 2011) for their livelihood; these have been eroded. Oil spills does not only impact negatively the physical but also psychosocial environment; as there is evidence of psychiatric disorder associated with oil spill (Palinkas, Petterson, Russel, & Downs, 1993). The impact of oil pollution include deforestation, ecosystem destruction and loss of pristine habitats, degradation and chemical contamination of land, air and water; long harm to flora and fauna, acute and chronic health problems for human beings; safety risks for host communities and oil industry workers and immediate to medium term threat to indigenous communities (Fagbohun 2010).

Oil spills when it leaves the place of its confinement to an undesired place, capable of causing harm or injury. A number of reasons have been adduced for oil spillage especially in NDR. These include corrosion of pipelines, corrosion of oil storage tanks, sabotage, equipment/machine failure, bunkering, loading/discharging error, oil theft/illegal fuel

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siphoning as a result of the thriving black market for fuel products, spills due to engineering drills, human error, accident from third party, illegal refining, deliberate damage of oil installations during protests, natural causes such as rain and flood, well head blowout, refinery process, marine transportation accident and unknown causes (Aprioku, 1999; Onyepe, 2002; Nwilo, & Badejo, 2006; Nwilo & Badejo, 2008; Imosemi & Abagwu, 2013). The unknown categories of oil pollution is referred to as an act of God under Section 1001(1) of United States Oil Pollution Act 1990 which include any "unanticipated grave natural disaster or other natural phenomenon of an exceptional, inevitable, and irresistible character the effects of which could not have been prevented or avoided by the exercise of due care or foresight". Also oil spills can be natural seepage from ground.

A standard practice is that oil pollution victim is compensated for loss suffered especially when the polluter is identifiable. This is entrenched under the polluter pay principle (PPP) and in tandem with equity, justice and fairness. Bleeker (2009) based on judgments of the European Court of Justice stressed that the application of the PPP must be proportional; that is, a polluter can only be asked to bear the burden of paying for pollution based on the proportion of his contribution to it. For polluter to actually pay for damage caused in oil spill situation and to ensure a standard compensation practice, the first step in the process is to properly and objectively identify claims made by oil spill victims. Such items of claims are also referred to as heads of claim (HOC). In Nigeria, studies such as Nuhu (2008), Otegbulu (2009), Famuyiwa and Omirin (2011) and, Udo and Egbenta (2011) on compensation valuation indicate that the exercise is bedevilled with inadequacies. The definition of what constitute HOC has always been controversial subject especially between oil companies and claimant/claim agents in Nigeria. Babawale (2013) observed that the law relating to compensation for oil spillage in Nigeria leaves opened a number of crucial issues including the exact 'heads of claim' as well as the basis and the method of valuation applicable; all these to the discretion of valuers, and of course, the court, which is the final arbiter.

This study is an attempt to define what oil spill victims have in mind when heads of claims are being contemplated; a reflection of what they possibly consider as necessary to launch them back to pre-pollution state. Although compensation claimants may be private individuals, partnerships, companies, private organizations or public bodies, including states or local authorities (International Oil Pollution Compensation Fund, 1992), the scope of this study is limited to private claims only. Such claims exclude properties which no individual can lay personal claim on in term of ownership and are naturally considered as community claims and no individual has ownership right to the exclusion of others. The rest of this paper is structured as follows: the next (section two) reviewed relevant literature; Section three is the description of procedure for data collection and method of data analysis. The fourth section presents the results and discussion of findings form the research. Finally, the closing section contains the recommendation, statement on the policy implications of the study and conclusions.

LITERATURE REVIEW

The purpose of compensation is to restore an injured party to the previous position he was prior the act that caused harm or damage. The purpose is neither to make him richer nor poorer but the universal principle underlying valuation for compensation is to obtain a cash payment that would reasonably restore the claimant to status quo (Babawale, 2013). In general, the word "compensation" means balancing one action (or its effects) with another action. In relation to oil spill damage, Thébaud, Bailly, Hay, and Pérez, (2005). stressed that the primary reason for assessing the cost of oil spill in monetary term is at least to establish the level of compensation that would make the victims whole. Ibrahima (2006), classified

damage resulting from oil spills into four and these are personal or health damage, material damage, loss of profit or pure economic losses sustained consequent upon damage to the environment, and damage to the ecosystem and living components of the environment.

Dick (2006) posited that the underlying principle of compensation which is to restore claimants to the same financial position as they would have been without the oil spill, poses a great challenge to Natural Resources Damage (NRD) valuation, because there are no commercial transaction on them; and this has led to some groups resorting to a kind of abstract calculations yielding value which are not defensible. Although the purpose of compensation valuation is unambiguous, the extent of environmental damage resulting from oil spill may be difficult to extrapolate because of many factors that interact leading to different levels of damage. For instance, the type of oil spilt, the time of the year of occurrence, weather condition as well as the effectiveness of clean-up, all combine to determine its environmental consequence. Therefore, over-simplifying such a complex changing situation may lead to adoption of a formula which is neither scientific nor reflecting the true effect oil spill has on the people and environment. Dick (2006) warned that any attempt to attach monetary value to distorted image of reality will lead to injustices, inconsistencies and the impression that polluter is penalised rather than compensating damage caused.

In Nigeria, there appears to be no comprehensive legislation that addresses issues of compensation and liability for oil spill and environmental damage (Oluduro, 2012). Schopp and Pendergrass (2003) observed that a majority of the statutes and regulations in Nigeria do not confer any right of private action for the victims of oil pollution. Thus, claims have generally been brought as common law tort claims under the theories of negligence, nuisance, and strict liability. Apart from Oil Pipeline Act Cap 145, LFN, 1990 that contains direct provision relating to compensation arising from oil spillage, other statutes - Land Use Act (1978), Minerals Act Cap 121 of 1946, and Petroleum Act No. 51 of 1969 now Cap 350 LFN 1990, Mining Act No 24 of 1990, Oil in Navigational Water Act, Cap 337 LFN 1990- deal primarily with property acquisition rather than injurious affection (Imosemi & Abangwu, 2013). Otegbulu (2009) described the Nigerian legal framework for compensation as either not designed to capture the total economic value of the impaired interests, or misinterpreted by the practitioners. Kakulu, Byrne, and Viitanen (2009) argued that Nigeria Constitution does not allow a fair play in compensation assessment of non-market goods; while NOSDRA (2014) concluded that the Land Use Act was not designed for the oil industry at all. Apart from the application of Land Use Act in the valuation of structures on land, Valuers depend largely on a pre- determined rates commonly called the OPTS (Oil Producers Trade Section of Lagos State Chamber of Commerce and Industry) rates.

Babawale (2014) examined the contents of compensation valuation reports prepared by Nigerian valuers and highlighted the reported heads of claim to include injurious affection, ecological degradation, health hazards, loss of fishing rights, loss/damage of fishing of trap/ponds/hooks, loss of shrine, and general claims. Although, this study regarded some of the claims as frivolous, lack adequate and convincing explanatory data, they are indeed a reflection of pains that victim of oil spill suffer in Nigeria. Akujuru and Ruddock (2014) opined that heads of claims for compensation purpose should incorporate socio-cultural values especially in oil producing communities of Niger Delta Region (NDR), Nigeria. The losses suffered by these communities included desecration of shrine or traditional worship sites, contamination of fish ponds and fishing channels, contamination of the mangrove forest resulting in the loss of mangrove and other economic trees, non-timber forest resources like crabs, periwinkles, crayfish and other seafoods which are usually gathered freely from the mangrove vegetation, and contamination of water sources and fishing gear.

Studies such as Akujuru (2005), Otegbulu (2005), Udo and Egbenta (2011), Ajibola (2012), Akujuru and Ruddock (2014), among others advocated for the application of Total Economic Value (TEV) framework as the basis of determining compensation payable for wetlands degradation and oil spill damage assessment. Total Economic Value (TEV) comprises both use values (direct and indirect use) and non-use values (Option, bequest and existence values) (Dixon, 2008). Grafton, Pendleton and Nelson (2002) broke TEV of an environmental goods and services into those values which people can exploit through direct use of the resource (called use values) and those that consumers do not put into direct use (non-use or passive use values). Based on TEV concept attempts have been made by scholars to classify various attributes and services of wetland that are germane to the wellbeing of the local communities especially in Niger Delta region of Nigeria. For example Adekola and Mitchel (2011) compiled the beneficial attributes of wetland to Niger delta communities as shown in Table 1.

Table 1: Major ecosystem services provided by or derived from Niger Delta wetlands

General Ecosystem Services	Niger Delta Ecosystem Services
Provisioning	
Food	Fish and other aquatic food such as barnacles, crabs and other invertebrates (Nwadiaro 1984; Fentiman 1996; Davies *et al*. 2009)
Fresh water	Agricultural and tree crops: cassava, yam, cocoyam, rice, maize, ogbono, cocoa, etc. (World Bank 1995; Umoh 2008; Omofonmwan, & Odia 2009)
Fibre and fuel	Timber products: saw logs, transmission poles, bamboo, building poles, fuelwood and chewing sticks (World Bank 1995; NDDC 2006; Alogoa 2005; McGinley 2008)
Biochemical	Aquatic insects (Arimoro, & Ikomi 2009)
Genetic materials	Medicinal species (Ndukwu, & Ben-Nwadibia (2005)
Other products	Bush meat (Luiselli 2003; Luiselli *et al*. 2006)
	Other products including raffia, snail, spices, mangrove salts, reeds and sedge (World Bank 1995; UNDP 2006)
Regulatory	
Climate regulation	Provides a good sink for greenhouse gases of CO_2 and CH_4 (Brooks *et al*. 2000)
Water regulation (hydrological flows)	Provides buffer against natural disaster including coastal erosion and regulates flood (Cugusi, & Piccarozzi 2009; Sanford 2009)
Water purification and waste treatment	Regulates water movement, quality and volume (Abam 2001; Uluocha, & Okeke 2004)
Erosion regulation	Habitat for pollinators (Dupont *et al*. 2000)
Natural hazard regulation	Natural attenuation (Benka-Coker, & Ekundayo 1995; Abu, & Dike 2008)
Pollination	
Salinity control	
Cultural	
Spiritual and inspirational	Source of spiritual inspiration (Isichei 1982)
Recreational and tourism	Site for fishing festivals (Jonathan 2006)
Aesthetic	Spiritual and sacred sites (Anderson, & Peek 2002; Bisina 2006)
Educational	Vast biodiversity (indicative of tourism) (World Bank 1995; Ebeku 2004)
Supporting	
Soil formation	Supports delta's biodiversity (Ejechi 2003)
Nutrient cycling	Soils support nitrogen mineralization (Iwegbue *et al*. 2006)
	Supports transportation (inland ports) that link places (Wolf *et al*. 2002; NDDC 2006; Egbagbe 2009)

Adapted from Adekola (2011)

METHODOLOGY

Ondo state is one of the oil producing states in Niger Delta Region of Nigeria. The oil production activities are particularly found in Abereke, Ilaje Local Government Area of the State (Department of Research and Statistics, 2010). Data used for this study was elicited from residents of Abereke – an oil rich community with an estimated population of 17,500 residents based on community records. A sample of 392 was selected following Israel (2013)

equation used for determining a representative sample proportion when dealing with large population. The study achieved 64% response rate (i.e. 247 retrieved questionnaire) and found the retrieved questionnaire useful for data analysis. Respondents were asked to rank the importance of various components of TEV based claims which they considered relevant to determining fair compensation payable to private claimants in event of oil spill damage using a five-point. Likert scale.

The relevance of each of the feature of wetland was examined and ranking of the nature of injury suffered during oil spill was carried out by use of Relative Importance Index (RII). RII was computed using equation (1) as follows:

$$\sum_{i=1}^{5} W_i X_i / \sum_{i=1}^{5} X_i \quad (1 \leq RII \leq 5) \tag{1}$$

Where:

W = the weight assigned to each factor by the respondents. This ranges from 1to 5 (i.e. where "5" means "extremely important" and "1" means "Not Relevant")

Xi = the number of respondents with the i^{th} rating of which i ranges from 1 - 5

FINDINGS AND DISCUSSIONS

Demographic Characteristics of Respondents

Data obtained on respondents' characteristics as shown in table 2 indicate that the male constituted 64% of the respondents while the female gender is 36%. The respondents' age distributions indicate that 98% are above age 20, and have lived in the community for nothing less than 10 years minimum. Apart from about 11% who are engaged in civil service, other respondents are self-employed in farming, fishing, trading and other businesses. Out of these, crop and fish farming constitute 60.8%.

Table 2 Respondents Characteristics

Category	Classification	Frequency	Percentage
Sex of respondent.	Male	158	64.0
	Female	89	36.0
	Total	**247**	**100**
Age of Respondents	20 years & Below	5	2.0
	21 - 29	41	16.6
	31 - 40	53	21.5
	41 - 50	75	30.4
	51 - 60	32	13.0
	Above 60 years	41	16.6
	Total	**247**	**100**
Number of years already spent in the Community	Below 10 years	6	2.4
	10 – 20 years	32	13.0
	21 – 30 years	38	15.4
	31 – 40 years	71	28.7
	41 – 50 years	49	19.8
	51 – 60 years	44	17.8
	Above 60	7	2.8
	Total	**247**	**100.0**
Nature of your occupation/ employment	Civil servant	27	10.9
	Trader	56	22.7
	Farming	95	38.5
	Fishing	55	22.3
	Others	14	5.7
	Total	**247**	**100**

Ranking of Total Economic Value based Heads of Claim by Oil Producing Community Residents

Residents of the oil producing communities as potential victims of oil spill damage were asked the relevance of the identified wetland features (functions and services) to determining the compensation for damage they suffered due to oil spill. Questions inherent in structured questionnaire meant to elicit information on the relevance were asked on a five-point Likert scale type and it was chosen for ease and uniformity of response. Their expressed opinions are as presented in table 3 based on aspects of total economic value concept.

Table 3: Abereke Community Residents Opinion of TEV based head of claims for compensation

Wetland Function/Services		SUM	RII	RANK
Extractive Use Value				
1	Fish harvesting	1190	4.82	1
2	Other aquatic life	1144	4.63	2
3	Source of drinking water	1100	4.45	3
4	Fibers and Fuel	1088	4.40	4
5	Food/Crop production	982	3.98	5
6	Spiritual inspiration	958	3.88	6
7	Recreational use	879	3.56	9
8	Timber production	763	3.09	15
9	Medicinal Herbs and Roots	835	3.38	12
10	Grazing	814	3.30	13
11	Game Hunt	876	3.55	10
12	Building Materials	925	3.74	8
13	Water Transportation	645	2.61	18
Non-Extractive Use Value				
14	Tourism	554	2.24	24
15	Education	600	2.43	22
16	Research	527	2.13	25
17	Aesthetic	518	2.10	26
Indirect –Use Value Attributes				
18	Flood control	505	2.04	28
19	Groundwater recharge	670	2.71	17
20	Toxics retention	567	2.30	23
21	Biodiversity maintenance	501	2.03	29
22	Shoreline protection	447	1.81	30
23	Micro climate stabilization	509	2.06	27
24	Groundwater purification	814	3.30	13
25	Carbon sequestration	641	2.60	19
26	External support for fish habitat	864	3.50	11
Non Use Values				
27	Biological diversity	691	2.80	16
28	Cultural Heritage	938	3.80	7
29	Wetland Uniqueness	642	2.60	19
30	Option Use/Bequest/Existence	608	2.46	21

The significance of aspects of TEV based potential heads of claim for compensation in the event of oil spill damage were expressed by the oil producing community in this riverine area. In all, the identified claim through literature search and classified under different TEV aspects are 30 in number. Table 3 indicate that fish harvesting in the community is the worst-hit of oil spill effect in the riverine area. This has RII of 4.82 and ranked 1st. The 2nd in rank was non-fish aquatic life with RII of 4.63. These are scarcely included in valuation for compensation purposes; whereas Kadafa (2012) had highlighted that a large number of local population of the Niger Delta survive on harvesting crabs, periwinkles, shrimps fish, cockles, mollusks, birds, and animals. 3rd and 4th in rank are pollution of source of drinking water, and fiber and fuel with RII of 4.45 and 4.40 respectively. Otegbulu (2009) had decried non-

recognition of non-timber forest products "NTFPs" in the natural resource damage valuation in Nigeria; this he claimed has led to impoverishment of the people.

It is noteworthy that oil spill affect the respondents mostly in the extractive use of wetland resource. Among the 13 identified extractive use of wetland in the study area, respondents expressed that the first six items (i.e. Fish harvesting, Non-fish aquatic life, Source of drinking water, Fiber and fuel, and Crop/food Production) have the 6th positions in the RII. 7th in rank is the cultural heritage of the people among the non-use values. This corroborates the findings of Akujuru and Ruddock (2014) canvassing for the incorporation of socio-cultural values in terms of sacred sites and traditional religion when valuating of contaminated lands in Niger Delta, Nigeria.

The 8th (RII= 3.74) ranked value to the respondents is the extractive use of building materials such as bamboos, rattans etc. They claimed that when oil spills affect the source for raw material for building purpose, the cost of buildings increases. Private recreational use and Game hunt ranked 9th and 10th among the extractive use of wetlands in the community. The flow of oil into rivers in the community hinders swimming and other recreational fishing activities. Also oil spills were claimed to repel game hunt. These have RII=3.56 and 3.55 respectively.

Item that ranked 11th is found under the indirect use value of wetland. This is External support for fish habitat which has a RII of 3.50. The importance of this factor stems from the fact that fish production/farming is a major occupation among the people in this region generally. Use of wetlands for medicinal herb ranked 12th in order of importance for compensation claims among the people. Use of some medicinal herb is hampered when they are affected by oil spill. Babawale (2014) reported that some valuers make claims for hospital bill incurred by persons affected by oil spill. Over the years the local communities have discovered ways of helping themselves with these herbs especially with the high cost of accessing hospitals and private clinics. It is not unusual that oil spill can affect human health. Institute of Medicine (2010) confirmed that oil spill have both short and long term physical and psychological effect on people. Both grazing and ground water purification activities in wetland were both ranked 13th in position with RII = 3.30. Timber production ranked 15th with RII=3.09.

Top from the bottom is shoreline protection, biodiversity maintenance, and flood control functions of wetland with RII of 1.81, 2.03 and 2.04 respectively. Whereas studies such as Otegbulu, (2005, 2007, 2009), Udo and Egbenta, (2011) have advocated for Total Economic Value as an acceptable basis for compensation valuation especially when the contaminated land is wetland; it is noticeable that disaggregating TEV into specific component reveals that when the impaired interest which are privately owned is the subject of valuation, it is doubtful if all aspect of potential heads of claim are relevant. Thus the reason why many items are ranked low by the respondents could be that they are not considered relevant to private claimants. These appear to be public goods and no one can lay claims on them to the exclusion of others. A careful look at table 3 paints a picture that private claimants' concerns are basically items (heads of claims) found within "Extractive Use Value" of wetland; only cultural heritage ranked high under 'Non-Use Values". The work of Ibagere (2002) corroborates the importance of cultural heritage to compensation claimants. The study reported that compensation claims presented in respect of desecration of Inyosa family Juju shrine, and Ikhimwin-no-zokpa shrine at the bank of Ikpoba River in Edo state were upheld by the High Court and the clients got the total claims as presented by the valuer. Akujuru and Yalaju (2015) argued that TEV as a basis for determining compensation is impracticable in Nigeria owing to the existing legal framework for compensation practice.

CONCLUSION AND RECOMMENDATION

The study has highlighted the definition of total economic value based claims within compensation for oil spill damage assessment for private claimants. The oil producing community residents have expressed dissatisfaction towards compensation paid for oil spill damage over the years, and many parts of Niger Delta have expressed their displeasure in riots, disruption of oil productions, destruction of oil and gas installations, and the new dimension of kidnap of expatriates and key oil company employees. Huge sum of money and man-hour have been lost to this unwholesome development. Although there are many dimensions to their displeasures, it is expedient that the government and oil companies should consider the local communities as a major stakeholder in compensation matter. Therefore it is hereby recommended that instead of relying on OPTS rate which has been described as illegal and inconsistent with any known legislation in Nigeria, valuers who have been trained in the valuation of impaired interests should be given freehand to determine the compensation sum due to their clients without undue interruption of the polluters. Valuers should in turn ensure that compensation claims on items that are not privately owned should be considered under community claims for the common benefit of all. Such fund should be well managed by the trusted members of the community and should not end in individuals' pockets. Also, there is need to redefine various heads of claim to reflect the actual loss people suffered in the event of oil spill. The intent of compensation practice is to and must indeed be seen to restore the claimants back to the position they were prior the unfortunate event.

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Impact of Design Errors and Incomplete Drawings on Construction Project Delivery in Edo State, Nigeria

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ABSTRACT

The problem associated with design errors and incomplete drawings is an old but recurring problem in the Nigerian construction industry. This study, therefore examined the effect of design errors and incomplete drawings on construction project delivery in Nigeria. Primary and secondary data were used for the study via questionnaire and literature survey respectively. The study population comprised Architects, Quantity Surveyors, Engineers, and selected building contractors within Edo State. Out of the 110 questionnaires administered, 45 were retrieved and considered fit for analysis. Purposive sampling technique and random sampling technique were adopted. Frequencies, percentages and relative importance index were adopted in analyzing and ranking the results. The study revealed that consultants, contractors and clients were the major stakeholders mostly implicated in design errors and incomplete drawings. The results indicated that late or inadequate instructions from client, regular interference by client, inadequate site investigation by design consultants, inadequate and unclear documentation by design team, hurry to meet-up with client unrealistic deadline, and lack of constructability reviews in design, lack of clarity in design were ranked most as the causes of design errors and incomplete drawings. Findings also revealed that delays, cost overrun, rework, accidents, disputes, loss of life were ranked most as the impact of design errors and incomplete drawings on construction project. The study concluded that comprehensive site investigation should be carried out at the design phase of the project. Also, there is need for construction design to pass through constructability reviews and encourage the use building information modeling during design.

Keywords: Keywords: Constructability, Construction, Design Errors, Incomplete Drawings, Project Delivery

INTRODUCTION

The construction industry is an important sector for the development and economic growth of Nigeria, which is a developing country (Ebekozien, 2012). In Nigeria, it is very rare case that most construction project is completed on the time and cost specified or agreed upon. Construction projects are mainly multi-disciplinary and involve several consultants and contractors. Therefore, project success is mainly propelled by essential understanding of the design principles and construction methods by various team players (Love & Smith, 2003). Construction designers (Architects and Engineers) are expected to use reasonable and ordinary care in the practice of their profession, and their responsibilities are in part defined by social provenance. Among professions, this legal perspective is well known, but conversely clients are not always aware or informed about it. Perhaps construction designers cannot guarantee the results of their service, their liability for errors and omissions (incomplete drawings) can be determined by whether they have performed their services with the standard of care consistent with other professional designers within their community (Guckert & King's study as cited in Love, Lopez, Kim, & Kim, 2014). There are cases where clients understand their designer's obligation but find it difficult to comprehend what is meant by standard of care. Clarity is expected to be provided by a court of law or panel of experts once a breach of the standard of care is identified.

Design errors and incomplete drawings are the major cause of construction project delay (Dosumu & Adenuga, 2013; Kikwasi, 2012; British Columbia Construction Association,

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2011). The problem associated with design errors and incomplete drawings is an old but recurring problem in the Nigerian construction industry. Design error entails different meanings and usages depending on how it is conceptualized. Busby (2001) defined design error 'as the occurrence which were unexpected, involve surprise and which could not be attributed entirely to chance or circumstance'. While Reason (2006) see design error as an error that relate to those occasions in which a planned activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some chance agency. Love and Smith (2003) defined design error 'as unintended deviations from correct and acceptable practice that are avoidable'. British Columbia Construction Association (2011) opined that different researchers have conducted studies to identify the common causes of significant claims on construction contracts and the results seem to be consistent. On average, claims amounted to 30% of the construction value. Four of the major causes for claims were: inadequate site and/or subsurface investigation prior to starting the design; starting design efforts too late and/or unduly limiting the cost of engineering and design; calling for bids with an incomplete set of drawings; and endeavouring to complete the design through shop drawing review. The common feature of all these projects was hurriedly and incompletely prepared bid documents, giving rise to design changes. Project changes and/or adjustments are inevitable as they are a fact-of-life at all stages of design and construction. These changes are not resolved through a formalized change management process; it can become the major source of contract disputes, which can pose severe risk that can hamper project performance (Hao, Shen, Neelamkavil, & Thomas, 2008).

All errors are human error, because it is the people who decide what to do; how it should be done; and it is the people who have to do it (Blockley's study as cited in Love *et al.*, 2014). Human errors are among the leading causes for defects, rework and wastages in construction projects (Love & Jasephson, 2004). Perhaps, errors in construction projects can be costly and even become a social problem due to future repairs, inconveniences, and other perils including safety (Rimer's study as cited in Ekambaram, Muthukaruppan & Chi-Ming, 2007). Research undertaken by the Construction Industry Institute (1987) and National Research Council (1994) reveals that design error and omission rate is in the range of 2-3% of construction cost and is deemed to be an acceptable threshold level. There have been several studies in this direction, Atkinson (1998); Love *et al*. (2014); Chapman (1991), identified types of design errors; while factors responsible for design errors were identified by Ren, Atout and Jones (2008), Palaneeswaran, Ramanathan and Tam (2007), Endsley (1999), Barkow (1995). The impacts of delays were identified by Oyewobi, Ibironke, Ganiyu and Ola-Awo (2011). Most of these studies were conducted outside Nigeria. For the few ones that were conducted in Nigeria, emphases were on the causes of construction delay and not within Edo State. Detail studies have not been conducted in the area of the major causes of construction delays in Nigeria. However, this subject area appears to be new in spite of the problem associated with poor construction project performance experienced in the country as a result of design errors and incomplete drawings; which are the major cause of construction delay (Dosumu & Adenuga, 2013). While design errors and incomplete drawings are deemed prevalent, most design and construction firms do not measure the number of errors they create, thereby having initial knowledge regarding their mechanism to undermine project performance even when it is obvious and recurring problem in the Nigerian construction industry.

Against this background therefore, the objectives of the study are to identify the stakeholders that are mostly implicated in design errors and incomplete drawings causation in construction projects, identify the prevalent causes of design errors and incomplete drawings, identify the effects of design errors and incomplete drawings on construction project delivery and proffer

measures to be taken in order to reduce the occurrence of design errors and incomplete drawings in construction documents. With the identification of the causes and impacts of design errors and incomplete drawings in construction projects, there will be a basis for design error minimization in construction projects with a view to better the professional image of firms. This will lead to resultant effect for more effective design management and improve the profitability and competitiveness of consulting and contracting firms.

LITERATURE REVIEW

The construction process can be divided into three important phases, i.e. project conception, project design and project construction (Ebekozien, 2012). Although the vast majority of project delays occur during the construction phase, theses cause could be traced to either project conception phase or design phase but only manifest during construction phase. Ramanathan, Narayanan and Idrus (2012) defined construction delay 'as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agreed upon for the delivery of a project'. It is a project slipping over its planned scheduled and this is a common problem in construction projects. It is in the design stage where the requirements of the client are identified and the constructive aspects and the standards of quality are defined through procedures, drawings and technical specifications. However, the work within the design stage is split into several temporary sequences, and it is delivered to different specialists for its execution. In building projects, first the owner selects the Architects who prepare the architectural designs and specifications, and then the structural design and other specialty designs are developed (Luis & Daniel, 1998).

Norman (1988) defined error as 'something that has gone wrong in the production of a design'. Mistakes are errors in choosing an objective or specifying a method of achieving it whereas slips are errors in carrying out an intended method for reaching on objective. The division occurs at the level of the intention. Center for Universal Design (2014) developed seven principles for professionals in the built environment. The principles are to guide the design process and educate both designers and clients about the characteristics of more usable products and environments. They are: equitable use; flexibility in use; simple and intuitive use; perceptible information; tolerance for error; low physical effort; and size and space for approach and use.

Common Causes of Design Errors and Incomplete Drawings

Records have it that design errors and incomplete drawings are the major causes of construction delay. However, it has been widely studied by researchers from different countries (Ren, Atout, & Jones, 2008; Rajendran, Seow, & Goh, 2014; Dosumu & Adenuga, 2011; Hao *et al.*, 2008; Luis & Daniel, 1998; Kikwasi, 2012; Baloyi & Bekker, 2011; British Columbia Construction Association, 2011; National Society of Professional Engineers, n.d.; Ekambaram *et al.* (2007); Ramanatham *et al*., 2012; Love *et al*., 2014; Alia, Emad, Ashraf & Mahmoud, 2014; National Research Council, 1994; Construction Industry Institute, 1987; Acharya, Lee & Kim, 2006). With this in mind, the following basic categories developed in Antill and Woodhead's study as cited in Baloyi and Bekker (2011) was adopted. Client related causes; consultant related causes and contractor related causes.

Past Studies

Kikwasi (2012) investigated the causes and effects of delays and disruptions in construction projects in Tanzania. The study revealed 'design changes' as the most significant cause of delays and disruptions in the order of severity. Also, time overrun and cost overrun were highly ranked 1st and 2nd respectively as effects on construction projects. These findings agreed with Ren and Jones (2008), which investigated the root causes of construction project delays in Dubai. The only slight difference is that the causes were categories into three

categories: client; consultant; and contractor. The survey by Baloyi and Bekker (2011) in finding the causes of construction cost and time overruns: the 2010 FIFA World Cup stadia in South Africa shows that design errors and incomplete drawings were ranked highly as major causes of construction cost and time overruns. Although advanced software tools and techniques, such as three-dimensional modeling, automated material take-offs and change reference control had been developed to improve the productivity of design outputs, these aspects remain some of the most significant contributors to time delays on construction projects.

Dosumu and Adenuga (2013) examined the causes, effects and remedies of errors in Nigerian construction documents. Lack of documentation, poor communication between professionals and clients, incomplete and incorrect drawings, changes to specification were among highly ranked factors identified as causes of errors in Nigerian construction documents. Others were: professionals' inexperience, non availability of information, lack of quality management, and negligence. The suggestion provided by the study in order to prevent errors in Nigerian construction documents includes: comprehensive information for the design of construction documents, good communication among project participants, effective project management, constructability, design reviews management, electronic document management system and use of building information modeling. Ekambaram *et al.* (2007) findings revealed three interesting cases of design and construction errors which frequently occurred in recent projects. The study also agreed that these errors if not properly checked, could lead to serious concerns as the resulting rework and wastages will affect project performance and productivity aspects. Ramanathan *et al.* (2012) studied construction delays causing risks on time and cost – a critical review. Findings revealed that 18nos categories of causes were identified from the various related studies reported in the literature. Among them: design-related, consultant and owner/client were significantly ranked high as major causes of delays causing risks on time and cost of the project.

Love *et al.* (2014) provided the initial platform to examine the probability of design error costs. The study identified direct and indirect costs as the components of design error costs. The study agreed that the probabilities for both components need to be derived to establish a realistic estimate of design errors. Alia, Emad, Ashraf and Mahmoud (2014) investigated the change orders in construction projects in Kuwait. A field survey was conducted to identify the major causes of change orders, their effects on projects and control measures. The findings revealed agreed with Dosumu and Adenuga (2013). The study most significant control measures were: checking and reviewing the contract documents, reviewing design before change approval and change order should be negotiated by knowledgeable persons. Steven (2011) discussed the incomplete or abandoned construction project. The study concluded that client should overlook trivial negotiations and focus on those provisions that address the biggest areas of liability for the owner, or those provisions that allow the owner some degree of control in limiting liability and exposure during the project. By so doing, the owner will be perceived as a fair and trustworthy participant in the project by the contractor, but will not be subject to unwanted and unnecessary liability.

METHODOLOGY

This study is descriptive, designed to obtain views from clients, consulting firms, and construction firms respectively in regard to causes, impact and proffer measures to design errors and incomplete drawings on construction projects. Descriptive was adopted because it is used to describe characteristics of a population or phenomenon being studied, such as this study. Also, descriptive research involves collecting data to answer questions concerning the current status of the subject of the study. The sample size of 110 respondents was estimated

comprising of 10 construction firms top management staff, 20 Quantity Surveyors, 25 Architects, 35 Engineers, 10 Builders and 10 selected clients within Edo State, Nigeria. Two sampling techniques were adopted due to the nature of respondents to be involved in the study. Random sampling was adopted to select consultants and contractors. Clients were selected using purposive sampling technique, a type of non probability sampling technique. According to Walliman's study as cited in Kikwasi (2012), purposive sampling is a useful sampling method which allows a researcher to get information from a sample of the population that one thinks knows most about the subject matter.

For the purpose of this study, literature review and structured close ended questionnaires were methods adopted among the available methods in collecting data. These were adopted because of the nature of the topic, respondents and data for the analysis. The study assumed that all respondents have been involved directly of indirectly in construction project that suffered as a result of design errors or incomplete drawings. Fifty out of 110 questionnaires administered were returned, 45 were found fairly filled for the analysis. Out of these 45 responses, 3 responses received from clients, 39 responses received from consultants and 3 responses received from contractors. Majority of respondents (80%) have years of experience between 10 and 25years. The results of the study was computed through the use of statistical package for social sciences (SPSS17) using frequencies, percentages and relative importance index (RII) as used in Kometa, Olomolaiye & Haris; Faridi & Sayegh; Aibinu & Bekker's study as cited in Baloyi and Bekker (2011).

$$RII = \sum W/(A \times N), (0 \leq index \leq 1)$$

Where W = weight given to each factor by respondents and ranges from 1 to 5, A is the highest weight (that is 5 in this case) and N = total number of respondents (also, that is 45 in this case).

FINDINGS AND DISCUSSION

Table 1: Stakeholders Mostly Implicated in Design Errors and Incomplete Drawings

Identified Stakeholders	Frequency	Percentage
Consultants	45	100
Clients	35	77.8
Contractors	25	55.6

Table 1 shows major stakeholders that are mostly implicated in design errors and incomplete drawings causation in construction projects. The results obtained from the respondents shows that consultants, clients and contractors are the major stakeholders that are mostly implicated in design errors and incomplete drawings causation in construction projects. Table 1 reveals that at least 55.6% of the respondents agree that consultants, clients and contractors are the major stakeholders. However, all the respondents agree that in addition to contribution from other stakeholders, consultants are the key stakeholders in respect to design errors and incomplete drawings. This finding agrees with Ren, Atout and Jones (2008) that categorized the causes of project delays under three sub-heading: client, consultant and contractor respectively.

Table 2, 3 and 4 shows the respondents ranking of causes of design errors and incomplete drawings. Table 2 reveals consultants contribution, Table 3 reveals clients contribution and Table 4 reveals contractors contribution respectively to design errors and incomplete drawings in construction projects. Based on the ranking of causes, the five most important factors that could cause design errors and incomplete drawings as perceived by consultants are: unclear documentations, inadequate documentation, inadequate site investigation, incomplete design consultant staff and hurry to meet up with unrealistic deadline with

relative important index (RII) of 0.843, 0.836, 0.793, 0.786, and 0.767 respectively. Similarly, based on the ranking of causes, the five most important factors that could cause design errors and incomplete drawings as perceived by clients are: poor communication and coordination, regular interference, site's topography is changed after design, late or inadequate instructions, and unrealistic control duration set-up by client with a RII of 0.901, 0.890, 0.867, 0.810 and 0.791 respectively. Also based on the ranking of causes, the five most important factors that could cause design errors and incomplete drawings as perceived by contractors are: lack of clarity, inadequate organization management, incompetent contractor staff, lack of technical professional in the organization and shorter time to verify consultants' drawings with RII of 0.817, 0.801, 0.769, 0.737, and 0.731 respectively.

Table 2: Respondents Ranking of Causes of Design Errors and Incomplete Drawings: Consultants Contribution

Identified Consultants Contribution	RII	Rank
Unclear documentation	0.843	1
Inadequate documentation	0.836	2
Inadequate site investigation	0.793	3
Incompetent design consultant staff	0.786	4
Hurry to meet up with unrealistic deadline	0.767	5
Poor design management	0.757	6
Inaccurate project feasibility study	0.745	7
Poor communication between consultant staff	0.736	8
Lack of design coordination to eliminate design conflict	0.707	9
Lack of constructability reviews on design	0.701	10
Conflicts appear between drawings from different disciplines	0.693	11
Fees paid not accurate	0.681	12
Slow responses	0.679	13

Table 3: Respondents Ranking of Causes of Design Errors and Incomplete Drawings: Clients Contribution

Identified Clients Contribution	RII	Rank
Poor communication and coordination	0.901	1
Regular interference	0.890	2
Sites topography is changed after design	0.867	3
Late or inadequate instructions	0.810	4
Unrealistic control duration set up by client	0.791	5
Change orders	0.754	6
Lack of a capable representative	0.716	7
Unquantifiable items in bill of quantities	0.567	8

Table 4: Respondents Ranking of Causes of Design Errors and Incomplete Drawings: Contractors Contribution

Identified Contractor Contribution	RII	Rank
Lack of clarity	0.817	1
Inappropriate organization management	0.801	2
Incompetent Contractor staff	0.769	3
Lack of technical professional professional in the organization	0.737	4
Shorter time to verify consultants drawing for deficiencies or completeness	0.731	5
Obsolete technology	0.517	6

Table 5 reveals the impact of design errors and incomplete drawings while Table 6 reveals the measures to mitigate design error and incomplete drawings. The impact of design errors and incomplete drawings on construction project delivery were found to be construction cost overrun with relative important index (RII) of 0.934 followed by construction time overrun and rework with RII of 0.911 and 0.905 respectively. Others include: lost of labour, materials and equipment; Contract failure; arbitration; litigation; accident, loss of life as revealed in Table 5. This result is similar to that of Kikwasi, (2012) with a little deviation. For this study, construction cost overrun ranked 1st while in Kikwasi's study, it was ranked 2nd. From Table

6, the remedies suggested by this study were found to be consistent with the ones provided by Dosumu and Adenuga (2013). However, the remedies were found to vary in the area of training of stakeholders on how to manage change in design. Also since change is inevitable in design, the study suggested that designers should prepare their mind towards change.

Table 5: Respondents Ranking of Impacts of Design Errors and Incomplete Drawings

Effects	RII	Rank
Construction cost overrun	0.934	1
Construction time overrun	0.911	2
Rework (both in design and construction)	0.905	3
Loss of labour, materials and equipment	0.817	4
Contract dispute	0.801	5
Contract failure	0.787	6
Arbitration	0.765	7
Litigation	0.756	8
Accidents	0.615	9
Loss of life	0.613	10
Total abandonment	0.609	11
Poor quality of work done to hurry	0.603	12
Delaying in getting profit by clients	0.601	13

Table 6: Respondents Ranking of Measures to Mitigate Design Errors and Incomplete Drawings Impact on Construction Project Delivery

Remedies	RII	Rank
Provision of detailed and comprehensive information among key stakeholders	0.901	1
Good communication among key stakeholders	0.886	2
Constructability reviews on design	0.867	3
Design drawings should be in 3 dimension building information modeling (3D BIM)	0.858	4
Effective and efficient project management	0.847	5
Stakeholders should prepare their mind for change	0.830	6
Construction professionals should be trained on how to manage change in design.	0.770	7

CONCLUSION

The conclusion of this study is that three major categories could be implicated in design errors and incomplete drawings causation in construction project. They are: consultants, clients and contractors. The causes of design errors and incomplete drawings are: unclear and inadequate documentations/ instruction, inadequate site investigation, incompetent construction professionals, unrealistic deadline set by client, lack of constructability, poor communication and coordination, regular interference by client, lack of clarity by contractors among others. In order to prevent or mitigate design errors and incomplete drawings, there is need to make detailed and comprehensive information available among the key stakeholders, constructability and design reviews management in three dimensions BIM and stakeholders being trained on how to manage changes. It is therefore recommended among others that stakeholders should allow adequate time for the preparation of design drawings, timely issuing of detailed and comprehensive information to stakeholders. Also, constructability reviews on design should be encouraged in addition to use of three dimension building information modeling with construction practitioners in Nigeria.

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Effect of Unethical Practices on Procurement Performance of Public Building Projects in Edo State, Nigeria

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ABSTRACT

Unethical practices hinder economic development, reduce social services, divert investments in infrastructure and encourage inefficiency in the procurement process. This study, therefore examined the effect of unethical practices on procurement performance of public building projects with a view to proffer ways to mitigating unethical practices during procurement of public building projects. Primary and secondary data were used for the study via questionnaire and literature survey respectively. The study population comprised governmental institutions, selected contracting firms and private consultancy firms within Edo State. Ninety questionnaire were distributed, 79 were returned and 72 (12 from governmental institutions, 18 from contracting firms and 42 from private consultancy firms) were found suitable for analysis. The method used in presenting and analyzing the obtained data includes tables, percentage and mean item score. The results indicated that culture of impunity, weak law enforcing institutions, cabal and political interference, fear of the unknown, absence of reward system, lack of leadership by example, absence of ethical training programs, and lack of consequences when caught were ranked most as the causes of unethical practices during procurement of public building projects. Findings also revealed that inflated contract sum, shoddy construction, fraud, unfair competition, dispute, litigation, and project abandonment were ranked most as the effects of unethical practices on procurement performance of public building projects. The study therefore recommended among others that policy makers and concerned authorities should practice what they preach. In conclusion, laws and regulations are no substitute for the presence of leaders who support and model ethical behaviour.

Keywords: Building Projects, Ethics, Practices, Procurement Performance, Public Building

INTRODUCTION

Construction Industry plays a substantial role in a country's economy irrespective of the country's level of economic development (In Zantanidos and Tsiotras work as cited in Hanizah, Abdul-Rahman, & Xiang, 2010). Abdul-Rashid and Hussain's study as cited in Alex (2014) stated that between 2 to 10 percent of the total work-force is employed in the construction industry and the second largest industry next to agriculture. The Nigerian government had given a much needed boost to the country's construction industry between 1999-2011 where a total of 650 projects were constructed and commissioned (Ebekozien, 2012). This is the sector that produces public building projects.

However, much had been reported about the performance of the construction industry in terms of quality, productivity, safety and procurement in Nigeria. Contract procurement is the process that is used to deliver construction projects (Ebekozien, 2014). The execution of a construction project requires both design work and the carrying out of construction operation. According to Alex (2014), it has reported in 2011 by transparency international, Bribe Payers Index that out of the entire prominent sector in the world, public work construct and construction scored the lowest. Also, it has been estimated that unless adequate measures are taken a sum of $1.2 trillion risks been lost to corruption as a result of unethical practice on an annual basis. This figure could double when considering management and execution inefficiencies. This is definitely a highly worrying matter. Nigeria is perceived as one of the most corrupt nation in the World (Transparency International, 2013). In the Transparency

Ebekozien A.; Uwadia, F. E. & Usman, D. A. (2016). Effect of Unethical Practices on Procurement Performance of Public Building Projects in Edo State, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 668-675

International (T.I) corruption perception index (C.P.I), Nigeria ranked 33rd most corrupt nation in the world in the year 2007 and 2013. This point to the fact that any positive development towards the reduction in corruption in the public procurement process would have a direct and positive significant impact on the overall construction industry in Nigeria.

There is a perception that majority of unethical practices on procurement performance are caused by human factor. Therefore, the issue of professional ethics within the construction industry affects a wide spectrum of population. The ministries, departments, agencies and parastatals at federal, state and local government level respectively, consultants, private client organisations, supplies, contractors and users of public infrastructure are all within the scope of professional ethics. Previous studies such as Vee and Skitmore (2003), Haminah, Narfashiha, Norazian and Norizan (2011), Alfred and Sealza (2008) noted that unethical practices hinders economic development, reduce social services, divert investments in infrastructure and encourage inefficiency in the procurement process.

Perhaps, for public project delivery to be efficient and effective, the procurement process should be ethical. In any given day, professionals in the construction industry would face numerous ethical dilemmas. In the construction business, they will come in fields of procurements estimating, management, accounting, financial, customer relations, sub-contractors, vendors and suppliers and more (Alfred & Sealza, 2008). However, for the purpose of this study, the study is restricted to unethical practices on procurement performance of public building project in Edo State, Nigeria. This study, therefore evaluate the causes of unethical practices and its effect on procurement performance of public building projects. Also, the study proffer ways to mitigate unethical practices during procurements of public building projects with a resultant effect of time, cost, and quality of public building project delivery.

LITERATURE REVIEW

The Construction Industry

The Nigerian construction industry is a unique, complex and often fragmented industry. The industry is important in all countries of the world since it helps to add to the quality of life both through its architecture and also through the facilities it provides to users, both internally and externally (Ebekozien, 2014). National Bureau of Statistics (2011) refers to the industry as Building and Construction Sector in their sectoral classification of economy. The construction industry is essentially an assembling industry, assembling on site the product of other industries. Ebekozien (2014) stated that in the developed world, the construction industry is the highest employer of labour. While, in the developing world such as Nigeria, the construction industry is expected to be the second largest employer of labour after the agricultural industry. The construction industry is therefore a critical factor or variable in the drive for economic advancement of nations especially the less developed countries (LDCs) such as Nigeria. A survey of households by World Bank (2013) revealed that:

i. In urban areas, there is lack of pipe borne water, irregular electricity supply and lack of good roads.
ii. The vast majority of Nigerians have little access to basic public services.

This is worrisome even with the huge amount of money that has gone into the sector for the past 15 years. Out of all sectors of the World economy, the construction industry was found to be the most corrupt economic sector as per the findings of the survey for investigation of corruption by Transparency International (T.I) (Alex, 2014). It was further revealed that in the year 2004, 10 percent of the total value of construction was lost due to corruption in construction globally due to corruption in infrastructure procurement. Vee and Skitmore

(2003) lamented the unhealthy nature of some professionals in the construction industry. The authors identified some the unethical behaviour of these professional to be:

i. Concealing of construction errors and stealing of someone else drawing.
ii. Exaggerating experience and academic achievements in resumes and applications for commissions.
iii. Charging clients for work not done, costs not incurred or overstated.
iv. False promises of advancement as practiced by some consultants.
v. Misleading clients in project management.
vi. Involvement in conflict of interest.

Ethics

Ethics is used in determining what is right in a given situation and then following through with actions to implement what is right. Alfred and Sealza (2008) defined ethics as: "(i) A system of moral principles, by which human action and proposal may be judged good or bad, right or wrong. (ii) The rules of conduct recognised in respect of a particular class of human actions. (iii) Moral principles, as of an individual".

They evolved initially from religion by many thinkers in the Judeo-Christian tradition. Their study involves the activity of examining one's more standards of society and asking how these standards apply to our lives and whether these standards are reasonable or unreasonable. Perhaps, ethics cannot be arbitrarily created but discovered through argument and persuasion (Johnson study's as cited in Vee & Skitmore, 2003). Remember, an organisation is judged by its reputation which is a result of its integrity to the business world and its employees. The ethics of both the organisation leaders and employees make up how the organisation is perceived and whether they are seen as ethical or not. The set of moral standard that we use to guide our decision making are our ethics (Alfred & Sealza 2008). Collins Dictionary (1991) defined morality as "conforming to a conventional standard of moral conduct ". A moral refers to a distinction between good and bad or right and wrong. Perhaps ethical conduct in simplest is doing the right thing when no one is looking (McCarthy, 2012). There are three primary ethical directives: loyalty, honesty and responsibility. We will be called upon to be loyal to friend, family, organisation, profession et al. and being loyal to one may mean being disloyal to another. Honesty is telling the truth as you see it but it really much more. Responsibility requires taking ownership of the consequences of our action and insuring no harm comes to someone because of those consequences (Alfred & Sealza, 2008).

McCarthy (2012) noted that ethical conduct is the compliance with the following seven ethical principles:

i. Honesty- act with honesty and avoid conduct likely to result, directly or indirectly, in the deception of others
ii. Fairness- does not seek to obtain a benefit which arises directly or indirectly from the unfair treatment of other people.
iii. Fair reward- avoid act which are likely to result in another party being deprived of fair reward of their work.
iv. Reliability- maintains up to date skills and provide services only within your area of competence.
v. Integrity- have regard for the interests of the public, particularly people who will make use of or obtain an interest in the project in the future.
vi. Objectivity- identify any potential conflict of interest and disclose the conflict to any person who would be adversely affected by it.

vii. Accountability- provide information and warning of matters within your knowledge which are of potential detriment to others may be adversely affected by them.

Alex (2014) lamented that the unethical practices among players of construction industry is on the increase. The lack of professional ethics, as evidenced by the high rate uncompleted and delayed projects with huge time and cost over-run, poor and substandard quality of work due to non-adherence to contractual design and specification leading to shedding and uneconomical constructions and collapse of structures during construction or thereafter may be viewed by international business organization as less easy, possible and likely, to do business in comparison to other developing nations due to corruption and lack of professional ethics. Hamimah *et al*. (2011) highlighted many reasons why professionals are involved in unethical practices. This may be due to insufficient legislative enforcement, fierce competition, the economic downturn, insufficient ethical education from schools and professional institutions, cultural changes and high complexity of construction works. The Nigeria construction industry is no exception. Vee and Skimore (2003) noted that one of the most frequently reported unethical practices in business is bribery. Other frequently reported unethical practices are related to fraud, breach of confidence and negligence, deceit, trickery, sharp practice, or breach of confidence by which it is sought to gain some unfair or dishonest advantage.

Procurement

Based on the aide spread corruption, conducting government business degenerated so much in Nigeria in the early 2000. In an attempt to stop the ”business as usual syndrome”, Budget Monitoring and Price Intelligence Unit (BMPIU) was established. This unit was given the mandate to ensure fiscal transparency, strict compliance with Federal Government guidelines on due process certification as it concerns budgeting for and procurement of facilities/services/contracts at appropriate costs (Ezekwesili, 2005). This facilitated the enactment of Procurement Act 2007. However, even with the existence of procurement Act, the level of corruption in relation to procurement is still high. Ayoola (2008) lamented that some of the common techniques employed by these parties in corrupting the procurement process include failure to meet quality standards, colliding to fix bidding prices, promotion discrimination, discriminatory technical standard, claiming urgency as an excuse toward to a single contractor without competition, demanding private benefits, and diverting delivered goods for resale or for private use.

Oshiogbele (2010) stated that there are eleven principles which govern the administration of public procurement as provided in construction procurement guide 2008. They are as follows; accountability, competitive supply, consistency, effectiveness, efficiency, integration, integrity, informed decision making legality, responsiveness and transparency. Ebekozien (2014) noted that contract procurement is the process that is used to deliver construction project. There are a number of alternative procurement methods a client may use to acquire these services. These procurement methods give the client a choice of various management structure, different contractual managements and varying degrees of client risk. Ashworth, Hogg and Higgs (2013), Ebekozien (2014), classified the method into two major methods. The first is the traditional methods; this is one of the oldest methods of building procurement and conformed to straight forward and well-tried procedure. Examples are: based on bill of firm quantities, based on bill of approximate quantities, based on drawing and specification, based on schedule of rates (measured contract or measurement contract), based on cost reimbursements (prime cost or cost plus). The second is the alternative methods-since construction activities are dynamic, various alternative ways of promoting and carrying out construction project have been devised with varying degrees of success. Examples are; design

and building (design and construct or package deal), management fee, government procurement routes, project management, partnering, and joint venture.

METHODOLOGY

The study adopted a survey research technique and was limited to Edo State, Nigeria. Survey research was adopted because is often used to assess thoughts, opinions, and feelings. It is a method of collecting information by asking questions of respondents. Also, since it was a quantitative research, survey research was adopted. The target populations for this study comprised governmental institutions, selected contracting firms and private consultancy firms within Edo State, Nigeria. The study made use of data and information collected from both primary and secondary sources via questionnaire and literature survey respectively. Purposive sampling technique was adopted in administering the questionnaire to those respondents directly involved in procurement of public building projects in the study area. Ninety questionnaire were distributed, 79 questionnaire were returned and 72 (12 from government institutions, 18 from contracting firms and 42 from private consultancy firms respectively) were found suitable for analysis. This gave a response rate of 80% of the total. Secondary data includes relevant information from related studies. The method used in presenting and analyzing the obtained data includes tables, percentages and mean score rank. This was adopted because it is the simplest way to present and analyze the data for easy interpretation.

FINDINGS AND DISCUSSIONS

Table 1: Summary of Background Information on Respondents

Category	Classification	Frequency (N) (%)	Percentage
Organization types	Govt Institutions	12	17
	Contracting Firms	18	25
	Consultancy Firms	42	58
	Total	**72**	**100.0**
Respondents Designation	MD/CEO	5	7
	Director/Management staff	7	10
	Principal Partner	20	28
	Partner	18	25
	Operational Staff	22	30
	Total	**72**	**100.0**
Higher Academic Qualification	HND/B.Sc/B.Tech	42	58
	M.Tech/M.Sc/M.Phi	30	42
	Total	**72**	**100.0**
Years of Professional Experience	0-5 years	3	4
	6-10 years	5	7
	11-15 years	30	42
	16-20 years	20	28
	Above 20 years	14	19
	Total	**72**	**100.0**
Numbers of Public Building Projects Involved in the last 10 years (2005-2014)	0-5	3	4
	6-10	24	33
	11-15	20	28
	16-20	10	14
	About 20	15	21
	Total	**72**	**100**

Table 1 shows the summary of the background information of respondents. It is observable from Table 1 that 58% of the respondents are from consultancy firms, comprises of: Quantity Surveying, Architectural, and Civil Engineering Consultancy Firms respective. Also, Table 1 shows that the minimum academic qualification of the respondents was HND/BSc/B.Tech in

their various fields of study. Also, it shows that more than 79% respondents have a minimum of 11years and above experience in the construction industry and respondents cut a cross stakeholders to the study area. Similarly, it shows that more than 63% of the respondents have been involved in public building projects of not less than 11 projects within the last 10 years (2005 – 2014).

Table 2: Identified Causes of Unethical Practices

Identified Causes	Govt Institutions		Contracting Firms		Consultancy Firms		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Lack of leadership by example	4.40	3	4.58	2	4.80	1	4.59	1
Fear of unknown	4.50	1	4.61	1	4.55	3	4.55	2
Culture of impunity	4.48	2	4.50	3	4.65	2	4.54	3
Weak law enforcing institution	3.75	5	4.55	4	4.11	4	4.14	4
Absence of reward system	3.90	4	4.40	5	3.90	5	4.07	5
Absence of ethical training programs	3.40	7	4.30	6	3.80	6	3.83	6
Lack of consequences when caught	3.60	6	4.20	7	3.50	7	3.77	7
Working in a diminished environment	3.10	8	3.60	8	3.20	8	3.30	8

Table 3: Identified Effects of Unethical Practices

Identified Effects	Govt Institutions		Contracting Firms		Consultancy Firms		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Inflated contract sum	4.20	1	4.40	1	4.51	1	4.37	1
Encourages bribery and corruption	4.05	3	4.33	2	4.40	2	4.26	2
Encourages Fraud, unfair and dishonest conduct	4.15	2	4.05	3	4.28	3	4.13	3
Collusion tendering	3.91	4	3.59	5	4.15	4	3.88	4
Negligence and shoddy construction	3.44	6	3.80	4	3.80	5	3.68	5
Unjustified claims	3.65	5	3.33	7	3.71	6	3.56	6
Conflict of interest, dispute litigation	3.19	7	3.41	6	3.55	7	3.38	7
Cost and time overrun	3.05	8	3.17	8	3.18	8	3.13	8
Non- respect of agreement	3.01	9	3.09	9	2.91	9	3.00	9
Reworks	2.85	10	2.91	10	2.88	10	2.91	10
Low inflow of foreign direct investment	2.76	11	2.75	11	2.88	10	2.80	11
Few and weak infrastructural facilities	2.69	12	2.65	12	2.77	12	2.70	12

Table4: Identified Ways to Mitigate Unethical Practices

Identified Ways	Govt Institutions		Contracting Firms		Consultancy Firms		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Leaders as role model	4.30	1	4.57	1	4.69	1	4.52	1
Reinforcement and Upholding the rule of law	4.17	3	4.45	2	4.51	2	4.38	2
Strengthening institutions	4.25	2	4.34	3	4.35	3	4.31	3
Building a culture of transparency	4.02	4	4.22	4	4.10	4	4.11	4
Create standard code of ethics	3.81	5	4.05	5	3.85	5	3.80	5
Make training and retraining on ethical matters compulsory	3.59	6	3.85	6	3.29	6	3.58	6
Openness and communication	3.25	7	3.49	7	3.01	7	3.25	7
Ethical awareness	3.01	8	3.19	8	2.85	8	3.02	8
Show employee appreciation	2.77	9	3.01	9	2.75	9	2.84	9

Table 2 presents that the ranking by the government institutions and contracting firms deviated slightly from that given by Consultant. While fear of unknown and culture of impunity was ranked first and second by the government institutions with a mean score of 4.50 and 4.48 respectively, contracting firms ranked fear of unknown and lack of leadership

by example first and second with a mean score of 4.61 and 4.58 respectively consultants ranked lack of leadership by example and culture of impunity first and second with a mean score of 4.80 and 4.65 respectively. On the average, lack of leadership by example was ranked first, followed by fear unknown while lack of consequences when caught and working in a diminished environment as the last. This deviate slightly with Hamimah *et al*. (2011). In the findings of Hamimah et al. (2011) stakeholders involvement in unethical practices may be due to insufficient legislative enforcement, fierce competition, the economic downturn, insufficient ethical education from schools and professional institutions, cultural changes and high complexity of construction works.

Table 3 reveals the ranking of the identified effects of unethical practices on procurement performance of public building projects in Nigeria from the respondents view points. The analysis reveals that inflated contract sum, encourages bribery and corruption, fraud, unfair and dishonest conduct, collusion agreement, and negligence and shoddy construction are the most significant impacts of unethical practices on procurement performance. While reworks, low inflow of foreign direct and portfolio investment, and few and weak infrastructural facilities as the least impact. The study recognised that these impacts are not good for Edo State and Nigeria as a country at large, which is trying to become among the best 20 countries in the year 2020. These identified impact touch on all facet of the economy which also agrees with Alfred and Sealza (2008). Alfred and Sealza (2008) findings reveals that unethical practices hinders economic development, reduce social services, divert investment in infrastructure, and encourage inefficiency in the procurement process. This findings slightly agrees with Vee as Skirtmore (2003).

Table 4 reveals major identified ways to mitigate unethical practices in procurement performance of public building projects. It shows that on the overall mean score, leaders as role model with mean score of 4.52 was ranked first as the most important way to mitigate unethical practices. Moreover, Table 4 reveals that reinforcement and upholding the rule of law was ranked second with a mean score of 4.38, followed by strengthening institution with a mean score of 4.31. The uniqueness of Table 4 is that all the respondents irrespective of the background agree and ranked leaders as role models as first in their respective segment. While openness and communication ethical awareness, and show employees appreciation, as the least way to mitigate unethical practices. This deviate with McCarthy (2012). McCarthy (2012) findings reveal that the only major way to mitigate unethical practices is expected that stakeholders should be doing the right thing even when no one is looking.

CONCLUSION

The study succeeds to examine the effect of unethical practices on procurement performance of public building projects with a view to proffer ways to mitigate unethical practice during procurement of public building projects. The study show that causes of unethical practice is not necessary the individual's lack of moral standards. It is therefore hoped that unethical practice can therefore be prevented or limited by implementing certain measures and recommended among others that government should strengthening institutions, improving sanction, and enforcement and upholding the rule of law, and leaders should be ready to set examples of ethical practices.

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Tenant Selection and Occupancy Rate of Office Properties in Akure

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ABSTRACT

The nature of commercial properties makes it susceptible to various management problems such as rent default, non-challant attitude among tenants in carrying out their obligations which have been attributed to inadequate / lack of tenant selection. This research work analyzed tenant selection and occupancy rate of office properties located along Oyemekun /Oba-Adesida road, Akure. Structured questionnaires were used in collecting data from the Estate Surveyors and Valuers in Akure as well as the occupants of office properties in the study area. Twenty-five(25) questionnaires was administered on practicing Estate Surveying and Valuation firms in Akure and a total of ninety-six(96) questionnaires were administered on occupants of office properties along Oyemekun /Oba-Adesida road. Data were analyzed using Descriptive statistics (weighted mean score) and Mann Whitney U-test. Results obtained from the data revealed that most of the Estate Surveyors and Valuers made use of the ability to pay rent and willingness to meet term of lease as basic selection criterion. It was also gathered that high rents have been the major determinant of occupancy rate of office properties in the study area with little impact from other factors such as adequate facilities, security, pollution, location, tenant selection amongst others. The research recommends that Estate Surveyors and Valuers should consider basic selection criterion such as ability to pay rent; meet lease obligations and ensure proper maintenance in other to keep the property in a tenantable condition, which if not done may lead to void in the long run.

Keywords: Occupancy Rate, Office Properties, Tenant Selection

Introduction

Commercial office properties comprise a large portion of the nation's wealth (DiPasquale and Wheaton, 1992) and provide the working environment that allows many businesses to operate efficiently (Clapp, 1993). Hough and Kratz (1983) also affirmed commercial properties as important component of the urban landscape. Commercial property which could come in form of office space, malls, retail stores, shopping centers, banks amongst others have an important role in real estate markets; which is related to three different factors such as factor of production, financial asset and as investment medium (Ustaoglu, 2003).

Oni, Bello and Oni (2011) asserted that there is an increased demand for commercial properties as a result of the increased population which has attracted a wide range of investors and developers in the provision of office spaces. Office properties generally provide environments conducive to the performance of management and administrative activities and other professional services (National Association for Industrial and Office Parks, 2012). These grandiose attributes of commercial properties offer have resulted to a plethora of such investment as office spaces in the study areas: Oyemekun and Oba Adesida Road, Akure which was hitherto a sprawl with residential structures.

The occupation of office spaces is initiated by a tenant selection process which is a very critical part of the property management process. Lawal (1991) noted that tenant selection requires personal knowledge of every prospective tenant and that Estate Surveyors and Valuers should ensure this by assessing the circumstances and needs of such prospective tenant. Agagu (2007) noted that the process ensures best-qualified tenants are selected while applicants with bad or no credit history are rejected. This process invariably affects the occupancy rate of such properties. Marrett and Swith (1989) also affirmed that tenant

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selection and occupancy period affect every type of real estate although in varying degrees. Ustaoglu (2003) further accentuated that tenant selection and occupancy rates are more evident in commercial properties which perhaps are due to the fact that these properties are majorly built for business transactions.

Agagu (2007) stated the problem faced in office properties are traceable to wrong tenants' selection and where unmitigated may affect the occupancy rate of such properties. According to Ayo-Ojo (2014), high vacancy rates are usually viewed as a sign that the market is struggling while high occupancy rate is desirable for major property investors. The level of the natural occupancy rate has direct implications for the return on property investment. In the long-run equilibrium, the higher the natural occupancy rate, the greater the amount of rent generated by a given rental property, everything else held constant and this can be achieved through a concise tenant selection.

Various criteria such as ability and willingness to pay rent; suitability of the tenant; ability and willingness to meet the terms of lease; provision of suitable referees; client's preference; tenant's personal data and credit worthiness are considered during the tenant selection process (Wheaton, 1997; Nwankwo, 2005; Agagu, 2007 and Bello, 2008). Wheaton (1991) and Agagu (2007) further assessed effect of tenant selection on office properties which leads to non-surrender of properties, subletting, alteration and unauthorized installation, non-payment of rent and fulfilment of lease term and obligations.

Based on the above discussions, this paper tends to discover it the mode of tenant selection by Estate Surveyors and Valuers have any effect on the occupancy rate of office properties in Akure.

LITERATURE REVIEW

According to Corgel (2006), office property is the most common of all the commercial property and is definitely the first type of property that springs to mind when the term commercial property is mentioned. Office properties have different categories which include: high rise office complexes and low rise office building. Relative to office space occupation and property management is the tenant selection process. Agagu (2007) emphasized that the concept of tenant selection revolves round a well-documented and adequate enforcement of the term 'lease'. As opined by Wheaton (1988) and Agagu (2007) one of the basic and most common problems that Estate Surveyors and Valuers or landlords face in their property is the adequate selection of tenant and adequate return on investment through rental collection. The selection of tenants and the occupancy of properties are strongly correlated (Nwuba, 1994; McAllister, 1994 and Ustaoglu, 2003).

There has been a dearth of literatures on tenant selection and occupancy rate. In the developed countries, a number of studies have tested the relationship between vacancy rates and rent levels in the housing and commercial office market. These studies include Eubanks and Sirmans, 1979; Rosen and Smith, 1983; Rosen, 1984; Voith and Crans, 1988; Wheaton and Torto, 1994; Belsky and Goodman, 1996; Sivitanides, 1997; Gabriel and Nothaft, 2001, Hagen and Hansen, 2010.

Wang (2009) carried out a research on evaluating office users' requirements and occupiers' preferences in changing business environment. The study mainly focused on identifying office users' and occupiers' requirements and preferences from physical, virtual, social and financial perspectives. The study however revealed that from the physical perspective, organizations prefer to adopt open-plan office, aiming to efficiently use their space and enhancing the communication ability among the employees

Zhao (2011) also examined how office property investors address the changes in office tenants' space and lease requirements and preferences in their office investments. The study reflected the property investors' attitudes to tenants as they are recognized as service providers rather than only physical place provider. The investors also aim to offer an efficient platform for tenants to conduct their business, thus, the offering of office space is as tenants demanded. The investors ensures high occupancy rate and income stream to overcome the market challenge.

Yasmin and Daud (2010) also carried out a research on Identification of Important Factors for Office Space Decision by Tenants in Kuala Lumpur city centre, Malaysia – Experts' View. The research adopted the importance index to examine the factors influencing the tenant office occupation decision. The findings show that there is mixture of factors that have achieved high important consideration by the experts.

In Nigeria, several authors such as; Agagu, 2007; Olabisi, 2010; Ezeokoli 2012; Odusote, 2014 and Bello and Ezeokoli, 2015 amongst others have embarked on various researches related to commercial properties and occupancy rates; voids, rents and its investment returns. Agagu (2007) assessed tenant selection and void period which is important factor in property management. The research examined the property market major players, method/procedure used in selecting prospective tenant and the effect of void period on properties and its mitigation. The study revealed that the Estate Surveyors and Valuers opined that through proper and adequate tenant selection, there should not be problem of tenant selection and the level of void period in properties can also be reduced by proper and adequate maintenance. Also, Olabisi (2010) investigated into the problems of office void which is limited to Lagos Island area. The research examined the types of property prone to void, causes of office property void, the disparity between actual and natural void and the effects of void on office properties. Akinwande, (2010) also examined the effects of tenant selection on property management and stated that rent affordability of low-income earners and the risk involved in private rental investment as basic factors affecting property management.

Odusote (2014) analyzed the vacancy rate and rent level in the commercial office market, with effect to four major areas of Akure. The results from the analysis showed that vacancy rate and rent level are directly related to supply of commercial properties' spaces and inversely related to the demand for shopping paces and that vacancy rates has no significant effect on commercial property returns. Bello and Ezeokoli (2015) examined the effect of vacancy on shopping center investment returns in six major areas of Akure using descriptive statistics, one-sample t-test and simple linear regression analysis. The research revealed that the average rate of vacancy in shopping centres in Akure is 13.67%. The result also, shows that centres in Oba Adesida, Oyemekun and FUTA experienced low vacancy rate. Furthermore, the research revealed that Vacancy rate has a negative effect on the rental values of shopping centres in Akure indicating that an increase in vacancy rate will cause a decrease in the expected rental value.

The above literatures none have been able address tenant selection and occupancy rate of office properties in Akure, Nigeria. Hence, this paper tends to address it.

STUDY AREA

The study areas Oba Adesida road and Oyemekun road are in Akure the capital city of Ondo state, the Oyemekun road is an integral part of Ondo state majorly accessed from Ilesha Road. Oba Adesida Road Metropolis is one of the major roads in Akure and a major road along the Central Business District (C.B.D) of Akure having its link to the ancient town and the ancient Palace of the King; Deji's Palace which automatically links it to one of the busiest

market in Akure; Oja-Oba. It is also characterized by the presence of major commercial properties including office spaces such as shopping complexes, banking halls, office spaces, and shopping malls.

METHODOLOGY

The population of this study comprises the occupants of office properties and practicing Registered Estate Surveyors and Valuers in Akure. There are 25 registered and practicing Estate Surveyors and Valuers in Akure as derived from Ondo State Branch secretariat record of registered Estate Surveyors and Valuers 2015. The office properties taken into consideration in this research are those located along Oba-Adesida and Oyemekun road, Akure. The total number of office properties along this study area as observed in the study areas from field survey is ninety-seven (97). Two sets of structured questionnaires were administered on the target population (Occupants of office Properties and Registered Practicing Estate Surveyors and Valuers in Akure) to elicit information on tenant selection and occupancy rates of office properties in Akure. A total of ninety-five (95) were completed and retrieved seventy nine (79) from occupiers of office spaces and sixteen (16) from Estate Surveyours and Valuers which were used for the analysis.

Descriptive statistics, weighted mean score and Mann-Whittney U test was carried out to ascertain the relationship between the responses of the target population regarding the study. Mann-Whitney U-test is a non parametric statistical method that is used in measuring the difference between two groups of responses. Fellows and Liu (2008) noted that Mann-Whitney u-test is one of the statistics that is used in testing hypotheses related to differences in metric and non-metric scales.

$$U=n\_1-n\_2 \ +(n\_1\ (n\_1+1))/2-R\_1$$

Where n1 and n2 are the sample sizes and R1 is the sum of the ranks assigned to the values of the first sample. In decision making using P-value, Lucko and Rojas (2010) noted that if the p-Value is less than 0.05 then the null hypotheses is rejected and vice versa.

FINDINGS AND DISCUSSIONS

Table 1: Firms' Year of Establishment

Year	Frequency	Percentage (%)
1-5	1	6.3
6-10	5	31.3
11-15	2	12.5
16-20	4	25.0
20 and above	4	25.0
Total	***16***	***100.0***

Table 1 reveals that, 31.3% of the firms have been established between 6-10 years ago, 25% between 16-20 years and those between 20 years and above, 12.5% were established between 11-15 years ago. This shows that the firms have enough years of experience and gave good judgment to the questionnaires administered.

Table 2: Professional Qualification of Respondents

Professional qualification	Frequency	Percentage (%)
ANIVS	6	37.5
RSV	1	6.3
FNIVS	3	18.8
Others	6	37.5
Total	***16***	***100.0***

Table 2 reveals that 37.5% are associate members of NIESV (ANIVS) while 18.8% are fellows (FNIVS) 6.3% are RSV while 6 of them have other qualifications at 37.5%. This implies that most of the respondents are competent professionals who are members of the Nigerian Institution of Estate Surveyors and Valuers and have registered to practice as practicing Estate Surveyors and Valuers. In view of this, their opinion and response can be adequately relied upon.

Table 3: Number of Office Properties Managed by Firms in the study area

Number	**Frequency**	**Percentage (%)**
1-5	9	56.3
6-10	7	43.8
11 – 15	-	-
16 and above	-	-
Total	***16***	***100.0***

Table 3 result shows that 56.3% of the firms have between 1-5 office properties been managed by their firms' while 43.8% of the firms have between 6-10 office properties been managed in the study area. This shows that majority of the respondents do manage one or more office properties in the study area.

Table 4: Type of Office Properties

Type	Frequency	Percentage (%)
Multi-tenanted office building	6	37.5
Converted residential building	8	50.0
Single tenant Office building	2	12.5
Total	*16*	*100*

This table reveals that most of the office properties managed by the Estate Firms located in the study areas are converted residential office properties which have the highest frequency of 8 representing 50.0% of the total number of firms. This result is in conformity with Oni et al (2011) which study reveals that multi-tenanted office properties which are usually purpose built but built with the intention of creating spaces for more than one tenant to use and usually built to generate more return and create more spaces. The single tenant office properties on the other hand are relatively small compared to the other two types with a frequency of 2 representing 12.5%.

Table 5: Tenant Selection Criteria employed by Estate Surveyors and Valuers

Criteria	**MU**	**U**	**LU**	**NU**	**Mean**	**Rank**
Ability to pay rent	14(75.5)	2(12.5)	-	--	3.88	1st
Ability and willingness to meet term of lease	-	11(68.8)	4(25.0)	1(6.3)	3.63	2nd
Provision of suitable referees	-	4(25.0)	8(50.0)	4(25.0)	3.44	3rd
Use of acquaintance request form	-	8(50.0)	5(31.3)	3(18.8)	3.31	4th
Conducting interview	-	3(18.8)	8(50.0)	5(31.3)	3.25	5th
Suitability of the tenant to the property	-	8(50.0)	7(43.8)	1(6.3)	3.06	6th
Client's preference	4 (25.0)	1(6.3)	10(62.5)	1(6.3)	3.00	7th
Credit worthiness	-	4(25.0)	4(25.0)	8(50.0)	2.88	8th

MU=Mostly Used, U=Used, LU=Less Used, NU=Not Used

Table 5 assesses the criteria employed by the Estate Surveyors and Valuers in selecting tenants for office properties in the study area. The result shows that ability to pay rent is a criterion that is mostly used by the Estate Surveyors and Valuers in selecting tenants which represents a mean score of 3.88 and ranked 1st. This is also in line with the findings of Ayinde, (2008) that the ability to pay rent is the most considered factor for selecting tenants to properties. Credit worthiness is the least used or employed as criteria for most of the Estate

Surveyors and Valuers with a mean score of 2.88 and ranked as 8th. Agagu (2007), though considered ability to pay rent as a significant factor, he also based it on the income earned by such tenant that is, ability to earn high income.

Table 6: The average time needed to affirm tenants' information before selection

Average time	Frequency	Percentage (%)
Immediately	10	62.5
1-3 weeks	4	25.0
1-3 months	1	6.3
Others	1	6.3
Total	***16***	***100.0***

Table 6 depicts the average time needed for the Estate Surveyor and Valuer to affirm tenants' background information before finally selecting as tenants. It shows that a tenant can be taken almost immediately after showing interest in the lease of such property as it has the highest number chosen by 10 representing 62.5%.

Table 7: Respondents Opinion on the occurrence of void, rate of vacancy and the level of demand for office properties

	Frequency	Percentage (%)
Vacant Spaces / occurrence of Void		
No	11	68.8
Yes	5	31.3
Total	***16***	***100.0***
Rate of Vacancy		
Very frequently	--	--
Frequently	3	18.7
Less frequent	5	31.3
Not at all	8	50.0
Total	***16***	***100.0***
Rate of Demand for Office Properties		
Very High	9	56.3
High	4	25.0
Low	2	12.5
Very Low	1	6.3
Total	***16***	***100.0***

Table 7 assesses the respondent's opinion on the occurrence of void, rate of vacancy and the level of demand for office properties in the study area. As presented in the table, the research revealed that most of the office properties are fully let with no vacancy representing 68.8% while 31.2% of office properties have some vacancies. The occurrence of void in relation to the rate of vacancy shows 50% of the respondents opine to lack of vacancy while 31.3% opine that rate of vacancies are less frequent. The rate of demand for office properties on the other hand in the study areas shows that the rate of demand is very high at 56.3%. These findings are in agreement with the findings of Agagu (2007) that the occurrence of void in office properties in Akure is less frequent and the occurrence of void period in office properties in the study area is very low; hence there is a high occupancy rate.

Table 8: Vacant Rate of Office Properties in the Selected Area

Selected Areas	Number of Office Properties	Number of spaces in the Office Properties	Vacant spaces
Oba Adesida	6	283	2
Oyemekun	7	185	7
TOTAL	***13***	***478***	***9***

The vacancy rate of some office properties within the study area are presented in table 8. The research revealed a total of four hundred and seventy-eight office spaces in the study area and about nine are vacant. The shows a high occupancy rate of 98.12% of office properties in the study area.

Table 9: Determinants of occupancy rate in Office Properties

Cause of void in Office Properties	Asymptotic Significance
High rent	.026**
Location	.000**
Condition of the property	.001**
Accessibility to the property	.000**
Quality of property	.953
Lack of security of life and property	.021**
Rent of similar or neighbouring office property	.220
Renovation of property	.128
Pollution	.270
Lack of adequate facilities i.e water, security, electricity e.t.c	.001**
Termination of lease	.002**

The result revealed that the asymptotic significance of the measured values for the causes of void/ low occupancy rate in office spaces in responses of respondents, seven variables which are high rent, location of the property, condition of the property, accessibility of the property, lack of security of life and property, lack of adequate facilities and termination of lease shows a significant difference in responses of the respondents at a significant level of less than 0.05. This implies that there is significant difference in response of the respondents. However, four variables quality of property, rent of similar or neighbouring office property, renovation of property and pollution reveals that there is no significant difference in responses of the respondents. This implies that there is no significant difference in responses of the respondents

CONCLUSION

The research has been able to show that most of the Estate Surveyors and Valuers make use of the ability to pay rent and willingness to meet term of lease as basic selection criterion. It was also gathered that high rent have been the major determinant of occupancy rate of office properties in the study area with little impact from other factors or causes such as adequate facilities available, security, pollution, location, tenant selection amongst others. The research recommends that Estate Surveyors and Valuers should consider basic selection criterion such as ability to pay rent and ability to meet lease obligations and ensure proper maintenance in other to keep the property in a tenantable condition which if not done may lead to deterioration and cause void in the long run.

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Value Profiling of End-Users' Housing Needs in Selected Housing Scheme in Kaduna State

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ABSTRACT

Housing is universally acknowledged as the second most essential human need after food and is a major economic asset in every nation. The study assessed the importance End-Users attach to their housing needs with a view to satisfying End-Users preference in housing delivery in Kaduna state, Nigeria. The research adopted a questionnaire survey to investigate a sample of occupants of the public housing units in Kaduna State. The population from which the samples were obtained is a 600 unit public housing scheme constructed in 2005 by Kaduna Sate Government. The housing scheme comprises three bedroom, two bedroom, two bedroom semi-detached and one bedroom units. A simple random sampling method, where each building type was given a number between 1 and 400, and the questionnaires were self-administered. Responses were requested on 5-point Linkert scale on factors obtained through an exploratory study and literature review. Four hundred questionnaires were distributed to respondents out of which 209 were completed and returned representing 52.25% returned rate and 47.75% were not returned. The data collected was analysed using Statistical Package for Social Sciences (SPSS) version 17.0. The results of the study were expressed in descriptive statistics namely: mean, frequencies, and percentages. The findings of the study suggest that the housing providers should meet the different segment of end-users. It is recommended that Housing providers should be aware of the important attributes of end-users' housing needs and expectations including incorporating them into design and housing provision(s).

Keywords: End-users, Expectations, Housing, Needs, Value profiling

INTRODUCTION

Housing represents one of the basic human needs and has profound impact on health, social interaction and general wellbeing of individuals and groups in any society (Mabogunje et al, 1978; Onibukun, 1998; Bayode, 2008). To most groups of people housing means shelter but to others it means more as it serves as one of the best indicators of a people's standard of living and their place in the society (Nubi, 2008). Housing is recognized world-wide as one of the basic necessities of life and a pre-requisite to the survival of man (Onibukun, 1983; Salau, 1990; United Nations, 1992; Ademuliyi, 2010).

According to a UNDP report in 2010, housing is a universal basic need and a key component of any nation's economy. Lack of it indicates one of the worst forms of poverty. Apart from its role in contributing to the Gross Domestic Product, it is an important contributor to the generation of employment, poverty reduction and promotion of social being. Despite numerous government intervention, policies and programmes towards remedying the worsening housing problem in Nigeria the dearth of housing has persisted unabated (Anunike, 2011).

Ogunsemi (2002) observed that housing shortages have been a recurring problem to the general public in Nigeria. This has been attributed to failure of various government efforts to adequately gauge the needs of those who end up using the products. Daramola (2004) made

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similar observation to the effect that design of government houses start and ends only with the Federal/State agencies and with little or no involvement of end-users. The end-users' habits, tradition and requirements are hardly captured or reflected in the briefing during the design development process. This reflects in the end products that do not adequately meet end-users' needs and expectations (Othman, 2008; Adellatif and Othman, 2006; Carroll, 2007). The result of which is the lack of interest or outright rejection of the products by the end users thus sustaining the dire need for the right housing types. Othman (2008) found that users who accept the facility usually rent out or sell it. Those who use the products often adopt/adapt them to meet their needs and to accommodate their activities. While selling or renting out the unsatisfactory products sustain housing needs in a country, adapting them constitute economic waste. The process of adaptation involve removing unwanted or replacing undesired items; it may include expansion or contraction of spaces by demolition or rebuilding certain areas. All these waste can be saved by reflecting/capturing user value requirements in the design and construction.

In line with this, the following questions are asked:

i. What are the housing needs and expectations of end-users in selected housing scheme in Kaduna?
ii. What importance do end-users attach to their various housing needs and expectations?
iii. How satisfied are end-users with the housing products made available by the providers?
iv. Do they have their preferences in terms of what should be provided?

These questions pose problems in defining end-users needs and expectations at the design stage of housing schemes.

Statement of the Problem

The dearth of adequate housing in Nigeria has persisted despite efforts by the Government and developers. The generic problem is the neglect to put users' needs into consideration in the design and construction of housing projects. Users therefore often fail to use the product for the purpose of which they are constructed. This has led to persistent need for housing in Nigeria. If design will meet the expectation of users, the product will be put to right use and the need for housing will be solved. It is unclear what the end-users' needs and requirements from housing are in Nigeria.

Aim and Objectives

Aim

This research aims to assess the importance end-users attach to their housing needs with a view to satisfy End-User preference in housing delivery in Nigeria using the housing schemes in Kaduna State.

Objectives

i. To identify End-Users' housing needs and expectations prior to implementation of housing projects in selected housing schemes in Kaduna State.
ii. To assess End-Users' needs and expectations in selected housing schemes in Kaduna State.
iii. To evaluate the importance housing End-Users' attached to their housing needs and expectations in selected housing schemes in Kaduna State.

LITERATURE REVIEW

Housing

Housing has been described by Boarne (1981) and Daramola (2004) as a package of bundle of services which include the consumption of neighbourhood services (parks, school(s), a location (accessibility to jobs and amenities) and the proximity of certain types of neighbours (a social environment). Olotuah (2005), and Isa and Jusan (2012) define housing as building structure that accommodate people and that meets their shelter and social needs. These definitions imply that beyond the physical structure, housing encompasses the immediate environment, sanitation, drainage, recreational facilities and all other economic and social activities that make life worthwhile.

Value Profiling

Calder et al (1999) observed that Value Profiling is a less-developed concept, which has started to attract the attention of research community. The study's approach to value profiling is described as defined by Dallas (2006), "Method articulating a Client's value expectations" Adopting this definition this study attempts to articulate the End-Users' Valued expectations regarding their housing needs.

According to Wandhal *et al,* (2007) value is a central component for participants in building projects. To the client, value is what he receives in terms of design, usability and quality commensurate with the amount of money he spends. To the contractor, the architect and other consultants value is to contribute to the fulfillment of the client's requirement in such an efficient manner.

End User Satisfaction Evaluation Criteria

Using value management evaluation criteria can help to improve building performance while contributing to user satisfaction. Post-occupancy Evaluation (POE), a well established building performance evaluation approach, attempts to provide a link between building production and use by employing the use of occupants' feedback mechanism (Ilesanmi 2010, Hendrickson and Wittman 2010). Hence end-user satisfaction although subjective, must be brought to bear in order to harmonise values of all stakeholders in housing production and use. In developed countries this provision is made, through regulatory frameworks requiring housing producers to establish user requirement by incorporating them at decision making stages, thereby producing tenant involvement statement to the appropriate regulatory agency as a means of verifying their commitment in ensuring user satisfaction in product delivery (HouseMark Report, 2010)

End-user' satisfaction is a subjective and multidimensional concept. Studies on end-user' satisfaction evaluation of public housing programmes, emphasize the need to identify what works well and what does not; as well as consequent impact of such programmes on the life of beneficiaries and surrounding. For the end- users, evaluation is essential in determining their environment against an image of what they would like it to be. The evaluative pattern is primarily influenced by objective and subjective factors (Ilesanmi 2010, Ibem and Amole, 2010). Studies carried out end-users satisfaction in housing indicate that user satisfaction had little impact on improvement in design and implementation input. Desired value in the construction industry is derived from different stakeholders by identifying opportunities and exploring them to attain housing delivery objective considering every stakeholder's role in the process (Kowaltowski and Granja 2011). However, there seems to be lack of effective integration of client value system and end user satisfaction generally. Although both aspects of value contain objective and subjective elements, their evaluation criteria differ and are measured by differing parameters hence achieving client value system cannot automatically translate to achieving user satisfaction. Evaluation by actual building users is important for

design improvement therefore if innovations must be achieved in housing projects, user contribution must be sought from conception of any (Ilesanmi 2010). Liu (1999) recommended that residential buildings should not only be fit for the purpose of the users but must be able to perform functions relative to resident's satisfaction.

Mass Housing Development for Kaduna State Civil Servants

Mass housing is aimed at providing large quantity of houses for the populace who do not own a house and majority of the mass housing schemes are located within the state capitals in Nigeria. Mass housing is often viewed as the only way through which low income earning population of an urban centre can own a house by installment payments. It has been observed that the houses oftentimes do not get to the proposed house owner because the housing process did not start by identifying them (Adedayo, 2012). According to Kabir and Bustani (2008), the 3rd National Development plan of 1975-1980 showed how government tried to provide houses in large quantities throughout the country regardless of location, climate and culture. This same practice according to Arbigbola (2008) was continued in National Housing Policies of 2002. The practice of providing same house type around the country has been suggested as a major reason for the failure of the policies. It can be assumed that the realization of the failure of the policies led the government to call for the private sector to play active role in mass housing provision (Adedayo, 2012).

METHODOLOGY

The research adopted questionnaire survey to investigate a sample of occupants of the public housing units in Kaduna State. The questionnaire was designed to seek information from the occupants of housing units who for the purpose of this research are considered as the End-Users.

The population from which the samples were obtained is a 600 unit public housing scheme constructed in 2005 by the Kaduna Sate government. The housing scheme comprises three bedroom, two bedroom, two bedroom semi-detached and one bedroom units located in Malali, Narayi, Unguwar Baro, Kurmin Mashi, Kawo, Unguwar Mu'azu areas within Kaduna Metropolis, Kafanchan and Zaria. A simple random sampling method where each building type was given a number between 1 and 400. The questionnaires were self-administered.

Responses were requested on 5-point Linkert scale (5-Very important; 1-Not Important) on factors obtained through an exploratory study, and literature review. Four hundred questionnaires were distributed to respondents out of which 209 were completed and returned representing 52.25% returned rate and 47.75% were not returned. The questionnaires were in two parts: Part A is general information about the location of the respondents and Part B is assessing Users' needs and satisfactions. According to Burns and Grove (2007) data analysis is a technique used to reduce, organize, and to give meaning to the data. The data collected was analysed using Statistical Package for Social Sciences (SPSS) version 17.0. The results of this study were expressed in descriptive statistics namely: mean, frequencies, and percentages.

The main focus of this study is to collate the value profiling of end-users housing needs in selected housing scheme of Kaduna State with a view to improving housing delivery for medium income public servants from Grade Levels 08- Grade Levels 12 in Kaduna state. The Housing schemes were occupied by low income Gl. 01-Gl.07, medium income from Gl.08-Gl.12 and high income form Gl.13 and above. However, Gl.08 -Gl.12 was the most prevalent in the houses occupied. Dwelling features preferences were examined by analysing the

distribution of responses to the questions eliciting the respondents' preferences for the housing profiles included in the surveys.

FINDINGS AND DISCUSSIONS

Four hundred questionnaires were distributed to respondents out of which 209 were completed and returned representing 52.25% returned rate and percentage used in analysis. The essence of the analysis was to provide answers to the questions raised in this study and to enable the research draw inferences on the population of the study.

Analysis of Demographic Data of Respondents

Table 1 Respondents' Residence

Location	Frequency	Percent
Narayi H/cost	23	11.0
Unguwar baro	19	9.1
Kurmin mashi	118	56.5
Kawo	49	23.4
Total	209	100.0

The above table shows that more than half (i.e., 118 respondents representing 56.5%) of the respondents who participated in this study were from Kurmin Mashi. 49 respondents representing 23.4% of the total number of participants were from Kawo. Narayi and Unguwar Baro had 23 (11%) and 19 (9.1%) respectively.

Analysis of Research Questions

Four research questions were asked in this study and the essence of these questions were to give this study a direction and guide. Therefore, in this section, answers to those questions were provided and the results presented below in tabular form.

Table 2 Housing Needs of End-Users

S/n	Housing & expectations	Mean	Std. Dev.	Rank
1	3bedroom	4.82	.407	1
2	4bedroom	4.61	.543	2
3	4bedroom semi-detached	4.55	.777	3
4	3bedroom semi-detached	4.39	.546	4
5	2bedroom semi-detached	3.73	1.237	5
6	1bedroom semi-detached	3.11	1.159	6
7	2bedroom self-contained	2.94	1.277	7
8	1bedroom self-contained	2.05	1.316	8

The above table shows descriptive analysis which was carried out to find out the type of End-Users housing needs and expectations. The result revealed the mean response of the items in order of most prevalent expectations and needs of End-Users are as follows: 3 bedroom, 4 bedroom, 4 bedroom semi-detached, 3 bedroom semi-detached, and 2 bedroom semi-detached, 1 bedroom semi-detached, 2 bedroom self-contained, and 1 bedroom self-contained. This indicates also the consideration of the size of the family. Those with large family size will prefer the 3-bedroom and 4-bedrooms.

The above table shows a descriptive analysis which was carried out to find out the level of importance End-Users attach to their housing needs with regards to the dwelling unit features, ventilation of house, and finishes. The analysis shows the ranking of the items in order of importance. It was found that end-users attached high level of importance Dwelling Unit Features. To the End-Users, Living area with a mean of 4.82 and rank 1 is very important. Closely followed is Children's bedroom and wall tiles (toilet/bathrooms) with a mean of 4.65 and rank 1 and 3 respectively, Master bedroom with a mean of 4.64. Next is Dining space 4.56, Ceiling 4.55, Kitchen/store 4.50, Floor tiles 4.46, Shower/bathtub 4.37, Visitors' bedroom 4.26, Aluminium sliding windows 4.24, Toilet in every room 4.20, Plaster/painted walls 4.19, Aluminium projected windows 4.08, open courtyard 4.00, Sliding doors 3.89,

steel doors 3.85, aluminium casement windows 3.85, Steel projected windows 3.79, Tropical steel windows 3.72, Kitchen 3.76, casement doors 3.64, entrance verandah 3.61, Visitors convenience 3.598, steel casement windows 3.547, were found to be significantly important to end-user. While the result shows also that cement floor only 3.38, shower only 3.04, bathtub only 2.98, other dependents bedroom 2.95, Small Zaure (ante-room) 2.86 which has cultural and religious values of the respondents and toilet shared by some rooms 2.70 are least important to the End-Users.

Table 3 Importance rating of end-users' various housing needs and expectation

MEDIUM INCOME EARNERS			
	Mean	Std Deviation	Rank
Living Area	4.83	.378	1
Wall Tiles (Toilet/Bathrooms)	4.65	.922	2
Children's Bedroom	4.65	.530	3
Master Bedroom	4.64	.499	4
Dining Space	4.56	.674	5
Ceiling	4.55	.579	6
Kitchen/Store	4.50	.783	7
Floor Tiles	4.46	.924	8
Shower/Bath Tube	4.37	.868	9
Visitors Bedroom	4.26	.986	10
Aluminum Sliding Windows	4.25	1.024	11
Toilet In Every Room	4.21	.969	12
Plaster/Painted Walls	4.20	1.205	13
Aluminum Projected Windows	4.09	.856	14
Open Courtyard	4.01	1.199	15
Sliding Doors	3.89	1.271	16
Steel Doors	3.85	1.116	17
Aluminum Casement Windows	3.85	.924	18
Steel Projected Windows	3.77	.740	19
Kitchen	3.76	1.149	20
Tropical Steel Windows	3.72	.972	21
Casement Doors	3.64	1.199	22
Entrance Verandah	3.61	1.265	23
Visitors Convenience (Toilet)	3.59	1.468	24
Steel Casement Windows	3.55	.995	25
Cement Floor Only	3.38	1.292	26
Shower Only	3.04	1.328	27
Bath Tub Only	2.98	1.408	28
Other Dependents Bedroom	2.95	1.680	29
Small Zaure (Ante-Room)	2.86	1.541	30
Toilet Shared By Some Rooms	2.70	1.593	31

Table 4: Importance rating of end-users' various housing needs and expectation

MEDIUM INCOME EARNERS			
Variable	**Mean**	**Std Deviation**	**Rank**
Passage	4.79	.41	1
Water supply	4.77	.42	2
Parking space	4.74	.43	3
Distance to market	4.71	.55	4
Distance to work place	4.70	.59	5
Refuse collection point	4.69	.64	6
Security control	4.65	.57	7
Rain water	4.61	.62	8
Electricity supply	4.60	.50	9
Sewage chambers	4.59	.49	10
Noise level (quite)	4.56	.81	11
Distance to school	4.56	.95	12
Landscaping	4.54	.56	13
Perimeter road	4.53	.74	14
Distance to hospital	4.25	1.33	15
Distance to worship places	2.68	1.65	16

The above table shows descriptive analyses which was carried out to find out the how much importance end-users attach to their housing needs with regards to the dwelling unit features, drainages, social environment, and services. The analysis shows the mean response of the items in order of importance as perceived by respondents. It was found that end-users attached high level of importance to household features. To the end-users medium income earners, dwelling unit features such as passage, parking space, refuse collection points; perimeter road and lastly landscaping are of utmost importance to them. On drainages, the respondents considered rain water and sewage chambers as very important to them. Of most important to the respondents on social environment is distance to market and work place followed by the noise level, security and distance to school. Of least importance to the end user on social environment is distance to places of worship. Respondents also reported that social services such as water supply and electricity are very important. Generally, out of all the 16 features listed, respondents attached higher value to passage, distance to market and workplace, and water supply.

Table 5 Satisfaction Rating of End-Users' Housing Product

MEDIUM INCOME EARNERS			
Variable	**Mean**	**Std. Deviation**	**Rank**
Painting and decorating	2.52	1.21	1
Type of doors	2.41	1.28	2
Type of windows	2.36	1.18	3
Drainages/parking	2.11	.79	4
No of bathrooms	2.10	1.25	5
Size of toilets	1.87	.87	6
No of rooms	1.85	1.14	7
Size of rooms	1.79	1.09	8
Ceiling	1.79	.72	9

The table above is a descriptive analysis carried out to assess the level of end-users satisfaction with regards to housing products made available by the provider. The result revealed that end-users were not very satisfied with virtually all the housing products made available by the provider. In order of dissatisfaction, the end-users appear highly displeased with the number and size of rooms, size of toilets and the ceiling. They also reported that they are dissatisfied with type of door, number of bathrooms, type of windows, drainages/parking and even the painting and decoration. By this outcome, it appears much work still need to be done to improve the housing products made available to the end users by the providers in Kaduna state.

Table 6 Preferences of end-users' of housing provision

Variable	**Rank**
Increase in no rooms	1
Increase in size of rooms	2
Consider building location	3
Type of Doors	4
Increase in no of bathrooms/toilets	5
Consider family size	6
Increase in size of Toilets	7
Types of Windows	8
Consider Grade level	9
Drainage/parking etc.	10

The above table shows the mean scores of end-users preferences in term of what should be provided by providers. In order of preference, the result revealed that end-users preferred the number of rooms, followed by the size of the rooms, building location, Type of doors,

increase in number of bathroom/toilets. In general, the end users reveal higher preference to number and size of rooms and less preference drainage/parking space and grade level. This therefore implies that in order to improve end users satisfactions, the needs such as number and size of room must be met.

CONCLUSION/RECOMMENDATION

The result reveals that end-users most prevalent expectations and housing needs are the 3 bedroom and 4 bedrooms.

The end-users attached high level of importance to household features such as living areas, children's bedroom and of least importance is distance to worship place.

The end-users were not satisfied with virtually all the housing products made available by the provider. They were also highly dissatisfied with the number and sizes of rooms.

They also reported that they are dissatisfied with type of door, number of bathrooms, type of windows, drainages/parking and even the painting and decoration

In general, the end users reveal higher preference to number and size of rooms and less preference drainage/parking space and grade level. This therefore implies that in order to improve end users satisfactions, the needs such as number and size of room must be met.

The study bring to fore the need for housing providers to be aware of the important attributes of End-Users' housing needs and expectations including incorporating them into design and housing provision(s)

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Property Manager's Perceptions on the Ondo State Land Use Charge Law, 2014

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ABSTRACT

The passing of the bill on land use charge into law in the mid- year 2014 has diverse reactions from the professionals in the built environment as well as the property owners within the state capital where its implementation is to take-off. The new law tagged: Ondo State Land Use Charge Law, 2014 has combined all the land based rates and charges previously in the State. A number of issues were identified at the point of implementation of the land use charge law. Hence, this study analyzes the perception of the property managers within the city on the contents of the law, the composition of the members to execute it and the method of assessing the chargeable value on the properties. This is a survey which elicits data from the practicing Estate Surveyors and Valuers through a structured questionnaire on the Land Use Charge and descriptive statistics is employed to present the findings. The result reveals among others that the composition of membership is grossly inadequate and the basis of assessment of chargeable tax under the stipulated law is faulty. The study recommends the inclusion of all stakeholders (practicing Estate surveyors and Valuers, Land surveyors and the Property owners) in the implementation of the law. This will go a long way to have an agreed and appropriate basis of assessment thereby ensuring a problem free property tax administration in Ondo State, Nigeria.

Keywords: Estate Surveyors and Valuers, Land Use Charge, Law, Ondo State, Perception

INTRODUCTION

The dwindling revenue allocation from the Federal government has made various state governments seek an alternative means of improving state internally generated revenues through property tax in order to face the challenge of providing infrastructural facilities (Oni and Ajayi, 2011). According to Tesfay (2008) the responsibility of providing infrastructure at all levels rest on Government. This has however posed a great challenge to Governments. The attempt to resolve this gave birth to the advent of Land Use Charge in Nigeria. The first in its series was the enactment of Land Use Charge Law by the Lagos state government on 22nd June, 2001. The justification for this as pointed out by Oserogho (2002) was to generate further revenue required to develop the state as it is faced with increasing population without corresponding increase and developments. Provision of basic facilities will according to Tesfay (2008) afford cities an effective requirement for national development. Though the initiation of the Land Use Charge meant well as it was anticipated to assist rapid provision of infrastructures, harmonize some property tax and ease the problem of multiple taxes. However, the implementation of the tax law in spite of its significance was faced with myriad of challenges as avowed by Oni (2009).

Similarly, in the context of Ondo state, on 14th March, 2014 the Land Charges Bill was passed into law. The objective is to model a consolidated land charges reasonable and affordable to the citizens in order to enable the state government discharge its responsibility of providing basic facilities and make life more meaningful to the citizens. In spite of the importance of the main aim of the enactment of the Ondo State Land Use Charge law, a number of issues arise at the peak of the implementation of the provisions of the law just as experienced in Lagos as affirmed by Oni (2010). This among many others include non-

Oladapo, R. A. & Ige, V. O. (2016). Property Manager's Perceptions on the Ondo State Land Use Charge Law, 2014. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 693-698

involvement of professionals on land matters, non-sensitization of property owners, non-clarification on method of assessment, determination of taxable property, reasonable approach of levying the tax and the view that local government constitutional role was eroded. To tackle these issues, this paper examined the perceptions of estate surveyors and valuers who are core professionals on land related issues.

LITERATURE REVIEW

Concept of Taxation

Tax is defined by Ogbuefi (2004) as is a compulsory monetary charge imposed by government on persons, entities, transactions, or properties to yield public revenue. This includes all governmental impositions on individual, corporate organizations and real property. Oni and Ajayi (2011) explained further that taxation is an essential part of contemporary economic systems worldwide, with array of diverse tax models. According to Newell, (1977), Emeni, (2000), Thacker, (2009) and Olusegun, (2003) a tax must be fair, equitable, politically acceptable to the payers, simple and clearly understandable, its administration must not be expensive and must be a good stabilizer. The basis of assessment as avowed by Harvey (2000) should therefore be open market value of a property while the method of tax assessment is on the net annual value of the assessed property. The economic consequence of tax is that there will be long term effect on open market price as it increases if there is higher demand. Equally, if the outgoings in form of tax liability are higher the rent demand by the landlord will be higher on the long run (Lean and Goodall 1977). Also in the short run the tax liability will be borne by landlords as the stock of rented houses is fixed and in the long run supply of houses is more elastic (Harvey 2000).

General overview of the Land Use Charge Law

Land use charge is a form of property tax (Harvey, 2000). Newell, (1977) and Oni (2009), described land use charge as a form of taxation with the objective of financing public spending within the framework of economic objectives of government. The land use charge law was first introduced into Nigeria system of property taxation by the Lagos state Government in order to strengthen its revenue base. The tax charged under the law is called the Land use charge and recognized as Land Use Charge Law Cap. L 61, Laws of Lagos State of Nigeria 2003. It is clearly an improved version of tenement rate, the main objective of the law as stated in the preamble is to consolidate taxes and rates hitherto payable under the land rates law, the neighborhood improvement charge law and tenement rate (Oni 2009). Oni (2009) stressed the importance of Land Use Charge as the means through which State Government raise revenue for maintaining existing infrastructure and providing new ones. This should also be fair to the citizens to avoid hostility and enable government discharge its duties to the public. Infrastructure is crucial for the functioning of communities (Oni 2009). Thus, for national development to be achieved, good infrastructure that affects all sectors is required. Apart from aiding government in generating additional revenue for the provision of infrastructures, Land Use Charge will according to Oserogho (2002) drastically help reduce problem of multiple taxes.

Certain Provisions of the Land Use Charge Law in Ondo State

The situation in Ondo State is a replica of that of Lagos with little disparities in their respective Land Use Charge Laws. The Chairman of the Board of Internal Revenue (BIR) is by Section 5(1)-(3) of the Ondo State Land Use Charge Law empowered to undertake or cause to be undertaken an assessment of chargeable properties subject to the advice of the commissioner for Lands and Housing in such areas of the state as the Governor may designate. In Lagos the Commissioner of Finance is by Law empowered to undertake or cause to be undertaken an assessment of chargeable properties in such areas as may be

designated (Oni and Ajayi 2011). In Section 5 (1) of the of the Lagos state Land Use Charge law, the formula for determining the annual amount payable is stated while in Ondo state the formula for calculating the rate was not stated but was to be determined by qualified Estate Surveyor based on the prototype properties across board for identical structures (Section 7(3) of the Ondo state land use charge law). On the contrary, Oni (2010) opined that the statutory supposition that all properties are homogenous was wrong as no two properties are the same in terms of specific location, road network, accessibility, demand and supply, and state of repair. The law as well negates the uniqueness of each property.

Like the Lagos State Land Use Charge, properties that are exempted from the Ondo state land use charge law according to Section 9 (a-h) include those that are owned, occupied and used by religious bodies exclusively for public worship or religious education, public library, non-profit making cemetery or burial grounds, public parks, diplomatic premises and real property used strictly by public institutions for learning or education. Having considered the relative importance of the Land Use Charge law and part of its provisions, there is need to also see the success of its implementation. According to Oni (2009), for instance, the execution of the law in Lagos State was faced with numerous hitches. This includes the long-run effects of the provisions of the law on the open market values of affected properties and the fair and reasonable basis for calculating the charge. In determining the Land Use Charge, the capital value basis is considered inappropriate while the investment method has however been stated to be appropriate basis by considering the open market rental value per annum after deducting the outgoings and appropriate rate per naira applied. The implication of charging LUC on capital value is that the landlord is made to sell his property annually. The Land Use Charge Law that has been in operation for barely more than a decade ago in Lagos State has been found to be subject of criticisms and litigations from diverse stakeholders (Akinsanya and Oladapo, 2015). Hence, there is need for Ondo State Government to take caution and resolve all controversial areas of the Law before implementation.

METHODOLOGY

The study adopted the survey research design. The motivation for this study stems from the observation on comments from the masses on the introduction of Land Use Charge in Ondo State with its attendant challenges. A closed-ended questionnaires were randomly distributed to the 25 private Estate Surveying and Valuation organisations in the study area. Twenty (20) of the questionnaires (80%) were returned on time. The purpose of the questionnaire was to obtain their opinion on the Land Use Charge Law and the determination of the appropriate methods of assessment. The data gathered from the survey was placed on a five point Likert scale (Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, strongly Disagree = 1) and was analyzed using descriptive statistical techniques.

FINDINGS AND DISCUSSIONS

Table 1 shows that majority of the respondents established their firms between 6-10 years ago. This implies that a reasonable result would be obtained considering their experience on rating exercise coupled with management of ratable properties. The significant level of their academic qualifications portrays a reasonable justification of the study as they are not novice on property tax issues.

When asked about the most appropriate method of assessment, the respondents strongly agree and agree that the investment method approach is the most suitable, which was evident from the mean score of 4.70. Ajayi (1998), Harvey (2000), Oni (2009) and Oni (2010) also emphasized that the net annual rental value basis is appropriate.

Table 1: The Main Characteristics of the Respondent

	Frequency	Percent
Year of Establishment		
1-5 years	7	35
6-10years	10	50
11-15 years	3	15
Total	20	100
Status of Respondents		
Principal partner	2	10
Partner	5	25
Branch manager	7	35
Senior Estate officer	6	30
Total	20	100
Academic Qualification		
HND only	4	20
B.Sc/B.Tech	14	70
B.Sc/B.Tech/ANIVS	2	10
Total	20	100
Years of Experience		
1-5 years	7	40
6-10years	8	35
11-15 years	5	25
Total	20	100

Table 2: Determination of the appropriate methods

Method	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Rank
Investment Approach	14	6	0	0	0	4.70	1st
Contractor's Methods	1	11	6	2	0	3.75	2nd
Profit Methods	0	11	5	4	0	3.25	3rd
Market Approach	0	6	10	4	0	3.00	4th

Table 3: Perceptions of Property Managers on the Land Use Charge Law

S/N	Property Manager's Perceptions	Mean	Rank
1.	Similar past laws have not been properly utilized	4.00	1st
2.	Property exempted are adequate	3.90	2nd
3.	Law will increase rate of default	3.30	3rd
4.	The new Tax is not Additional Burden	3.25	4th
5.	Land Use Charge Law will Reduce / Prevent Tax Invasion	2.95	5th
6.	Law will Cause upward review of rent	2.55	6th
7.	The Composition of Admin is Adequate	2.20	7th
8.	Assessment method is straight forward	1.75	8th

The aftermath implication of the existence of the Land use charge law in Ondo state was shown in Table 3. Though the tax was designed to consolidate all other property tax, if the objective is meant to be achieved the above stated perceptions of Professional Property Managers may affect the success rate of the law. Starting from the lowest mean of 1.75, which shows that the assessment method is not straight forward, similarly, the administrative composition which is ranked with a mean of 2.20 indicates inadequacy of the administrative composition. The highest mean on the table is 4.00, which shows that similar past laws have not been properly utilized, while the second in rank mean with 3.90 indicates that property exempted are adequate.

CONCLUSION

The Ondo State Land Use Charge law was conceived in utmost good faith, adopted, as it was in Lagos where it had been tested. It has being a very good initiative meant to increase internally generated revenue in order to provide basic infrastructural facilities for the citizens. The biggest challenge however was at the implementation of the law just as similar past laws. As it was faced with numerous difficulties; ranging from non-involvement of professionals on land matters, non-sensitization of property owners, non-clarification on method of assessment, determination of taxable property, among others. The survey of property manager's in Ondo State, Nigeria was carried out with specific attention on their perception of the land use charge law. The study found out that the most appropriate method in arriving at chargeable fee is using the investment method of valuation that considers net annual rental income. It was also observed that the administrative composition in charge of the law is inadequate. Hence, to ensure a problem free property tax administration, appropriate basis of assessment should be used. Ondo state should also be made more investment friendly so as not to give the impression that government is on the ploy of taking over property rights of the citizens.

In view of this, the following recommendations are made based on the researchers' findings:

i. The government should amend the law and not sideline the contribution of the relevant professionals such as Estate surveyors and valuers.
ii. The so called ghost formula for arriving at the charge is not recognized and alien to the real estate profession. Hence, it should be abolished and, and the service of Estate surveyors and valuers is required in determining chargeable tax based on the appropriate method of valuation.
iii. The composition of the administration of the land use charge is incomplete if the service of professional property manager was not sought. Estate surveyors are the property manager; hence, with their cordial relationship with property owners, they would be helpful collection/payment of the levy.
iv. Funds generated should be channeled to socio-economic development of the dwellers. This will rescind the assertion that Similar past laws are not been properly utilized

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Impact of the Federal University of Technology, Akure on Residential Property Values in Akure, Nigeria

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ABSTRACT

The paper examines the impact of the Federal University of Technology Akure (FUTA) on rental values of residential properties. For the study, properties between 5 meters to 1000 meters to the University were considered. Structured questionnaire were administered to 251 tenants occupying residential properties in the area out of which 176 were retrieved for analysis representing 70.1% response rate. The data collected were analysed using Descriptive Statistics and Simple Linear Regression Analysis. The Descriptive Statistics was used to analyse the socio – economic characteristics of the respondents while the Simple Linear Regression Analysis was used to determine the impact produced by the presence of the University on rental values of residential properties. The result reveals that greater number of the student population resides off campus and rents are higher for properties in close proximity to the University. This study therefore, recommends that government should build more hostel accommodation inside the University. Also, the University authority should encourage Public Private Partnership in hostel provision. If this is done, many of the student population will move into campus and this will reduce the pressure in the housing market thereby reducing rental value of residential properties.

Keywords: Residential Property Values, Population, University

INTRODUCTION

In recent time the Nigeria government has shown strong commitment to growth in higher education sector by the establishment of more institutions especially Universities and the liberalization of its ownership. It has the biggest University system in Sub-Sahara Africa with 114 accredited tertiary institutions (Alithei, 2012). Despite this, there is a surge in student's population which has not been matched by a corresponding growth in student accommodation. Hence Alithei (2012) noted that the student's enrolment in tertiary institutions is growing at an average of 12% per annum and the provision of new purpose – built student housing is limited.

Students housing being one of the basic student needs is an aspect of the development economics and therefore, of topical interest to all sectors of all societies. Although, it is regarded as an aspect of pupil personnel management in education and thus not directly in the primary assignments of educational administrators with respect to instruction, it is basically true that academic performance must necessarily be influenced by the quality and quantity of the residential accommodation (an aspect of the learning environment) of the students (Oyetunji, 2014). Unfortunately, in Nigeria not much attention is placed in providing students accommodation on campus especially in Nigeria.

The Federal University of Technology Akure was established in 1982. It operates the dual – residential accommodation system where some of the students (especially the first year and the final year students) are accommodated while others are made to seek accommodation

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elsewhere around the institution. As a result of this, majority of the university population take solace in the rental market for alternative accommodation. The demand for housing has resulted in the establishment of niche marker because student's market especially appears to be robust. Hence, Peacocke (1999) opined that the major characteristics of students demand is that it monopolizes the market thereby reducing supply to other tenant groups. The result of this is a sharp increase in rent since the available housing accommodation even in the rental market is not enough to meet the demand.

In the past, houses were completed by landlords or property investors, but today, students struggle to make payment even when such accommodation are yet to be completed. The landlords and investors exploit this situation and rents are arbitrary fixed and outrageous. Therefore, this study aims to investigate the impact of the Federal University of Technology, Akure on the rental values of neighbouring residential properties. The paper is organized as follows. The next section (section 2) deals with the university location and neighbouring residential property rental values. This is followed by discussion of the research method employed in section 3 with the results presented and analysed in section 4. The paper concludes with summary of findings, recommendation and conclusion in section 5.

University Location and Neighbouring Residential Property Rental Values

Historically in Nigeria, majority of universities were located at the community outskirts so as to create conducive environment for learning; less difficulty in getting required land size and the minimum financial implication attached. However, these Universities including the Federal University of Technology, Akure have enjoyed circumferential expansion in their neighborhoods primarily because of the functions they perform. The presence of a university in an area may initiate the transformation of the entire neighbourhood through the action of development, regenerating houses in order to attract students, staff, and those providing support services to live (Perry and Wiewel, 2005). Also, universities can function completely apart from the surrounding neighborhoods, ignoring social problems (Anamaria and Melchior, 2007).

Universities and colleges primarily acquire land and structures that support their core mission or immediate growth demands, it is however not uncommon for surrounding communities to criticize universities for their unresponsive development policies or lack of a plan to mitigate negative spillover effects. For neighbourhood residents, some of the major concerns relate to quality of life issues, such as conversion of houses and other buildings to student occupancy; upward pressure on rents; adaptation of shops and facilities to student markets; and increase in traffic, noise, and parking problems (Harasta, 2008). In spite of these Vandergrift, Lockshiss and Lahr (2009) noted that university can provide culture, high technology, recreational facilities, open space, sporting facilities, and fun. A university campus is often the focal point of a municipality. Green areas, water bodies, and open space are all common on campuses. Thus, through higher demand for this unique confluence of amenities, a campus itself may cause house prices to be 10% higher (Vandegrift et al 2009).

Haurin and Brasington (1996) employed the hedonic price model that includes an accessibility index, arts index, population growth index, and recreation index among several other house characteristic variables. Distance to a central business district was positive, but

not statistically significant. The four indices used were all statistically significant except the population growth rate index. This suggests that housing prices within towns that provide arts and recreation increase due to the amenity value present. Since college towns are well known for providing such value to those who are not enrolled, it is hypothesized that housing prices in University towns should be higher due to the availability of recreation and arts.

Hayes and Taylor (1996) examined the extent to which school quality as a location characteristic influences property values in Dallas using hedonic model of property values. They noted that some homebuyers are not only cognizant of differences in school quality but also have revealed their preferences for higher quality schools by paying a premium for their home. Their analysis suggests that this premium for school quality can be among the most important determinants of housing prices. Not all school characteristics appear to be indicators of school quality, however. There was no evidence found that homebuyers are willing to pay for changes in school expenditures or student body characteristics. Evidence was found that the school characteristic for which homebuyers pay a premium is the same characteristic that economists associate with school quality, namely, the marginal effect of the school on student performance. Also, the study of Bradbury, Mayer and Case (1997) used repeat sales analysis to look at the relationship between changes in school quality and changes in house prices in 208 cities and towns in Massachusetts. Percentage changes in house prices between 1990 and 1994 for these 208 cities and towns were regressed on the change in per-pupil operative spending relative to the optimum level of spending, the combined test scores in 1990. The result of Bradbury et al shows that both school quality measures were significant like in the study of Hayes and Taylor (1996), but the study differs in that Elimentary School was the focus.

Shigeru, Hiroshi and Qiang (1999) carried out a study on the effects of University of Kansas on residential house values by using non-parametric assessment. Geographical information system ‘overlay’ and ‘near’ was used to determine the distance of each household to the institution. 6,415 residential sales were analysed. The study found out that house adjacent to the university values more than 40% higher than the comparable house located 2000 meters or more away from it. It was also found out that as the distance to the University gets large, such effects initially declines rapidly and then in a more moderate pace. The study further found out that the reason for the university effect to disappear around 1800 meters is that the walking distance of 20 minutes is the maximum an average person will choose to commute on foot. This view was supported by Owusu – Edusei, Espey and Lin (2007) study that there is a positive value associated with proximity location to schools and a negative value associated with greater than average distance from schools.

Janmaat (2007) carried out a study on the factors affecting residential property rental values in a small historic Canadian University town and found out that view and average sound level were not statistically related to home price. Peak sound level is priced with one decibel increase reducing the average house price by 2%. The study also revealed that given the high population of student tenants in Wolfville, tenants are unlikely to live in areas zoned single family residential; these results suggest that rental externalities - either due to student tenants or landlord practices – are having a strong negative impact on rental values.

Ankeli (2007) carried out a study on the impact of tertiary institutions on residential property values in the Federal Polytechnic, Ede and found out that the establishment of the polytechnic led to the influx of people into the town, thereby, making the residential property market subsector experience a moderate increase in rental values between 1994 and 1997. Another slight increase was also experienced between 1998 and 1999 and the highest rental increment was observed between 2001 and 2005. However, tenement properties close to the Polytechnic experienced the highest rental growth rate.

Anamaria and Melchior (2007) in the study carried out on the impact produced by the presence of university campuses on land and property values using the Hedonic Model and found out that in the immediate area of influence (a radius of 1km from the campus) of the two campuses studied, land and property values were expected to be impacted by proximity of the Universities.

Ajayi and Nwosu (2011) examined the relationship between the Federal University of Technology, Akure and property values. Using the Pearson's product moment correlation, the study revealed a strong positive relationship between population of students and residential property values.

RESEARCH METHODOLOGY

The data for the study was collected from tenants occupying residential properties within 5 meters to 1000 meters to the Federal University of Technology Akure (FUTA). The distance of 5 meters to 1000 meters was taken as appropriate since most students prefer to live close to school. More so, studies carried out in the past were on residential properties within 2000 miles (Singeru et al 1999) and 800 to 2000 miles (Owusu – Edusei et al 2007). The number of residential property that fall within the distance of 5 meters to 1000 meters is 726 and this was obtained through house counting. To obtain the sample size for the study, Cochran (1963) formula modified by Israel (2002) was used and the formula is given as:

$$n = \frac{Z^2 pq/e^2}{1 + \frac{[(Z^2 pq/e^2) - 1}{N}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where n = sample size

N = sample frame of residential properties around the Federal University of Technology, Akure

z = is the abscissa of the normal curve that cuts off an area at the tails for 95% confidence, which is 1.96 assuming the population is normally distributed

p = estimated proportion of attribute that is present in the population which is 50% (0.5)

q=1-p = 1-50% = 1-0.5 = 0.5

e = is the desired level of precision which is 5% (0.05)

Using this formular the sample size obtained is 251. Questionnaires were administered to the tenants of the residential properties in the study area to elicit information on the type of accommodation occupied and rents paid among others,. Out of the two hundred and fifty one (251) questionnaires distributed to the tenants of the residential properties in the study area, one hundred and seventy six (176) were dully filled and returned for analysis representing 70.1% response rate. Descriptive Statistics such as Frequency Distribution was used to analyse the socio – economic characteristics of the respondents while Linear Regression Analysis was used to determine the impact produced by the presence of the University on rental values of residential properties. The form of Regression Function used is

$RV = a_{0 + b\ DIST + e}$ ……. …(2)
RV = Rental Value (₦)
a = Y intercept
DIST = Distance from FUTA in (M)
b = Coefficient of DIST
e = random error term

Table 1: Operationalization of Variables

Variable	Definition of Variables	Measurement
RV	Rental Value	Naira (₦)
DIST	Distance	Meters(M)

DATA ANALYSIS AND DISCUSSION

Background Information on the Tenants around the Federal University of Technology, Akure

The background information of the tenants residing around the Federal University of Technology, Akure is detailed in Table 2 and 3.

Table 2: Tenants Educational Qualification and Monthly Income

EDUCATIONAL QUALIFICATION	MONTHLY INCOME			
	10,000-40,000	40,001-70,000	70,001-100,000	100,001 and above
No formal education	0(0.0)	0(00)	0(0.0)	0(0.0)
Primary School Leaving Certificate	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Secondary School Leaving Certificate/Students	87(49.4)	9(5.1)	0(0.0)	0(0.0)
O.N.D	8(4.5)	8(4.5)	0(0.0	0(0.0)
H.N.D	0(0.0)	12(6.8)	0(0.0)	0(0.0)
B.Sc	13(7.4)	4(2.3)	8(4.5)	12(6.8)
M.Sc	0(0.0)	0(0.0)	0(0.0)	16(9.1)
Total	108(61.3)	33(18.7)	8(4.5)	28(15.9)

The result from Table 2 indicates that 61.3% of the respondents are low income earners who earn between ₦10,000 and ₦40,000 and are students in the University. The low income may be because majority of the students depend on their parents for upkeep.

Table 3: Type of Residential Property occupied by the Tenants

Residential Property Type	% of Tenants in each Residential property Type
Tenement apartment (a room)	81 (46.0)
A room self contain	31 (17.6)
1 bedroom flat	4 (2.3)
2 bedroom flat	16 (19.1)
3 bedroom flat	44 (25)
Total	176(100.0)

Table 3 shows that 63.6% of the respondents residing around FUTA, lives in tenement and a room self contain accommodation. The result is not unexpected as majority of the student population that lives off campus are interested in these type of accommodation. Also, 2.3%, 19.1% and 25% of the respondents lives in 1 bedroom, 2 bedrooms and 3 bedrooms flat respectively. The accommodation type is mostly sought by staff of the University. Duplex were not included in this analysis because the accommodation type was found to be owner occupied.

Impact of distance from the Federal University of Technology Akure on Residential Property Values

As earlier stated, Simple Linear Regression Analysis was employed to estimate the impact produced by the presence of the University on rental values of residential Properties. In this case, residential property value is the dependent variable (RV) while distance is the independent variable (DIST).

Table 4: Model Summary of Distance and Rental Value of Residential Property

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	0.881[a]	0.777	0.775	41675.24427

Table 5: Analysis of Variance of Distance and Property Values

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	1.050E+12	1	1.050E+12	604.814	0.000[b]
Residual	3.022E+11	174	1736825985		
Total	1.353E+12	175			

Table 6: Regression Coefficients of Distance and Property Values

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
(Constant)	241047.244	6470.451		37.254	0.000
Distance	-270.814	11.012	-0.881	-24.593	0.000

The Regression equation is:

Predicted Rental Value = - 270.814 + 241047.244 X (distance to FUTA).

The Linear Regression produced in the Tables above established that distance to FUTA could statistically predict rental values of residential properties. The computed F statistics is 604.814 (Table 5), P value is significant at 0.000 and distance to FUTA accounted for 77.7% (R^2) of the explained variability in rental value of the properties. This confirms the expected relationship between the variables. That is any decrease in the distance of properties to the University will lead to an increase in rental values of properties. Correspondingly, any increase in the distance of properties to the University will lead to decrease in rental values. The result however, is in conformity with the result of Shigeru et al (1999) and Owusu – Edusei et al (2007) who found out that house adjacent to the university values more than comparable house located 2000 meters or more away from it.

CONCLUSION AND RECOMMENDATION

The paper revealed that larger proportion of the people living around the Federal University of Technology Akure have Secondary School Certificate and are students of FUTA earning between 10,000 naira to 40,000 naira. The result also, showed that tenement accommodation and a room self contain accommodation are mainly sought for by the tenants. The regression analysis carried out showed that residential properties in close proximity to the University values more than residential properties located farther away from the University.

The study therefore, recommended that the University authority should build more hostel accommodation inside the University and encourage public private partnership in the provision of student housing on campus. This gesture will reduce the pressure on the private rental market; mitigate high rents and exploitation of students.

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Application of Construction Management, Procurement and Project Delivery Systems by Private Housing Developers in Nigeria for Sustainable Development

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ABSTRACT

The purpose of this study is to find out the applicability of the different Project Delivery Systems (PDSs) within the private sector housing developers in Nigeria; conditions influencing the choices they made of PDS and procurement phases, and their pursuit of project objectives of affected stakeholders. The paper presents an overview of different forms of Project Delivery Systems (PDS). It also covered some of the various project procurement phases. It highlighted the implications of the developers' choices in their practice and other stakeholders' interests for sustainable development. There are many existing studies in this research area, but could not find any within the context of the Nigeria private sector housing delivery. Hence, a motivation for this study, to fill a gap in research and contribute to the on-going debate on housing and environmental scholars/practitioners in this identified research area. A questionnaire survey was administered on the housing practitioners through email on member organisations under the Real Estate Developers Association of Nigeria (REDAN). Data collected were analysed using percentage statistical method for subsequent interpretation. Results revealed low response rate and factors likely responsible discussed. Results showed that procurement approach and modern project delivery systems are not alien to the Nigeria private sector housing developers but found DB and PPP most popular among them. The paper made its conclusion for an increase application of modern PDS for improved project performance by the private sector with emphasis on stakeholders' objectives and sustainability for a better world.

Keywords: Housing, Procurement, Project Delivery Systems, Stakeholders, Sustainability

INTRODUCTION

Many previous authors have argued that selecting an appropriate PDS can improve the project performance effectively (Hong, Kim & Leem, 2008; Ojiako, Johansen & Greenwood, 2008; Oyetunji & Anderson, 2006). There are also different procurement phases, a process through which a project is carried out. Admittedly, construction technologies may be similar globally; market environment varies significantly across countries (Qiang, et al., 2015). There are many existing studies in this area of research, but could not find any within the context of the Nigeria private sector housing development. This study, therefore, is a contribution to the on-going debate on housing and environmental scholars and practitioners in this area. Thus, it would be interesting to know the developers responses to questions about what PDS they apply in the delivery of their housing projects and main factors influencing the choices they made; what procurement phases they adopt; how their choices affects the own objectives, environment and other stakeholders benefits. Is the private home developers' application of PDS merely geared towards profit-making or reflecting other objectives? The first part of the paper presented a review of relevant literature on procurement and project delivery systems. A general overview of the Nigerian housing sector was carried out. Following was a discussion of the research method applied; sample, data collection and analysis. The study provided its conclusions, recommendations and limitations for future research.

REVIEW OF LITERATURE

Procurement

Housing delivery entails a process of planning, programming, designing, and constructing facilities. Dell'Isola (2002) categorised procurement process into three phases encompassing

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of Planning/Programming (identification of scope, objectives, expectations, budget, schedule and approach); Design (involves three sub-phases- schematic design, design development, and construction documents and Construction. The Nigeria Institute of Quantity Surveyors (NIQS, 2002, p. 67) classified construction projects into six phases comprising namely, Engineering phase, Procurement phase, the Construction and Construction Management, Commissioning and Operation, Project De- commissioning stage and Project Abandonment. However, in Nigeria, the private sector housing developers may undertake procurement of housing in five phases:

i. *Project idea, planning, design and programming*: housing projects ideas initiated may be from market intelligence survey. The ideas get transformed into outline/sketch design upon which an initial cost estimate and timelines are based leading to working drawings submission for government approval before actual construction works can take place.
ii. *Marketing, advertising and promotion*: Private sector housing developers canvass for homebuyers' off-the-plan purchase through different advertisement media such as project fliers, handbills, pricelist, advertising billboard, radio and television jingles, etc. Prospective home buyers are requested to make down payments for Unit (s) allocation before the actual delivery of the homes.
iii. *Construction and completion phase:* whereby approved building plans are implemented into tangible physical (house) leading to physical home delivery.
iv. *Handing over and occupation:* Upon completion of the housing project, subscribers receive their houses either for a living or letting or sale if bought for investment purposes.
v. *Facility management:* developer provides after-sale services to the inhabitants of the homes and may include security, building maintenance, estate cleaning, gardening and water and electricity management services.

A proper understanding of these various procurement phases is important in making a quality decision about selection of a project delivery system to apply for any given housing project.

Project Delivery Systems (PDS)

Project delivery system (PDS) describes how the project participants are organised to interact, transforming the owner's goals and objectives into finished facilities (ASCE, 2000; Chen et al., 2011). Selecting an appropriate PDS for a project can improve its performance effectively (Hong et al., 2008, Ojiako et al., 2008 and Oyetunji and Anderson, 2006). Many authors argued that a reasonable PDS is a critical success factor for any project (Naoum 1994; Sharif and Morledge 1994; Dorsey 1997; Al Khalil, 2002, Chan et al., 2001 and Kumaraswamy and Dissanayaka, 2001) as it affects project schedule, cost, quality and contract management. And that improper selections of PDS portend adverse implications on the overall project performance include cost overrun, delay to completion, poor quality delivery among others (Laedre et al., 2006). Meanwhile, Konchar and Sanvido (1998) presented a comparison of project performance among the various PDS on cost, schedule and quality performance of CM at risk, DB and DBB and were similar to Dell'Isola (2002) examined the impacts of DBB, DB & CM on cost management. Qiang et al., (2015) remarked that PDSs are selected to integrate resources from participating entities, including consultants, designers, contractors and suppliers to make up for the clients' incapability in delivering construction projects. It thus follows that the importance of a proper choice of PDS on a project performance cannot be overemphasised.

Types of Project Delivery Systems (PDS)

The choices for Systems for project delivery have expanded and refined over the last 30 years, and identified were several types of PDS; their peculiarities and applications have gained increasing interest by previous researchers. Discussed below are the various PDSs. They include Traditional Design-Bid-Build (DBB), Construction Management (CM), Design-Build (DB), Engineering Procurement and Construction (EPC), Turnkey, Project Management (PM) (Dell'Isola, 2002; Chen et al., 2005; Liu, et al., 2015).

Traditional Design-Bid-Build (DBB)

According to Pietroforte & Miller, (2002, p.429), a client provides funding for all the various phases of a project including the completion of full design before tendering in DBB. The common practice is for a project owner to hire a design team in an agency relationship (service) and a separate general contractor for the construction in a vendor relationship. Adequate contract documents are usually available which defines a basis of quality and performance and are verified through shop drawings and submittals making pricing also relatively straightforward. Liu et al., (2015) noted there are three players in this approach namely: owners, designers (architects) and general contractors. While the owner pays both the designers and the general contractor, designers act on her behalf and the contractor delivers the required product. More so, owners undertake robust risks, such as political risks (e.g., wars and military coups), social risks (e.g., strikes and civil strife), economic risks (e.g., price increases), legal risks, and natural risks. In the Nigeria housing environment experience, DBB is usually adopted by government and have applied same in the past decades to deliver notable housing projects such as (by the Federal government) 'Jakande Estates' and 'Shagari Estates' built in the 1980s and other many public buildings.

Design and Build (DB)

DB project delivery system requires one general contractor to undertake the two roles of design and construction. A client should, therefore, ensure comprehensive pretender site investigation (Leung, 1999), develop a clear understanding of the project scope (Ashley et al., 1987), prequalify potential tenderers, and assess contractors' proposals thoroughly. Time, cost and quality of design and workmanship represents the key elements of overall success of DB projects (Chan, et al., 2001). Pietroforte & Miller (2002) observed that the market for DB has grown steadily in the private sector for project delivery in the last ten years. Private home developers explore DB for a speculative housing market based on perceived homebuyers' requirements that guide home design and construction. Significantly, a DB system allows design and construction to take place simultaneously and provides improved quality of the final product since new ideas can be injected into the design as work progresses.

Partnering: Public – Private Partnerships (PPPs)

Yuan et al., (2012) argued that PPP is suitable where a government makes a commitment to building a large amount of public housing (building) but is limited by capital gaps and management problems in project operation, resources utilization, and service delivery. Invariably, PPP is adopted by the public sector to attract private investments, to use their advanced management and operation skills, to provide better services to the general public, and to achieve value for money (VFM) (Stewart 2005; Sengupta 2006; Abdul-Aziz and Kassim 2011). Many developed countries such as the UK and most of the Commonwealth countries including developing countries like Eastern Europe and east/south Asia have increasingly adopted PPP (Winch 2000). The primary role of the private sectors is to finance, construct, and operate public housing at the right time as her cardinal involvement in facilities development (Tang et al. 2010). Some of the PPP variants are Build, Operate and Transfer (BOT), Design, Build and Operate (DBOT). Fundamentally, in a BOT, cash flow to support the design, construction, maintenance and operations are generated by the private

investor finances or the financial viability of the project itself (Pietroforte & Miller, 2002). And the BOT private investor recoups its financial investment from financial returns over the duration of the concessionary period at the end of which the property revert to the client (reversionary period). In Nigeria, government at both federal and State level have adopted the PPPs for housing development in the recent years.

For instance, the Federal Capital Territory (FCT) applied PPP in her 'Accelerated Mass Housing Programme' whereby the government provides land to selected private developers to develop mass housing in the under-developed districts of the City. The mass housing private developers provide finances and technical know-how for actual home construction. The resultant housing units are either sold to the government (workers) or third party by the developer to recoup her finances.

Engineering Procurement and Construction (EPC)

In EPC system, a general contractor is handed over general investment requirements by an owner while the former proceeds into detailed engineering designs and its eventual construction. EPC applies mostly to core infrastructure and engineering projects such as rail, manufacturing and processing projects. Higher technical engineering skills are required such as may not be available to the owner or her in-house technical personnel. Owner's involvement in EPC projects is greatly limited considering the technical skills required for design and construction. Giving that the contractor in EPC is in full charge of design and construction, it bears all major if not all the risks associated with the project such as natural and economic risks which also creates ample opportunity to the EPC general contractor to maximise profit due to a lower involvement of the owner in risk sharing. Pre-conditions for EPC application include: few parties participating, an owner does not wish for higher participation, owner's in-house technical personnel is weak, owner's wish contractor take up full risks and owner does not want control over engineering design.

Turnkey

In turnkey, one contractor is charged with the responsibility of full design, construction and finance of the project. Often, a client may desire to have a house and only wish to pay for it at the end of the project when a contractor/developer may have fully delivered it. Some of the influencing factors for selecting a turnkey may include the contractor is fully known to the client and vice versa, client willingness to pay only at completion and handing over, contractor fully pays for the entire procurement process before getting paid and there is joint agreement on terms and conditions between both parties. This approach may be suitable where and individual or homebuyers desire few numbers of houses. It may be impracticable to adopt a turnkey to develop projects such as 'mass housing' that comprise a lot of housing units without a client making any financial commitment.

Project Management

Project management goal is that a project can be effectively managed from its different aspects of cost, quality and time. The primary role of a project manager is to ensure that a housing project meets the cardinal objectives of effective cost management, quality management and time management. He or she is appointed by a project owner to coordinate other participants so that design and construction achieve the defined objectives. A project manager may function within any of the other types of project delivery system and may not necessarily be an independent type of PDS.

Indicators of PDS selection

Admittedly, there might not be an exclusive set of influencing factors for PDS selection (Luu, et al., 2006; Skitmore and Marsden, 1988) as numerous studies constructed various systems of indicators, hence, no universality (Chan, 2007). But often, choice of PDS is based merely

on the in-house experience and or advice by external consultants (Masterman & Duff, 1994). Chan et al., (2001), Love et al., (1998) proposed a multi-attribute utility for PDS selection. Chen, et al., (2011) identified common indicators for PDS selection as speed, certainty, flexibility, quality, complexity, risk allocation, responsibility, arbitration and dispute, and price competition as common indicators. Hughes (1989) revealed how external factors influences PDS selection. Gordon (1994) proposed three groups of factors summarized as project characteristics, client characteristics and market environment. Chen et al., (2011, p.5457) presented four main grouping of indicators. They include project objectives (delivery speed, cost, project quality) and project characteristics (project type, project scale, ability to define the project, flexibility). Others are characteristics of owner and contractor (owner willingness to be involved, owner's available personnel and contractor capability, and the external environment (market competitiveness, regulatory flexibility and technology availability. Therefore, it is agreeable that stakeholders must consider several factors to determine which PDS is most suitable for a project.

The Nigeria Housing Sector- Changing dynamics

For several decades, the formal housing sector in Nigeria has been largely dominated by the government at various levels. Many public buildings and facilities were undertaken through the traditional design, bid and build (DBB) delivery system. But with the dwindling financial resources and competing demand from other critical sectors (education, health, defence) for limited resources, the government in recent years had encouraged private sector participation in housing and other infrastructure development. Also, government past reforms made the dismal performance (Ikejiofor, 1999) necessitating government desire for meaningful and robust solutions to address the over 17 million housing supply deficits (Adeboye et al., 2012; Ifemelunma, 2015). Furthermore, housing demand has been continuously on the increase. All these factors were the impetus for the private sector greater participation in housing delivery as the developers equally saw a business opportunity.

The increased private sector participations have contributed to increasing in housing stock in recent years and created more construction employment/jobs. But increased housing construction activities have brought with some concerns as well. These include inferior and of low-quality houses delivery by some developers and quacks activities exacerbated. Also noticed is a disregard of city Master Plan, depletion of local raw materials and an alarming rate of mining and quarry activities. There is also the importation of construction skills and many other sustainable development issues that have grief implications for human needs of the present and that of the future generations. Private sector housing developers' decision on procurement and PDS for housing delivery must, therefore, take cognizance of these issues to safeguard not only the developer's (owners) objectives but other stakeholders' interests and the planet. Schumacher (1973) noted 'nothing makes economic sense unless its continuance for a long time can be projected without running into absurdities.' Grinde & Khare (2008) argued that many of nature's resources are being harvested at rates where growth is uneconomic and damaging to future production. Consequently, sustainability is seen as 'the ability of a company to make profits while sustaining the environment' (A Dictionary of Business, 2002).

METHOD

The sample for this study is drawn from the private sector housing developers in Nigeria who are members of the Real Estate Developers Association of Nigeria (REDAN). REDAN is the principal agency and umbrella body of the organized private sector responsible for housing development in Nigeria. A list of its (REDAN) members containing 1948 housing developers' organisations was received. A questionnaire survey (email) was the means

chosen to collect data for the study. The email communication method was adopted giving its benefits. Email survey is easy to send, easy to respond, not constrained by geographical location, cost efficiency and applied on a large population (Tuten, Urban and Bosnjak, 1999; Bachmann, et al., 1996; Sproull, 1986; Mehta & Sivada, 1995; Schmidt, 1997; Parker, 1992).

However, only 975 developer organisations have their email addresses indicated on the REDAN register. Hence, questionnaire survey was limited to them using one email address per a developer organisation to prevent multiple entries by one organisation. Meanwhile, 359 bounced invitations occurred and additional six invitees opted out leaving 614 expected respondents. Comely (1996) argued that 'even when a population of e-mail users is chosen, e-mail addresses may be incorrect or inactive, thereby preventing the survey from reaching the intended individual. Importantly, 35 responses were received out of which only 24 fully completed. The response rate was significantly low and of about 6% and many factors may be attributable. Past researches by different authors have reported exceptionally low response rate. Using email for their survey, Swoboda et al., (1997) achieved 20%, Tse et al., (1995) obtained 6% response rate. In this instance, perhaps some developer organisations that received the email survey may have incompatible systems to the one used to send mail for email form to be displayed and filled out correctly (Smith, 1997; Parker, 1992). Second, there may be some developers that are not too familiar with using email but merely provided their email addresses to REDAN while filling membership application form before their registration. Also, some developers may not have imbibed the culture of checking out their email boxes as they would have done for telephone calls, SMS or face-to-face interview schedules. Nonetheless, a multi-mode strategy as suggested by Schaefer and Dillman (1998) was applied to encourage developers' participation in the survey. Reminders emails were sent after the initial notification just as the short survey was designed (Smith, 1997; Bosnjak & Batinic, 2000) with 13 questions so that respondents do not lose interest quickly in participation (Krasilovsky, 1996). However, the response speed was respectable commendable between 2 – 8days. Telephone conversation with all the respondents who returned survey ensures the validity of the data using their telephone numbers provided on the REDAN register. The respondents subsequently provided affirmation.

The questionnaire survey had two sections with the first providing personal background information about the participating organisations. The second section entails key issues on the various types of PDS and each organisation choice and implications of choices developers make.

DATA ANALYSIS

Age of Housing Practice (AHOP)

Table 1 presents the age of the respondent organisations in private housing practice. It shows 41.18% developers have practiced for about10years while another 35.29% were in business within 5 years. Combined, a three-quarter of the entire participating developers have housing experiences spanning within 1 – 10 years. Suffice therefore to say that private sector housing have only evolved within the last one decade ago in Nigeria with very few in practice beyond 10 years. In the recent years, the government liberated the sector by divesting itself from direct housing provision and construction that resultantly made the private sector on the driver's seat of housing delivery. The growing housing supply deficit may also have created ample business opportunities in the sector to fascinate the private developers.

Commendably, the survey was filled by 77.42% CEO and 22.58% senior management indicating the importance the respondents' organisations may have attached to their participation.

Table 1: Age of Housing Practice (AHOP)

SN	Age of Organisation	Responses	% Responses
1	1 – 5	12	35.29%
2	6 – 10	14	41.18%
3	11 – 15	5	14.71%
4	16 – 20	1	2.94%
5	21 and above	2	6.88%
Total		34	100

Housing Project Profile- HOPP (Low-income, Middle-income and High-income)

As shown in Table 2, half of the respondents (developers) reported a mix housing development as their house products, 18.75% developers deliver low-income housing, 25% are Middle-Income, and only 6.65% are high-income developers. A mix-housing development combines more than one class of housing classifications in one housing project (estate). And in this data, the mix-housing developers may have prioritised combination of low-income and middle-income housing in one housing scheme. The developers ensure an inclusive housing demand so that the housing needs of the poor and vulnerable may be considered side by side with the affluent. The developers may also have chosen the lower housing classes since it was where the housing demand is strongest.

Table 2: *Housing Project Profile (HOPP)*

Home class delivery	Responses	% Responses
Low-income	6	18.75%
Middle- income	8	25.00%
High- income	2	6.25%
Mix development (contains more than one type)	16	50.00%
Total	32	100

In addition, about 80% respondents have delivered between 1- 10 housing projects in the past 5 years and the remaining 20% respondents have executed above 10 projects within the same period. This output is comparatively low when compared to the 17 million housing deficit confronting the country.

Procurement Phases for housing projects delivery (PPHOP)

The different procurement phases for housing projects delivery are provided in below Table 3 as adopted by sampled housing developers. 64.52% respondents applied a procurement model comprising six-phases comprising of *Project idea/Planning, Design and Programming, Marketing/Advertisement/Promotion, Construction and Completion, Hand-over and Occupation, and Facility Management* while 31.82% respondents organisations adopted a three-phase procurement model consisting of *Planning/Programming, Design and Construction*. With a clearly defined procurement phases, private housing developers can engage the requisite project participants and procure services towards a successful housing development.

Table 3: *Procurement Phases for housing projects delivery (PPHOP)*

Procurement Phases	Responses	% Responses
A Procurement Phase comprising THREE PHASES: Planning/Programming; Design and Construction.	10	32.26%
A Procurement Phase comprising SIX PHASES: Engineering, Procurement, Construction and Construction Management, Commissioning and Operation, Project De-Commissioning, Project Abandonment.	1	3.23%
A Procurement Phase comprising SIX PHASES: Project idea/Planning; Design and Programming; Marketing/Advertisement/Promotion; Construction and Completion; Handing-Over and Occupation; and Facility Management.	20	64.52%
Others (Please Specify)	0	0.00%

Project Delivery Systems (PDS)

As shown in Table 4, Design – Build (DB) is the highest form of housing project delivery system adopted by the private developers to deliver their housing projects with a percentage score of 37.5%. Public – Private Partnership (PPP) occupies the second position with the system generating 31.25% respondents. Authors as Ke et al., (2009) and Tang et al., (2010) noted that PPPs have been adopted more extensively by governments and have gained importance as vehicles to finance public infrastructure around the globe. Less than 10% developer adopted Project Management as well as Turnkey and no developer currently applied Traditional Design, Bid and Build (DBB) and Construction Management (CM).

The inherent benefits of a DB system to the developer and the organisation may account for higher application. DB enables a developer to take full charge of both the design and construction of the housing projects without many external influences. For instance, the private developer initiates the ideas of the houses, determines what type of houses to be developed and when such projects are delivered. Also, the developer determines the construction method (direct, sub-contracting, general contracting) to apply, the cost of the project, the housing market segment, and the selling price. DB also gives the developer the flexibility to determine how many loans to take for the development, and who the building materials suppliers shall be and so on. All the 35 respondents agreed that a selection of a PDS could make a difference between success and failure of their housing projects.

Table 4: Project Delivery Systems- Housing developers Choice (PDS- HDEC)

PDS choices	Responses	% Responses
Traditional Design, Bid and Build (DBB)	0	0.00%
Design and Build (DB)	12	37.50%
Construction Management (CM)	0	0.00%
Project Management (PM)	3	9.38%
Engineering Procurement and Construction (EPC)	5	15.63%
Turnkey	2	6.25%
Partnering (e.g Public- Private Partnership – PPP)	10	31.25%
Total	32	

Selection of Project Delivery Systems (PDS) - Performance

The respondents (developers) provided an overview of how their chosen PDS has aided attainment of defined projects goals as:

i. *Meeting organisation owner's objectives:* defined as profit maximisation, cost minimization and timely completion. Significantly, 42.11% respondents' developers reported a 'fair' performance; 36.84% remarked 'Good'. In the overall, choice of PDS helps towards achieving the salient business owners' goals.
ii. *Homebuyers' objectives:* defined as price, quality, timely hand-over amenities, and allowance for involvement to make input and house choices. 57.89% agreed to 'Good' and 15.79% stated 'Very Good' indicating that the developers applied PDS to fulfil the homebuyers' objectives.
iii. *Commitment to Environmental issues:* defined as a local community benefit, conformity to city planning, a creation of meaningful employment and local inclusion and efficient use of local materials. Three-quarter of the respondents is a combination of 'Good' and 'Very Good'. The percentage is more so as the majority of the developers reported an adoption of Design and Build, which may allow them to incorporate environmental solutions the project designs such as the preparation of Environmental Impact Analysis (EIA). The goal of EIA is to explore the impact a new (housing) project would have on others, thereby ensuring that it does not cause negative or adverse effects on people, society and earth.

iv. *Other stakeholders' benefits:* defined as the interest of other participants in the project such as timely loan repayment to banks/financiers, use of local building materials, contractors/sub-contractors prompt valuation certificate payment and input of external consultants to enrich project performance. 45.45% respondents posted 'Good' performance and 'Very Good' was 25.00%, thus, illustrating majority of the respondents' satisfaction with their PDS performance on attaining stakeholders' requirements.

Additionally, over three-quarter of respondents agreed that choice PDS can improve the profitability and about 80% developers also believed that modern PDS promote inclusiveness of local community needs in the project. 66% participants contend that modern PDS protect the housing industry and society from environmental degradation and harm. An example is cited of the PPP system whereby government ensures that EIA is incorporated as part of the project documents before the relevant government agencies grant construction approval. The increasing application of modern PDS such as DB is also argued to improve activities by the private sector developers' thereby increasing housing supply. For instance, about 95% respondents agree that PDS (DB, PPP) help the developers to adapt continuously to project changes and variations. The very high percentage is possible as the developers' in-house personnel possess technical and professional skills to identify changes and address it appropriately especially during the construction period to improve project performance. However, 50% respondents agreed to adopt different PDS to future projects to seek new ways of getting better outcomes. The remaining half respondents were 'not sure' of changing their current PDS. Meanwhile, profit making is not reported as the strongest motivating factor influencing the developers' selection of a PDS for housing delivery. Rather 50% respondents insisted are motivated to provide affordable housing so as to generate fair market share, hence, priority development in low-income and middle-income or a mix-development housing comprising the two. Also, 38.89% respondents believed in the factor of 'quality of houses (QHO)' as another consideration for chosen PDS method. The weakest factor determining influencing factors for PDS selection reported by respondents is profit making since the mere emphasis on it pushes them out of competition among other private housing developers.

CONCLUSION

Suffice to conclude that application of some of the modern PDS is not alien to the Nigeria private sector housing developers. However, much of the developers' favoured design and build (DB) as it provides them near absolute control of the entire procurement phases of the project. The Public – Private Partnership (PPP) also has been applied by a good number of the developers considering that such partnering foster beneficial housing delivery and lessons construction cost and marketing by the developers. It is however yet unknown how many housing projects that the partnership has successfully delivered. The study also argued that the bulk of the private housing developer in Nigeria adopts a six-phase procurement approach starting with project idea till hand-over and facility management. Also, the study noted that private sector housing developers no longer embrace mere profit-making objective rather ensures by applying chosen PDS, other stakeholder benefits considered in order to remain relevant in the competitive housing market. In line with the above inclusive project objectives, priority development is given to low-income, middle income and mix development housing and preparation of EIA forms part of the project documents currently in use. The earlier admonition of McDonough et al., (2002, p.117) is apt, 'Insanity has been defined as doing the same thing over and over expecting a different outcome. Negligence is described as doing the same thing over and over even though you know it is dangerous, stupid or wrong. Now that we know, it is time for a change. Negligence starts tomorrow'.

RECOMMENDATIONS/LIMITATIONS

The following recommendations arose from the study:

i. **Housing developers should adopt modern PDS**

It is important for developers to apply modern PDS so as to bring improved participation among different project participants as well as achieve all-inclusive project objectives. Private home developers in their efforts to boost housing quantity, quality should not be jeopardized on the altar of profit-making. The three main classes of housing demand (low-income, middle-income, and high-income) must be represented to ensure sustainable development. Even where the developer maintains full control of the procurement phases such as with DB, building plans and construction must be guided, monitored and controlled using an Environmental Impact Analysis (EIA) to prevent harm to society. Houses should not be built on the waterways to prevent flooding that can lead to wanton of loss of lives and properties. The choice and application of PDS must guarantee sustainable development. The increasing influx of quacks in the housing market must be controlled as their activities are causing untold problems to quality house delivery, project abandonment, death and loss of properties where collapse occurs. A regulatory body should be established to evaluate projects from inception to completion and ensure compliance.

ii. **Apply intensive risk-sharing partnering and monitor EIA performance**

Increase emphasis should be on improved partnership between government and the private sector since each party can bring different values into the housing sector for a drastic reduction in the current housing deficit. Such PPP should also reduce total burden of project delivery on one party since technical, managerial, financial, social, economic, and political and other risks need to be shared for mutually beneficial relationship. Government roles in PPP must encompass not just the provision of non-cash incentives such as land but ensures that EIA prepared for projects development must be strictly adhered and monitored for implementation during the actual construction phase.

iii. **REDAN must update Membership database (email addresses update)**

REDAN needs to update its membership database to include valid email addresses for member organisations without any on her register. There are over 1,000 current member organisations on her register without any email address! Second, at least, a third of email addresses on the REDAN register is invalid and need an update. Developers should be made aware to adapt to modern communication technologies such as effective use of their email addresses to enhance better communication with them.

iv. **Need for study on precise housing stock delivered using different PDS**

Future studies are needed to review in greater details specific number of housing stock delivered by the private sector developers using the various identified PDS. Outcomes of such a research shall provide evidence to help practitioners and scholars to understand the efficiency of each PDS within a given country or clime.

v. **Further study on housing sustainability- deepening the concept of 3Ps (Profit/People/Planet)**

As the private sector housing developers are becoming increasingly committed to other objectives beyond profit-making based on data from this study, additional research is needed to demonstrate how expanded project objectives become achievable. It is imperative that housing delivery would lead to quality homes, quality life and city of beauty and not ‘slums’ due to increasing urbanization and uncontrolled human migration from rural to urban centers.

vi. **Applying email survey for data collection in developing countries**

There is the need for researchers to review the efficiency of applying email for survey especially in developing and under-developed countries where infrastructure is a challenge and users' awareness is minimal. Could the research study outcomes have been different with a higher percentage of respondents?

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Readiness of the Nigerian Building Consulting Firms to Adopt Lean Construction Principles

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ABSTRACT

Studies have shown that construction projects are susceptible to problems such as low productivity, poor safety, inferior working conditions, insufficient quality, lack of timely communication and coordination amongst project stakeholders, and rising litigation. The adoption of lean construction (LC) Principles within the manufacturing and other industries had led to notable improvement and resulted in improved time-to-market, reduced production cost, improved quality of the product and active customer involvement. This study appraised the readiness of Nigerian building consulting firms to adopt LC principles. The method of study involved a critical exposition of related literature, VERDICT readiness assessment model for analysis and ANOVA for readiness comparison. A structured questionnaire was issued to a sample size comprising 130 firms drawn from a finite population of 306 Nigerian building consulting firms (Project managers, Architects, Quantity surveyors, Structural engineers and M&E engineers) operating within Northern Nigeria. The result of the study revealed that Nigeria building consulting firms has process/project readiness to adopt LC principles, but do not have management, people and technology readiness to adopt LC principles. The study concludes that Nigeria building consulting firms are not yet ready to adopt LC Principles. The study recommends continuous awareness campaign of LC principles and its potential benefits via education and training to professional bodies, tertiary institutions offering building construction related programmes and stakeholders in the construction industry.

Keywords: Adoption, Consulting firms, Lean Construction, Nigeria Construction Industry, Readiness

INTRODUCTION

Construction is a key sector of the national economy for countries all around the world, as traditionally it took up a big portion in nation's total employment and revenue generation as a whole. However, until today, several countries are still facing numbers of contingent problems that were bounded to be resolved since the past time. The chronic problems of construction *are well* known such as low productivity, poor safety, inferior working conditions, insufficient quality, lack of timely communication and coordination amongst project stakeholders, and rising litigation (Koskela, 2000 & LePatner, 2007). The phenomenon of the poor performance and conditions in construction had long been witnessed and recorded by academics and practitioners throughout the world regardless in developed countries e.g. England (Eaton, 1994) or in developing countries e.g. Chile (Serpell *et al*., 1995). Thus, the UK Government initiated reports such as the Latham Report (1994) and the Egan Report (1998), both of which recommended the improvement of the construction industry's business performance.

The Nigerian construction industry is not also free from such problems. It has severally been characterized as inefficient with low productivity and lack of capacity to deliver and satisfy its clients. Oyewobi *et al.* (2011) attributed the drop in the Nigerian construction industry's contribution to GDP between 1980 and 2007 to poor performance and low productivity.

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Similarly, Idrus and Sodangi (2007) asserted that the Nigerian construction industry produces nearly 70% of the nation's fixed capital formation, yet its performance within the economy has been, and continues to be, very poor. Among other criticisms facing the industry are time and cost overruns (Kuroshi & Okoli, 2010; Ameh & Osegbo, 2011; Ogwueleka, 2011), inadequate planning and budgetary provisions, contract sums inflation, inefficient and poor service delivery (Kolo & Ibrahim, 2010).

The need for greater co-ordination and integration within the industry has led to the adoption of various concepts from other industries, for example; partnering (Ibrahim & Price, 2006), concurrent engineering (Khalfan *et al.*, 2000), technological innovations in design and construction processes such as 3D, CAD and modelling (Isikdag & Underwood, 2010; Olatunji, *et al*., 2010); BIM (Abubakar, 2012). Lean Construction principles are one of such innovative processes that bring about the much needed continuous improvement and desired change in the construction industry.

According to Dulaimi and Tanamas (2001), the adoption of lean techniques to construction eliminates non-value steps i.e. waste and better meet client's demands and dramatically improves the Architectural/ Engineering/ Construction (AEC) process and products. Interestingly, unlike Nigeria this has been used with significant benefits in countries like Singapore (Dulaimi & Tanamas, 2001); UK (Common *et al*. 2000); Brazil (Silva & Cardoso, 1999); Chile (Alarcon & Ashley, 1999) and so on. Consequently, it becomes imperative for the Nigerian construction industry, which has been described as a 'sleeping giant' and having no capacity to deliver due to inefficiency and poor service delivery among other problems (Kolo & Ibrahim, 2010), to exploit the widely acclaimed benefits of lean construction in order to practice in line with the global best practices and achieve the continuous improvement needed by its players in the industry.

However, because adoption of innovations such as lean construction principles usually brings about changes in the business processes and operational procedures of an industry or an organization, there is the need to carry out the level of readiness of the construction industry for lean construction implementation by the stakeholders' organizations or the entire construction industry in order to continuously deliver value for money and effectively satisfy the needs of the clients.

LITERATURE REVIEW

Lean Construction Principles

Lean construction has been defined in several ways by different authors. The most popular definition by Koskela *et al*. (2002) states that lean construction is a way to design production systems to minimize waste of materials, time, and effort in order to generate the maximum possible amount of value. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user requirements. In the context of the construction industry, another definition states that lean construction is a holistic facility design and delivery philosophy with an overarching aim of maximizing value to all stakeholders through systematic, synergistic, and continuous improvements in the contractual arrangements, the product design, the construction process design and methods selection, the supply chain, and the workflow reliability of site operations (Abdelhamid, 2004).

Benifits of Lean Construction Principles

Broadly speaking, lean construction has led to significant improvement in the performance of construction industry professionals especially in design, construction and facility management. Michigan State University (MSU) reap double benefits of lean construction as a

client and on its own self-performed works, by saving on time and money and improved quality of projects, building relationships with the service providers, and providing value to the end users who otherwise are often not involved in the entire process. The following are some of the benefits of lean construction as reported by Mossman, (2009):

a. More satisfied clients
b. Productivity gains
c. Greater predictability
d. Shorter construction periods
e. Operatives able to make better money
f. Sub-contractors able to make better money
g. Improved design
h. Reduced costs, less waste
i. Improved safety and health
j. Improved quality, fewer defects

Also, a case study taken in USA in 1998 shows remarkable benefits of implementing LC (Garnett *et al*., 1999): Office construction times reduces by 25% within 18 months; Schematic design reduces from 11 weeks to 2 weeks; Turnover increases of 15-20% (Pacific Contracting); Satisfied clients looking to place repeat orders; Reduction of project costs.

Readiness Assessment Models

Readiness refers to a measure of the capability to adopt a new paradigm prior to its implementation. Prior to adoption of a new paradigm**, s**o many readiness assessment models have been developed in recent times.

Some of these tools include the one developed by Harvard University Center for International Development (CID, 2001) called Networked Readiness Index which gauges a country‘s ability to make use of its Information and Communication Technology (ICT) resources. It defined readiness as the degree to which a community is prepared to participate in the networked world and its potential to be part of the networked world in the future (Kirkman *et al.,* 2002). Similarly, the Asia Pacific Economic Cooperation‘s (APEC) e-readiness assessment focused on government policies for e-commerce, while Mosaic global diffusion of the internet project‘s readiness assessment tool aimed at gauging and analysing the worldwide growth of the internet (Ruikar *et al*., 2006; Vaezi & Bimar, 2009).

On the other hand, as these tools were based on measuring the readiness of countries, governments and policies for adopting internet technologies, there are others that focused on assessing the readiness to adopt different engineering concepts and approaches. For example, SCALES (Supply Chain Assessment and Lean Evaluation System) was developed specifically for the manufacturing industry in order to assess companies‘(especially SMEs) readiness for adopting lean manufacturing techniques. Furthermore, there are several other tools that were developed for Concurrent Engineering (CE) such as RACE (Readiness Assessment for Concurrent Engineering) which was developed in the West Virginia University (United States) in the early 90s. It was conceptualised in terms of two major components: Process and technology. It is widely used in the software engineering, automotive and electronic industries (Ruikar *et al.,* 2006). According to Khalfan and Anumba (2000), RACE can be modified to be used in construction and other industries. Similar to this one is the SPICE (Standard Process Improvement for Concurrent Engineering), which was developed in the University of Salford, United Kingdom in a form of a questionnaire. It was designed to evaluate the key construction processes within construction organisations (SPICE Questionnaire, 1998). In addition, the BEACON (Benchmarking and Readiness Assessment Model for Concurrent Engineering) was created to evaluate the construction company’s

readiness level in implementing concurrent engineering with the aim of improving the project delivery process. Others include the Capability Maturity Model (CMM) developed for software development and evaluation, and the IQ Net readiness scorecard (Khalfan & Anumba, 2000; Ruikar *et al.*, 2006; Aminali, 2007).

Another readiness assessment tool that is of particular relevance to this research is the VERDICT (Verify End-User e-Readiness using Diagnostic Tool) developed to assess the overall readiness of end users involved in the construction industry for using e-commerce technologies (Aziz & Salleh, 2011). The VERDICT model is a combination of two e-readiness assessment models-the BEACON model and the IQ Net readiness scorecard. BEACON, as mentioned earlier, assesses the readiness of construction companies to improve its practices for implementing concurrent engineering. It consists of four elements- process, people, project and technology. IQ Net readiness scorecard is web based application developed by CISCO based on a book called Net ready. Aminali (2007) assesses the readiness of IT service providers in such a way that the companies are presented with statements which fall into four categories as leadership, governance, technology and organisational competencies, for which upon completion, they will be shown their e-readiness assessment result.

Similar methodology was adopted in developing the VERDICT model. In it, companies' e-readiness results are presented to them after responding to some statements that fall under four categories- management, process, people and technology. Ruikar *et al.* (2006) the developers of VERDICT argued that to successfully implement any technology, there is need to have the people with adequate skills, understanding of, and belief in the technology, then processes that enable and support the successful adoption of the technology, then the technology tools and infrastructure necessary to support the business functions and another key element to consider is the management buy-in and belief. Therefore, the next is the management that believes in the technology and takes strategic measures to drive its adoption, implementation and usage in order to derive business benefits from the technology (Ruikar *et al.*, 2006; Vaezi & Bimar, 2009). All the four elements have to work complementarily for any organisation to achieve readiness.

The developers claim that VERDICT can be used to assess the e-readiness of construction companies, departments within a company, or even working groups within a department. The assessment is performed by finding an average score for each of the four categories from the judgment of the respondents on the statements of the questionnaire. According to Ruikar *et al.* (2006):

i. An average score greater than or equal to zero and less than 2.5 shows a red colour which indicates that urgent attention is needed to achieve e-readiness.

ii. An average score greater than or equal to 2.5 and less than 3.5 is amber colour which means that certain aspects need attention to achieve e-readiness.

iii. An average score greater than 3.5 shows a green colour which indicates that the organisation is adequately ready and matured enough for e-commerce tools.

The choice of these boundaries was based on simple average scores computed for each of the four elements in the questionnaire.

METHODOLOGY

The study made use of data and information collected with the aid of structured questionnaires which were administered in northern Nigeria (specifically, Abuja (FCT), Kaduna and Kano states of Nigeria). In a study conducted by Kado (2013), the total number

of registered consulting firms with the Corporate Affairs Commission was shown to be 6,990; 34% of which are located in northern part of the country. Making use of Yamane (1986)'s sample size formula i.e.:

$$n = \frac{N}{1+N(e)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where n = required sample size;
N = the population size
e = level of precision (0.050), the sample size of the study was computed as 306.

The population for the study comprise the stakeholders majorly responsible for design of building projects delivery in Nigeria. They include Project Management Firms, Architectural Design Firms, Structural Design Firms, Mechanical and Electrical Services Design Firms, and Quantity Surveying Firms. The questionnaire was designed/structured based on the VERDICT readiness assessment model of Ruikar et al. (2006). Respondents were asked to choose based on a 5-point Likert rating scale, (in which 5 represented strongly agree, while 1 represented strongly disagree), the extent to which their firms conformed to the requirements of the VERDICT readiness assessment model. This was carried out to gain a practical view point, testing to see if the ideas identified and outlined in the literature review were a reality in practice.

A reliability analysis using the Cronbach's alpha, was performed to determine the internal consistency and thus, the reliability of the scale used in the survey questionnaire. The study utilized a number of descriptive statistical techniques to facilitate the organization, analysis and interpretation of the data. Mean, standard deviation and relative ranking were also used.

FINDINGS AND DISCUSSIONS

Out of 306 questionnaires administered, 130 representing 43% of the total were returned and found appropriate for analysis. Moser and Kalton (1971) asserted that, result of a survey could be considered significant if the response rate is not lower than 30-40%. In view of this, the 43% response was considered adequate for analysis.

Among the respondents, 27% was engaged in Architectural consultancy, 29% was engaged in Quantity Surveying consultancy, while 21% and 13% were engaged in structural engineering consultancy and project management consultancy respectively. The remaining 10% of the respondents was engaged in Mechanical & Electrical consultancy. The result expresses a fair representation of the major stakeholders of the Industry. Furthermore, 27% of the respondents belonged to the strategic/senior management level, 60% belonged to the middle management level, while only 8% and 5% belonged to the knowledge/lower management level and operational levels respectively**.** In addition, 34% of the respondents had 16-20 years of experience, 24% had 11-15years of experience, 22% had more than 20 years of experience, while 15% and 5% had 6-10years of experience and less than 5 years of experience respectively.

Readiness Assessment of Nigerian consulting firms

Table 4.1 presents average scores indicating the level of readiness of each professional practice firm in each category i.e. management, process/project, people and technology. As outlined by Ruikar *et al.* (2006) an average score greater than or equal to zero and less than 2.5 is red, and indicates that several aspects (within a category) need urgent attention to achieve readiness; an average score greater than or equal to 2.5 and less than 3.5 is amber, and indicates that certain aspects (within a category) need attention to achieve readiness; and

an average score greater than or equal to 3.5 is green, and indicates that the end-user organisation has adequate capability and maturity in these aspects and therefore is ready (in those respects).

Table 4.1: Summarised average scores indicating the level of readiness of each professional practice firm

Consulting firm	Category Name	Average Score	Situation Based on Ruikar's boundaries
Project Management	Management	2.77	Amber
	Process/Project	3.80	Green
	People	3.28	Amber
	Technology	3.18	Amber
Architectural	Management	2.76	Amber
	Process/Project	3.80	Green
	People	3.28	Amber
	Technology	3.23	Amber
Quantity Surveying	Management	2.78	Amber
	Process/Project	3.80	Green
	People	3.3	Amber
	Technology	3.26	Amber
Structural Engineering	Management	2.77	Amber
	Process/Project	3.84	Green
	People	3.28	Amber
	Technology	3.25	Amber
M&E Engineering	Management	2.76	Amber
	Process/Project	3.83	Green
	People	3.31	Amber
	Technology	3.27	Amber

For this study however, it is evident from Table 4.1 that; the average scores for the categories; management, people as well as technology, were all greater than 2.5, but less than 3.5 (amber), for all the consulting firms considered in the study (Project management, Architectural, Quantity Surveying, Structural Engineering and M&E engineering firms in Nigeria). This clearly shows that Project management firms, Architectural firms, Quantity Surveying firms, Structural Engineering firms and M&E engineering firms in Nigeria all require attention on certain aspects to achieve management, people as well as technology readiness for adopting Lean Construction.

Also, as shown in Table 4.1, for all the building consulting firms considered, process/project was the only category in which an average score greater than 3.5 (green) was obtained. This also clearly indicates that Project management firms, Architectural firms, Quantity Surveying firms, Structural Engineering firms and M&E engineering consulting firms in Nigeria have adequate capability and maturity in this aspects and it's therefore ready to adopt new innovations.

The Cronbach's alpha computed to measure the internal consistency among ratings of respondents as well as the reliability of the scales used for determining the readiness of Nigerian building consulting firms to adopting lean construction in the Nigerian construction industry, was very close to one (0.990), indicating that the scales used were reliable and the respondents understood the questions being put forward to them in the questionnaire. The aforementioned findings corroborates the findings of Olatunji (2008) as they suggest Nigerian building consulting firms have low level of awareness with regards to LC principles.

Comparing Readiness of Nigerian Building Consulting Firms to adopt LC Principles

One-way ANOVA was conducted to compare and thus, determine if there is a significant difference between the levels of readiness of the various Nigerian building consulting firms to adopt lean construction, based on these hypotheses:

Null Hypothesis (H0): there is no significant difference in the level of readiness of the various Nigerian building consulting firms to adopt lean construction.

Alternative Hypothesis (H1): there is a significant difference in the level of readiness of the various Nigerian building consulting firms to adopt lean construction.

As shown in Table 4.2, the significance value is above 0.05 (1.00), indicating clearly that the null hypothesis which states that there is no significant difference in the level of readiness of the various Nigerian building consulting firms to adopt lean construction, is accepted.

Table 4.2: Comparing Readiness of Nigerian Building Consulting Firms to adopt LC principles

	Descriptives							
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Project Management	4	3.258	0.424	0.212	2.583	3.932	2.77	3.8
Architectural	4	3.268	0.425	0.213	2.591	3.944	2.76	3.8
Quantity Surveying	4	3.285	0.417	0.208	2.622	3.948	2.78	3.8
Structural Engineering	4	3.285	0.438	0.219	2.589	3.981	2.77	3.84
M&E Engineering	4	3.293	0.437	0.219	2.597	3.988	2.76	3.83
Total	20	3.278	0.381	0.085	3.099	3.456	2.76	3.84
ANOVA								
	Sum of Squares			df	Mean Square		F	Sig
Between Groups	0.003			4	0.001		0.005	1.000
Within Groups	2.750			15	0.183			
Total	2.753			19				

CONCLUSION

The paper appraised the readiness of Nigerian building consulting firms to adopt Lean Construction principles. The VERDICT readiness assessment model developed by Ruikar et al. (2006) was adopted and used for the assessment. The results of the study shows that the Nigerian building consulting firms have process/project readiness to adopt lean construction principles, but needs to give attention to management, people and technology to achieve full readiness to adopting lean construction principles. This study therefore clearly provides the Nigerian Construction Industry with useful information on the nature of improvement needed to set the scene for effective implementation of LC principles and thus improve performance and productivity in the industry. The study also provides a basis for further research on factors inhibiting Nigerian building consulting firms from attaining management, people and technology readiness to adopt LC principles. Finally, the study recommends more awareness of lean construction principles and its potential benefits via education and training to professional bodies, tertiary institutions offering any building construction related programmes and stakeholders in the construction Industry.

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Perceptions of Construction Practitioners on the Benefits of Construction Change Management Practices

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ABSTRACT

The panacea to imminent changes, which are inevitable from construction projects, is an effective construction change management (CCM) practices. This study was undertaken with the sole aim of assessing the perceptions of construction practitioners on the benefits accruable from the practice. Survey method was adopted with 131 questionnaires administered to the respondents that are working on building projects in tertiary educational institutions in Ondo State, Nigeria. Percentile and Mean Item Score (MIS) were employed to analyze the data collected via questionnaire survey drawn on a 5-point likert scale. While MIS was used to rank the benefits, Kruskal Wallis H test was adopted in testing the opinions of the respondents. Cronbach alpha test with value of 0.909 attests to high degree of reliability of the instrument used in collecting the data. Out of the 13 benefits accruable from CCM practices, the most highly significant ones include; improvement in the construction process, improved flow of knowledge, enhanced collaboration and coordination among the consultants and managing change places one in a position of being ready for change among others. Kruskal Wallis H test shows divergent views of the respondents in relation to the benefits arising from implementing the practice of CCM and this is without prejudice to the uniqueness of construction projects. The conclusion is that there are significant benefits accruable from adoption of CCM practices; hence construction stakeholders are enjoined to adopt the practice CCM in its entirety as this will enhance the performance of tertiary educational building projects.

Keywords: Changes, Construction changes, Change management practices, Educational institutions

INTRODUCTION

The performance of the construction industry in terms of meeting its objectives or goals has been invariably affected by construction changes. Construction changes could occur in form of variation or change orders, rework, industrial action, inclement weather and Construction Change Directives (CCDs) (Hao et al., 2008) among others. These eventually lead to what has been broadly categorized as time and cost overruns (Aibinu & Jagboro, 2002; Ogunsemi, 2002; Garry, 2005; Ubani, Nwachukwu & Nwokonkwo, 2010; Ademeso & Windapo, 2014). Also building projects tend to lack good quality of its end product which hardly meets client's requirements (Oyewobi & Ogunsemi, 2010; Oyegoke, 2006).

Construction change is defined as the act or an instance of making or becoming different, an alteration or modification culminated with a situation whereby the scope of work performed differs from the scope of work outlined in the contract documents (Egan, Seder & Anderson, 2012; Erdogan, Anumba, Bouchlaghem & Nielsen, 2005). Construction changes during most project execution are inevitable and can lead to cost and schedule overruns (Egan et al., 2012; Hao et al., 2008) and effective management of these construction changes can significantly reduce the risk of claims that often result in costly disputes and litigation. Therefore, construction change management is a practice that requires an integrated solution to discipline and coordinate the process e.g. documentation, drawing, information, cost, schedule and personnel of a project from inception to completion by ensuring that disputes, cost and schedule overruns are managed (Hao et al., 2008).

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It has been established that construction changes will never disappear; the best option is to manage them to prevent negative consequences (Harrison, 2012; Lazarus & Clifton, 2001). The impacts and consequences of changes on an organization and people vary according to the type and nature of changes, but most importantly according to how they are managed (Erdogan et al., 2005). The essence of this construction change management is to maximize the benefits, minimize the penalties, and ensure that both benefits and penalties are distributed equitably (Lazarus & Clifton, 2001; Erdogan et al., 2005). It is upon this pedestal that this study assessed the practitioners' perceptions of the benefits accruable from implementing the practice of construction change management.

LITERATURE REVIEW

Construction Changes

The more the construction changes on a project, the greater the likelihood that they not only become time consuming and costly in the construction projects (Ojo, 2010) but also critically cause extra demands of equipment, materials, labour and overtime (Hao et al., 2008). It is almost becoming a rare thing for a project not to have changes, thus becoming a normal occurrence and inevitable as they are fact-of-life at all stages of a project's life cycle (Hao et al., 2008; Ojo, 2010). Some salient facts are true about construction changes: changes cannot be totally avoided and the riskier the change is, the costlier the consequences if the wrong decision is made in terms of management (Egan et al., 2012). However, in spite of the changes involved, the history of the construction industry is full of projects that were completed with significant cost and time overruns, poor project performance, and quality failures (Adedokun, Ogunsemi, Aje, Awodele & Dairo, 2013; Ademeso & Windapo, 2014; Baloi & Price, 2003; Elinwa & Buba, 1993; Garry, 2005; Ogunsemi & Aje, 2005; Okpala & Aniekwu, 1988).

Therefore, there is the need for the project owners or managers to make an informed decision, one with minimal error and this error free decision is only possible if there is effective construction change management process (Harrison, 2012; Hao et al., 2008) that will adequately manage (identify, evaluate, assess) construction changes. The need to consciously manage construction changes is now recognized as important practice to improving innovation, construction project performance and client's satisfaction. It is then that the resultant effects/impacts of construction changes on project(s) can be minimized and the objectives or goals of the industry achieved at the end of the day because most of the times when construction changes are not dealt with satisfactorily, the industry tend to suffer poor performance.

Challenges facing construction change management practices

Hao et al (2008) opined that developing an effective construction change management process is a challenging task because it requires an integrated solution for coordinating everything involved for the purpose of the change management in question according to figure 4. Change management is a topic that one can hardly get through any resources unlike project management or construction enterprise management software that are readily available on the market.

Hence, the following are some of the challenges facing construction change management practices (Hao et al., 2008): unacceptability of new ideas by professionals, inadequate encouragement as regards learning within the firm, unavailability of change management unit, unavailability of time to exchange ideas, insufficient time for after action review, difficulty in transferring change management knowledge, unwillingness of staff to share knowledge, excessive time associated with construction change management, uniqueness associated with projects which makes knowledge gotten from a project a waste to other

projects, variation on nature of projects, lack of organizing training/ seminars due to insufficient resources, too much work preventing evaluation of previous work, overbearing workload which prevents cross project learning, unwillingness to learn by professionals and resistance to change current practice and adopt new approach.

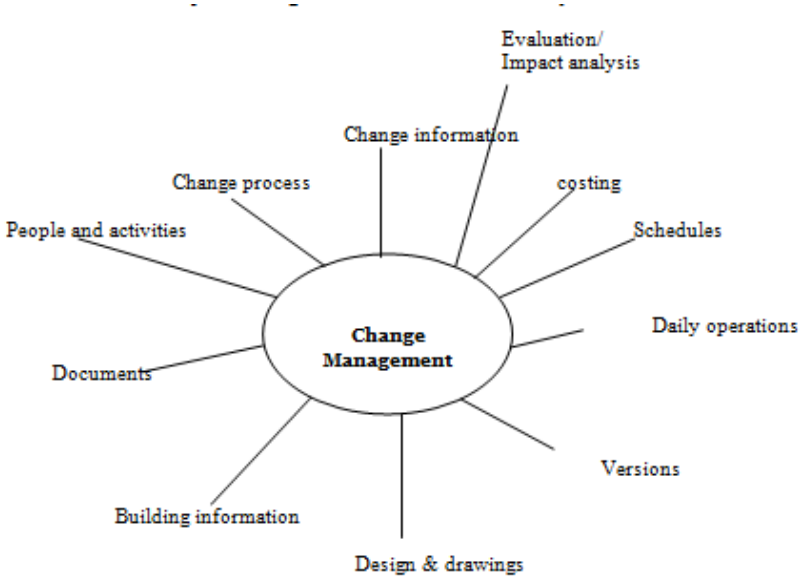

Fig 4: Requirements of an integrated change management system (Hao et al., 2008)

Construction change management

Construction projects are becoming complex in nature; clients are also becoming knowledgeable, more demanding and selective in what they want from consultants (Preece, Moodley & Smith, 2003). This complexity gives rise mostly to unwanted situations leading to construction changes like variations (change orders), reworks (Erdogan et al., 2005), or unexpected events such as industrial action, inclement weather (Love, Holt, Shen, Li & Irani, 2002) and construction change directives (Hao et al., 2008) with their attached effects as aforementioned.

Change management is one of the priority areas of construction practitioners and concerted efforts are being made to cushion the effects of cost and time overruns that characterized construction projects be it vertical or horizontal (Harrison, 2012; Hao et al., 2008). Also, significant poor project performance and quality failures (Adedokun et al., 2013; Ademeso & Windapo, 2014; Baloi & Price, 2003; Elinwa & Buba, 1993; Garry, 2005; Ogunsemi & Aje, 2005; Okpala & Aniekwu, 1988) cannot be over emphasized.

Benefits of Construction Change Management Practices

Each construction project is unique in its entirety; therefore the challenges of one project may require management measure that is quite different from others (Aje, Adedokun & Adedokun, 2015) and thereby yielding benefits that are project specific. Therefore managing changes effectively is crucial to the success of a construction project (The Happy Manager, 2014) as it helps in controlling time, cost and quality right from inception stage of the construction project to completion. According to Happy manager (2014), some of the benefits are:

i. Managing change puts you in a position of being ready for change.
ii. Developing an understanding of the kind of change required – understanding that different characteristics of change need different approaches.
iii. Implementing a process to navigate the change required.
iv. Gaining clarity about what is being achieved – why we are changing.

v. Building commitment to work together, to bring people with you.
vi. Appreciating the best of the way things are done now, so that the future is built on current strengths within the organisation.
vii. Shaping change through principles which establish how you manage change – the principles upon which change is shaped.
viii. Delivering change that makes improvements.

RESEARCH METHODOLOGY

This research employed a qualitative research design in the conduct of the study which involved the use of questionnaire survey administered to key construction stakeholders. The population for this work includes 131 key construction stakeholders comprising 44 Contractors/ representatives, 32 Quantity Surveyors, 28 Architects and 27 Structural Engineers, in the tertiary educational institutions in Ondo state, Nigeria (see Tables 1 and 2). The construction professionals used are both in-house professionals within the client organisation and the consultants outside the client's organisation but working on client's projects and the contractors executing the projects for clients. The targeted respondents were involved in the completed tertiary educational building projects from 2010 – 2014. The choice of the duration is to enable the respondents to quickly remember the activities that transpired during the course of the projects, knowing too well that records are seldom kept in a retrievable manner (Tarr and Car, 2000), hence taking too long a duration will allow guess work to set in.

Table 1: Population breakdown of the respondents

S/N	Institutions	CLIENTS REPRESENTATIVES						Nr. of Kto rs/Rep	**Total**
		In-House Professionals			External Consultants				
		QS	Arch	S/Eng	QS	Arch	S/Eng		
1	Tert. Ins. 1	2	2	4	5	4	4	10	31
2	Tert. Ins. 2	3	1	2	4	3	3	5	21
3	Tert. Ins. 3	0	0	0	1	2	2	5	10
4	Tert. Ins. 4	2	2	2	9	7	6	10	38
5	Tert. Ins. 5	0	0	0	0	0	0	0	0
6	Tert. Ins. 6	0	0	0	4	4	3	8	19
7	Tert. Ins. 7	2	3	1	0	0	0	6	12
	Total	9	8	9	23	20	18	44	**131**

Key:
Tert. Ins. – Tertiary Institution; Nr. of Ktors/ Rep – Number of Contractors/ Representatives; QS – Quantity Surveyors; Arch – Architects; S/Eng – Structural Engineers

The lists of relevant construction professionals were collected from Physical Planning Unit (PPU)/ Works and Services Department of their respective Tertiary Educational Institutions. The adequacy of a sample is assessed by how well such sample represent the whole population of participants from which the sample is drawn (Kothari, 2009). Having found the target population to be 131, it was found to be manageable size and thus census method was employed which involved the use of the entire population rather than picking a sample which might introduce some level of bias in the study.

Table 2: Population of the respondents

S/N	Respondents	Population
1	Quantity Surveyors	32
2	Architects	28
3	Structural/Civil Engineers	27
4	Contractors/ Representatives	44
	Total	**131**

Data Collection Instruments

The research instrument that was used for collecting data from the respondents included a structured questionnaire that was administered using a set of predetermined questions. The questions designed for this research were such that first section dwelt on the background information of the respondents while the other section focused on matters relating to the research study. Questions inherent in the structured questionnaire were multiple-choice type with different checkboxes and tables posed on a 5-point likert scale for ease and uniformity of response. Its application implies that most part of the data analysis was based on a scoring system.

Reliability of the research instrument

Reliability according to Kothari (2009) is an important aspect of research instrument and must be considered to ensure that accurate results are obtained. One of the most commonly used reliability coefficients according to Kothari is Cronbach's alpha test (α). Cronbach alpha test was employed in this study to test the reliability of the questionnaire administered to the respondents during the survey carried out.

Table 3: Test of reliability for measuring scale

Scale of measure	Cronbach ∝-value
benefits of construction change management practices	0.909

Table 3 shows that the Cronbach's α value for scale of measures of the research instruments ranges from 0.800 to 0.946. Since the degree of reliability of the instrument is more perfect as the value tends towards 1.0 (Kothari, 2009), it can then be concluded that the instrument used for this research is significantly reliable.

DATA PRESENTATION, ANALYSIS AND DISCUSSION

Tables were employed in this paper for data presentations while the analyses of the collected data were carried out using percentile, mean item score, and Kruskal Wallis test. The results of the analyses were presented as follows under various headings.

Background Information of Respondents

Out of the 131 questionnaires administered, 87 were filled, returned and found suitable for the analysis. The analyzed questionnaire represent 66.41% of the total questionnaire sent out which is considered sufficient for the study. From Table 4, it can be seen that majority of the respondents in this case are Quantity Surveyors with 43.7% and was closely followed by 29.9% quota, represented by the Structural/Civil Engineers and least was Architects with 26.4%. The professional membership status of the respondents shows that 41 are graduate member, 44 are corporate/ associate members while 2 of them are fellow of their respective professional bodies with 47.1%, 50.6% and 2.3% respectively.

As for the years of working experience possessed by the respondents, it can be seen that 26.4% falls within 1 - 5, 54% of the respondents are within 6 – 15 years of experience, while 8% falls within 16 - 20. On the average, the respondents have 10 years of working experience and the information supplied by this category of professionals is considered adequate and relied upon. These set of respondents have their establishment in existence for an average of 13 years. Analysis in Table 4 reveals that majority of the respondents are Postgraduate Diploma holder with 40.2% and this is followed by respondents with BSc/ BTech qualification representing 20.7% followed by 19.5% and 18.4% representing HND and MSc/ MTech. Only one of the respondents has a PhD as the highest qualification and this translated to 1.2%.

Practitioners' based perceptions of benefits of construction change management practices

Table 5 reveals the benefits of construction change management practices based on the practitioners' assessment (Quantity Surveyors, Architects and Structural/Civil Engineers). Based on the perception of the Quantity Surveyors, the practice offers improvement in the construction process; enhances team collaboration and improves flow of knowledge. Architects are of the opinion that construction change management practice enhances team collaboration; improves flow of knowledge and improves the construction process.

Table 4: Demographic information of the respondents

Background Information	*Frequency*	*Percentage*	*Cum. Percentage*	
Profession of respondents				
Quantity Surveyors	38	43.7	43.7	
Architects	23	26.4	70.1	
Structural/ Civil Engineers	26	29.9	100.0	
Total	***87***	***100.0***		
Year of experience				
1 – 5	23	26.4	26.4	
6 – 10	32	36.8	63.2	
11 – 15	15	17.2	80.4	
16 – 20	7	8.0	88.4	
Above 20	10	11.6	100.0	
Mean		**9.8**		
Total	***87***	***100.0***		
Highest Qualifications				
HND	17	19.5	19.5	
BSc/BTech	18	20.7	40.2	
PGD	35	40.2	80.5	
MSc/MTech	16	18.4	98.8	
PhD	1	1.2	100.0	
Total	***87***	***100.0***		
Type of firm/ Sector				
Client organization	26	29.9	29.9	
Contracting firm	46	52.9	82.8	
Consulting firm	15	17.2	100.0	
Total	***87***	***100.0***		
Year/ length of establishment of firm				
1 – 5	13	14.9	14.9	
6 – 10	23	26.5	41.4	
11 – 15	18	20.7	62.1	
16 – 20	11	12.6	74.7	
Above 20	22	25.3	100.0	
Mean		***12.8***		
Total	***87***	***100.0***		
Membership grade				
Graduate	41	47.1	47.1	
Corporate/ Associate	44	50.6	97.7	
Fellow	2	2.3	100.0	
Total	***87***	***100.0***		
Professional body of affiliation				
NIQS	37	42.5	42.5	
NIA	21	24.1	66.6	
NSE	24	27.6	94.2	
Others (NICE, COREN)	5	5.8	100.0	
Total	***87***	***100.0***		

On the part of the Structural Engineers, managing change put one in a position of being ready for the change; delivering change that makes improvement on project performance while

thirdly, it offers improvement in the construction process. Taking cognizance of the most highly ranked three benefits, it is evident that only one benefit cut across the ratings of the respondents being improvement in the construction process, though with different levels of ranking. With reference to the most highly rated three benefits, Quantity Surveyors and Architects had the same benefits but in different order of mean scores.

Table 5: Practitioners' based perceptions of benefits of construction change management practices

Benefits	Quantity Surveyors		Architects		Structural/Civil Engineers	
	Mean	Rank	Mean	Rank	Mean	Rank
Improvement in construction process	4.32	1	4.39	3	4.20	3
Enhanced team collaboration and coordination	4.30	2	4.43	1	4.00	8
Improved flow of knowledge	4.30	3	4.43	1	4.20	3
Managing change puts you in a position of being ready for change	4.27	4	4.13	8	4.32	1
Appreciating the best way things are done now, so that the future is built on current strengths within the organisation	4.19	5	4.30	5	4.16	5
Improved decision making	4.16	6	4.39	3	4.16	5
Gaining clarity about what is being achieved- why we are changing	4.06	7	3.83	11	4.16	5
Delivering change that makes improvement on project performance	4.03	8	4.26	6	4.28	2
Mitigating risk	3.97	9	3.74	12	3.96	10
Developing an understanding of the kind of change required-understanding that different characteristics of change need different approaches	3.97	10	4.00	9	3.96	10
Shaping change through principles which establish how you manage change- the principles upon which change is shaped	3.95	11	3.91	10	4.00	8
Building commitment to work together, to bring people with you	3.81	12	4.18	7	3.92	12
Implementing a process to navigate the required change	3.81	13	3.74	12	3.76	13

Table 5: Benefits of construction change management practices

Benefits	**Group Mean**	**Group Rank**
Improvement in construction process	4.31	1
Improved flow of knowledge	4.31	1
Enhanced collaboration and coordination	4.25	3
Managing change puts you in a position of being ready for change	4.25	3
Improved decision making	4.22	5
Appreciating the best way things are done now, so that the future is built on current strengths within the organization	4.21	6
Delivering change that makes improvement on project performance	4.16	7
Gaining clarity about what is being achieved-why we are changing	4.02	8
Developing an understanding of the kind of change required-understanding that different characteristics of change need different approaches	3.98	9
Shaping change through principles which establish how you manage change-the principles upon which change is shaped	3.95	10
Building commitment to work together, to bring people with you	3.94	11
Mitigating risks	3.91	12
Implementing a process to navigate the required change	3.77	13

Benefits of construction change management practices

Table 6 reveals that despite the fact that the most highly ranked benefits are improvement in the construction process (Mean Score = 4.31) which tied with improved flow of knowledge, the 3rd benefit is having enhanced collaboration and coordination among the consultants (Mean Score = 4.25) which also tied with managing change puts you in a position of being ready for change, all other benefits are also significant with a considerable impact on

construction projects. The least ranked benefits includes implementing a process to navigate the required change (Mean Score = 3.77), mitigates risk (Mean Score = 3.91) and lastly building commitment to work together (Mean Score = 3.94).

Table 7: Significance test on the benefits of CCM practices

	Profession	Group	Mean
Chi-square	.532	Quantity Surveyors	19.38
Df	2	Architects	21.85
Asymp. Sig	0.767	Structural/ Civil Engineers	18.77

Significance test on the benefits of CCM practices

Table 7 reveals that the respondents have divergent opinions on the benefits of construction change management practices on projects. The result of Kruskal-Wallis test carried out shows a low chi-square value of 0.532, P value is > 0.05 i.e. 0.767, hence there is no significant agreement in the opinions of respondents on the benefits of construction change management practices. These divergent views may be due to the fact that each construction project is unique its entirety; hence the challenges of one project may require management measure that is quite different from others and thereby yielding benefits that are project specific.

DISCUSSION OF FINDINGS

Benefits of construction change management practices

Despite the challenges militating against full adoption of construction change management practices in its entirety (Dairo, 2015), all the benefits, according to the ratings of the respondents, were found to be significant after analysis and these closely support the happy manager (2014) and MDC System (2002) that the benefits accruable from adopting construction change management practices are the improvement to the construction process, improved flow of knowledge, enhanced collaboration and coordination among project participants and the fact that managing change puts one in a position of being ready for change among others factors.

CONCLUSION AND RECOMMENDATION

Conclusion

This study assessed benefits accruable from construction change management practices based on tertiary educational building projects in Ondo state, Nigeria. Consequent to the analysis carried out, it can be concluded that construction change management practices offer improvement to the construction process, flow of knowledge, enhanced collaboration and coordination among project participants while the practice also puts one in a position of being ready for the change.

Recommendation

Based on the forgoing, it is hereby recommended that construction practitioners should fully adopt construction change management practices in building projects because it offers improvement to the construction process among others.

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Assessment of Construction Cost Escalations in the Public Sector's Projects in Lagos State, Nigeria

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ABSTRACT

The construction industry is an important player in the development of any Nation. Hence, it is fundamentally essential to make construction projects completed successfully within time, budget and expected quality. Despite proven importance of cost as a driving force of project success, it is common to see construction projects failing to achieve its objectives within specified cost. This research aims at assessing construction cost escalations in the public sector's projects in Lagos State, Nigeria. The objectives are to identify the rate of occurrence of cost escalation in public sector's construction projects, find the relationship between project size and cost overrun, and identify and rank the most important causes of cost escalations in the public sectors' construction projects as perceived by various construction industry participants (the clients, consultants and contractors). Data were collected and analysed using both descriptive and inferential statistics. The study showed that cost overrun in public sector projects was 19.14% on the average. There was a significant relationship between project size and cost overrun. The most important cause of cost overrun in public sector is additional work to project. As measures against cost overrun, this study recommended, among other things, the necessity of having well defined project scope from inception to completion.

Keywords: Construction, Cost overrun, Nigeria, Projects, Public sector

INTRODUCTION

The construction industry is a dynamic sector and an important player in the development of any nation (Memon, Rahaman and Azis, 2012). It is an important industry that plays a vital role in the socio-economic growth of a country. Yet, it has been regarded as one facing chronic problem of poor performance leading to failure in achieving effective time and cost performance (Olawale and Sun, 2010; Memon et al 2012). Cost escalation has become a very frequent problem that is almost associated with nearly all projects in the construction industry. This trend is more severe in developing countries, where these escalations sometimes exceed 100 percent of the anticipated cost of the project (Memon, Rahman and Azis, 2011). It is a problem because of its inherent effects, some of which are budget short fall of project owners, project delay, poor quality, project extension, project abandonment, litigation (Nega, 2008; Azhar, Fasooqui and Ahmed, 2008; Kaliba et al, 2009).

Morris (1990) observed that if cost overruns in public sector are pervasive, they will increase the cost of investment in real terms and raise the capital-output ratio in the construction industry, an effect which can spread to other sectors. The primary concern of the construction projects' clients, therefore, is to see their projects completed successfully within specified cost, time and quality. Given the large capital amounts associated with construction projects, the performance in terms of cost is supposed to be closely monitored, especially where tax payers' money is involved (Baloyi and Bekker, 2011). This study therefore focuses on

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assessing the cost escalations in the public sector of the Nigerian construction industry. This will further assist this sector, and by extension all stakeholders in the construction industry, to identify their peculiarities in the area of cost escalation of projects.

This research is aimed at comparing construction projects cost overrun in the public and private sectors in Lagos State, Nigeria. The objectives are to: (1) identify the rate of occurrence of cost escalation in public sector's construction projects, (2) find the relationship between project size and cost overrun, and (3) identify and rank the most important causes of cost escalations in the public sectors' construction projects as perceived by various construction industry participants (the clients, consultants and contractors).

LITERATURE REVIEW

The construction industry is observed to be one of the most complex fragmental schedule and resource driven industry (Memon et al, 2011). It is also a highly dynamic sector and plays very important role in the development of any nation. The industry is considered as a driver of economic development in a country. The Nigerian construction industry's contribution to the Gross Domestic Product (GDP) is about 2.95% between 2009 and 2010 (Isa, Jimoh & Achuenu, 2013), 2.08% in 2011 (National Bureau of Statistics, 2012; FSDH Merchant Limited, 2013), between 2.19% and 3.01% in 2012 (National Bureau of Statistics, 2012; Centre for Affordable Housing Finance in Africa, 2013; FSDH Merchant Limited, 2013; Isa et al, 2013) and 3.10% in 2013 (African Economic Outlook, 2014). Besides, the all-inclusive effects of this construction sector, and especially its employment generating potentials, makes it a veritable platform for sustainable development especially if proper mechanisms are put in place for the growth of the sector to be stimulated (Isa et al, 2013).

Dantata (2007) however, observed that despite the impressive performance of the construction industry, it faces a significant number of challenges including lack of local skilled labour, power shortage, the unavailability of materials, and the unethical practices that are very common in the industry, and of course, delay schedule and cost overruns. Cost escalation or overrun is the amount by which actual costs exceed the baseline or approved costs (Danso and Antwi, 2012). According to Nyamoki (2012) and Subramani et al, 2014), cost overrun is also defined as the difference between the actual construction cost on completion of work and original estimated costs, with all costs calculated in constant prices.

Causes of Cost Escalations

The history of the construction industry worldwide is full of projects that were completed with significant cost escalations (Azhar et al, 2008; Ameh et al, 2010). A large number of studies and surveys evidenced the fact that cost overrun affects all kinds of projects in all industries, and in all countries either in the public or in the private sector (Boukendour, 2005). According to Azhar et al. (2008); Ameh, Soyingbe and Odusami (2010), the history of the construction industry worldwide is full of projects that were completed with significant time and cost overruns. Memon et al (2011) observed that time and cost overruns vary considerably in their magnitude from project to project. However, the trend is more severe in developing countries where these overruns sometimes exceed 100% of the anticipated cost of the projects.

Azis, Memon, Rahman and Abd. Karim (2013) pointed out that contractors' site management is the most significant contributor to cost overruns in Malaysia. This is followed by information and communication, project management and contract administration, labour related factors, materials and machinery and external factors. Others are design and documentation and financial management.

The construction of new stadia and upgrading of existing ones in South Africa, as reported by Baloyi and Bekker (2011), experienced time delays and cost overrun in nearly all the projects with an average of about 45 percent overrun, ranging between 5.4% and 93.8%. In the study, top ten factors contributing to more than 85% of the cost overrun were ranked as increase in material cost (external factor), inaccurate material estimates (client-related), shortage of skilled labour (contractor-related), clients' late contract award (client), project complexity (external), increase in labour cost (external), inaccurate quantity take-off (client), difference between selected bid and the consultants' estimate (client), change orders by client during construction (client) and shortage of manpower (external).

The study of road construction projects in Palestine by Mahamid and Amund (2012) indicated that 100% of the projects suffer cost deviation from 39% to 98% with an average of 14.6% between estimated and actual cost. The suggested reason for cost deviation could be because of under-estimation of project cost which affected 76% of sampled projects to an average of 22.34% ranging from 0.39% to 98.04%. The results, however, show that the relationship between the project size (length and width of the road) and the cost deviation is very weak. This is at variance with Singh (2009) which reported that cost overruns soar as project size increases for infrastructure projects in India. Results of the perceptions of contractors on factors affecting cost overruns on building projects in Palestine indicated the top five factors as fluctuation in the currency exchange rate, project financing, contract management, level of competition, and cost of materials (Mahamid, 2014).

Investigation into the causes of cost overruns in Uganda's public sector construction projects by Alinaitwe, Apolot and Tindiwensi (2013) revealed that changes in the work scope, delayed payments to contractors, poor monitoring and control, high inflation and high interest rates were five most important causes.

The results of the study of Ameh et al (2010) on telecommunication projects in Nigeria identified and ranked the prevailing causes of cost overruns in order of importance as lack of contractors' experience in telecommunication projects, high cost of imported materials, fluctuations in material prices, frequent design changes due to inadequate site and environmental information, mode of financing, bonds and payments, fraudulent practices and kickbacks. Kasimu (2012) in his study of significant factors that cause cost overruns in building construction projects also in Nigeria identified market condition, lack of experience in contracts works, insufficient time (for pre-tender stage), material price fluctuation and political situation as the major significant factors that cause cost overruns in those projects.

Brunes and Lind (2014) observed that overruns in infrastructure projects in Sweden, occurred in the planning stages up to the final design and are related to design changes because of technical and administrative problems. Other factors are lack of competence among consultants, project managers and higher level staff, as well as psychological (optimism) bias.

The analysis of 58 Australian transportation infrastructural projects revealed that rework during construction as a result of design changes, errors and omission are the major contributors of overruns in projects (Love, Sing, Wang, Irani & Thwala, 2014). In the survey of 74 road projects awarded in the West Bank-Palestine over the years 2007-2010 by Mahamid (2013), 100% of the projects suffered from cost deviation with an average of 16.73% ranging from – 20.33 to 56.01%. A correlation between project size and cost deviation was also observed. According to the findings, as project size increases, its resources increase requiring a more control measure to maintain the project performance in terms of cost, time and quality.

METHODOLOGY

The study made use of cross-sectional and adopts a quantitative research method. Different data were collected from both secondary and primary sources. Data collected from secondary sources include archival information on cost details such as initial contract sum and final account sum of most recently completed construction projects by the public sector (Ministry of Works & Structures and Ministry of Housing in Lagos State). Clients, consultants and contractors were the sources of this information through questionnaires. Other sources of secondary data are publications, textbooks, journals, research works, conference/seminar papers, Internets, etc. Data from primary sources were those collected through questionnaires administered on construction industry professionals, i.e. architects, civil/structural engineers, mechanical/electrical engineers, builders and quantity surveyors working within clients' (project owners) organisations, consultancy firms and constructing organisations. The questionnaire contained demographic information and organisational data of respondents, and their opinions concerning causes of cost escalations.

The study employed a multi-stage sampling technique. Stratified sampling technique was used for picking professionals from each of the five groups. The study area was divided into three strata on the basis of senatorial districts. Thus out of 130 professionals, 50 were sampled from Lagos Central while 40 were sampled from Lagos West and Lagos East respectively. This is based on the consideration of commercial/economic status of the districts and constitutes good representation of the population. The questionnaires were distributed in the senatorial districts by simple random technique. Out of the 130 questionnaires administered, a total of 92 were duly completed and returned, representing approximately 70.77% response rate, for the analysis.

The questionnaire was designed to seek respondents' opinion on level of importance of the listed factors causing cost overruns on a 1-5 Likert-type scale using 1 for not important, 2 for slightly important, 3 for moderately important, 4 for very important, and 5 for extremely important.

On the basis of the data obtained from the respondents, the causes were assessed for their relative importance index using the mean item score (MIS) method. A five point scale was used to calculate the MIS for each factor, which was then used to determine the relative ranking of different factors by assigning ranks to the mean scores, with high mean scores assigned high ranks and vice versa. These ranking made it possible to cross-compare the relative importance of the causes as perceived by the three groups of construction industry participants (the clients, consultants and contractors organisations).

To test for the degree of agreement in ranking of the individual factors between various groups of construction participants, a Kendall tau Rank Correlation Coefficient (analysis) was used for any two groups (clients and consultants, clients and contractors, consultants and contractors respectively). The null hypothesis (H_0) that the two groups of construction participants (the clients and consultants organisations, etc) do not agree on the ranking of significant causes of cost overruns was tested and the coefficient of concordance determined.

FINDINGS AND DISCUSSIONS

Rates of occurrence and percentages of cost escalation in public sector were computed and it was observed that about 68.48% of the total number of executed projects in the public sector experienced cost overrun with an average of 19.14% cost escalation ranging from 1.19% to 81.82%. It is equally noted that projects that were completed at the exact initial contract sum

were 22.83%. Those that were completed with savings (at prices less than the initial contract sum) ranging from -4.30% to -0.14% of initial contract sum were 8.69% (Table 1)

Table 1: Rates of Occurrences of Cost Escalation in Public Sector' Projects

	Range of % of overrun	No. of Occurrence	% of Occurrence
Savings	-4.30-0.14	8	8.69
Zero Escalation	0.00	21	22.83
Positive Escalation	1.19-81.82	**63**	68.48
Total		**92**	**100.00**
Average % of Overrun/Occurrence	**19.14**		**69.39**

Relationship between Project Size & Cost Overrun

A hypothesis was set up to examine whether a statistically significant relationship exists between project size and cost overrun. The result of Pearson correlation analysis revealed a significant and positive relationship (r = .315, N = 92, p = .002) as indicated in the correlation Table 2. From the Table, it can be concluded that the relationship between project size and cost overrun is statistically significant at $p<0.05$. The correlation coefficient (r) equals 0.315, indicating that the strength of the relationship between project size and cost overrun was below average in the positive direction.

Table 2: Relationship between Project Size & Cost Overrun

		Initial Contract Sum	Actual Cost overrun
Initial Contract Sum	Pearson Correlation	1	.315**
	Sig. (2-tailed)		.002
	N	92	92
Actual Cost overrun	Pearson Correlation	.315**	1
	Sig. (2-tailed)	.002	
	N	92	92

**. Correlation is significant at the 0.01 level (2-tailed), correlation coefficient, r = .315, p-value at 0.01 = .002

Relative Importance Indices of Cost Overrun

Table 3 shows the relative importance indices (RII) and ranking of the first twenty factors causing cost escalation in the public sector. In the overall weighted average of the groups of construction industry participants, additional work to the project came first as the most important factor causing cost overrun with a mean item score of 4.184. This factor was also ranked first by contractors but ranked fifth by clients and consultants respectively. The second most important cause is lack of detailed and well defined design brief (4.061). This was ranked first by the clients but ranked 10^{th} and 11^{th} by consultants and contractors respectively. The third factor causing cost overruns is delayed payment and cash flow difficulties faced by contractors (4.020). This was ranked first by consultants, seventh by the clients and 17^{th} by the contractors. The analysis of variance (ANOVA) was carried out to determine the significant difference in the group (clients, consultants and contractors) mean for each cause of cost overrun. From Table 4, p-value is greater than .05 for 18 out of the first 20 ranked causes of cost overrun in the public sector projects. This shows that the results of these 18 causes are not significant at the 5% level, implying that the null hypothesis ($H_{o)}$ will be accepted and the alternative hypothesis rejected. Thus, there is sufficient evidence to conclude that there is no significant differences (or there is significant degree of agreement) between the mean values of these groups (or between the group means) of these 18 causes of cost overrun. With a view of ascertaining the level of agreement / disagreement between any two groups, Kendall tau rank correlation coefficient was carried out and Table 4 shows the result of this for the public sector.

Table 3: Relative Importance Indices (RII) and Ranking of Factors Causing Cost Overrun in the Public Sector Projects

Causes of cost overrun	Category of causes	Clients (N=30)		Consultants (N=34)		Contractors (N=28)		Overall average (N=92)		F-Stat	p-value	Level of Sig.
		Mean	R	Mean	R	Mean	R	Mean	R			
Additional work to the project	Clients	4.111	5	4.133	5	4.571	1	4.184	1	0.566	0.572	NS
Lack of detailed and well defined design brief	Consultants	4.259	1	3.933	10	3.571	11	4.061	2	1.435	0.249	NS
Delay payment and cash flow difficulties faced by contractors	Clients	4.000	7	4.400	1	3.286	17	4.020*	3	3.040	0.058	NS
Fluctuation/ Price escalations of materials, labour and equipments	External	3.963	8	4.267	4	3.714	9	4.020	4	0.878	0.422	NS
Inflation and high interest rates on the cost of construction materials	External	3.963	9	4.000	8	4.286	3	4.020	5	0.319	0.728	NS
Poor project management and contract administration	Contractors	4.185	3	4.067	6	3.286	18	4.020	6	3.675	0.033	S
Incomplete design information when estimating	Consultants	4.111	6	4.000	9	3.571	12	4.000	7	0.879	0.422	NS
Design changes	Consultants	3.815	14	4.333	2	4.000	6	4.000	8	1.785	0.179	NS
Rise in foreign exchange rate (for imported materials)	External	3.926	11	3.800	17	4.571	2	3.980	9	1.652	0.203	NS
Lack of contractors' experience in relevant projects	Contractors	4.222	2	3.667	20	3.714	10	3.980	10	1.881	0.164	NS
Poor financial resources management	Contractors	4.149	4	3.867	16	3.429	15	3.959	11	1.385	0.260	NS
Inaccurate or poor estimation of original cost	Consultants	3.889	12	4.000	7	3.571	13	3.878	12	0.289	0.750	NS
Use of inefficient contractors	Clients	3.926	10	3.867	15	3.571	14	3.857	13	0.214	0.808	NS
Fraudulent practices and kickbacks	External	3.815	15	3.933	11	3.857	7	3.857	14	0.065	0.937	NS
Rework during construction as a result of design changes, errors and omission	Consultants	3.704	17	3.933	13	4.143	4	3.837	15	0.593	0.557	NS
Government bureaucracy	External	3.704	18	3.933	14	3.857	8	3.796	16	0.315	0.732	NS
Project complexity	Consultants	3.778	16	3.933	12	3.429	16	3.776	17	0.617	0.544	NS
Financial difficulties of owners	Clients	3.630	20	4.333	3	3.143	20	3.776	18	3.525	0.038	S
Poor management of uncertainty in project management and administration	Contractors	3.667	19	3.733	19	4.143	5	3.755	19	0.638	0.533	NS
Poor monitoring and inefficient cost control systems	Contractors	3.852	13	3.800	18	3.286	19	3.755	20	0.928	0.403	NS

Note: * Equal mean scores of the individual factors ranked according to the number of respondents scoring 5 and 4 respectively; F-stat = test statistic; p-value = probability that the null hypothesis is true; significant at $p<0.05$.

Table 4: Test of Agreement on Ranking of Important Causes of Cost Overruns in the Public Sector

Construction Industry Participants	Test Statistic	p-value	Accept H_0?	Remark
Clients and Consultants	0.084	0.604 > 0.05	Yes	Not significant
Clients and Contractors	-0.042	0.795 > 0.05	Yes	Not significant
Consultants and Contractors	-0.074	0.650 > 0.05	Yes	Not significant

Note: Kendall tau-b Test Statistic = Correlation coefficient; p-value = Probability that the null hypothesis is true; Significant at p<0.05 (2-tailed).

The result in Table 4 shows the computation of a Kendall tau rank correlation coefficient (r) (analysis) and the decision rule of rejection of null hypothesis for the ranking of causes of cost overrun as perceived by different groups. The p-values (0.604; 0.795; 0.650) > 0.05 indicate that the agreements between groups are not significant. This implies acceptance of null hypothesis (H_0) and rejection of alternative hypothesis (H_1). Thus, there is sufficient evidence to conclude that there are no relationships, meaning there are no agreements between two groups of construction industry participants i.e. clients and consultants, clients and contractors, as well as consultants and contractors in their ranking of important causes of cost overrun in public sector projects.

Discussion of Findings

Frequency of occurrence of cost overrun was 69.39% with a percentage of 19.14% in the public sector. This frequency is lower than that of Malaysia with 92% and Palestine with 100% (Mahamid and Amund, 2012). The average percentage of overrun is higher than the Malaysian situation of 5-10% (Memon et al., 2012) and Palestinian situation of 14.6% (Mahamid and Amund, 2012). This range of percentage of cost overrun is an upward experience from 14% reported in Nigeria by Omoregie and Radford (2006). The finding of this study validates Mahamid and Amund (2012) that the relationship between the project size and cost deviation is very weak. It also supports the studies of Singh (2009) and Mahamid (2013) that there is a positive correlation between project size and cost deviation in Indian and Palestinian public sector projects respectively.

The finding of this research also shows that additional work to the project is the most important cause of cost overrun in the public sector. This was also rated as the most important cause in the work of Choudhry et al. (2012) in Pakistan. Decision by clients to increase the scope of any ongoing contract will change the contract cost and invariably leads to cost overrun unless there is a trade off of any part of the project without compromising the quality.

The result of analysis revealed that there are no agreements in the ranking of causes of cost overrun in the private sector. This is a confirmation of the rankings in Table 3 where it was observed that the first ranked cause of cost overrun, additional work to the project, was ranked first by the contractors and fifth by both the clients and the consultants. These results can be due to different perception in the ranking of possible causes of cost overrun.

CONCLUSION AND RECOMMENDATIONS

Cost overrun is still a severe problem faced by public sector in the Nigerian construction industry. A rise in the average percentage of cost overrun from 14% in previous studies to 19.14% in the public sector as observed in this study should be of great concern to Nigerian construction industry stakeholders. This will pose a serious threat to the success of project delivery if left unchecked. The earlier researchers' call for a percentage increase in contingency allowance to about 15-20% is almost becoming inappropriate in Nigeria's situation with an average of 19.40% cost overrun established from this study. This makes the improvement of the management of financial resources, in both public and private sectors,

inevitable. Cost overrun, for whatever reason, could lead to additional financial burden on the clients in form of claims by the contractor and a total frustration of the projects' objectives.

In the light of the aforementioned research findings and conclusion, this study hereby recommend as follows:

For any project, there must be well defined scope from inception to completion. More time should be invested in the early briefing stages of design (including site investigation) to clearly define project's scope and complexity including completion of detailed design by the consultants before going to tender. Government should put in place strong monetary policies, through proactive strategic planning and approaches, to fight inflation and high interest rates so as to stabilise or/and reduce cost of construction materials. Fluctuation of prices of raw materials and cost of manufactured construction materials are severe when these elements are in short supply. In order to stabilise their costs, government should provide enabling environment towards increasing supply of materials. This will be useful to break the monopoly of few suppliers controlling the supply chain of the market.

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Assessment of Construction Productivity of Indigenous Construction Firms in Southwestern, Nigeria

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ABSTRACT

Engagement of indigenous contractors in the construction sector is one of the several ways the sector boosts the economy. This study was at the instance of the high level of discrimination meted on indigenous contractors from clients on the account of gross incompetence. With this study, the Performance Ability Ratio of indigenous firms on significant construction work items, their competence and readiness for construction activities were evaluated; factors influencing their construction productivity were also identified and analysed. Data obtained from 25 indigenous contractors' site operating on a large scale were used in computing the Performance Ability Ratio (PAR) while data from structured questionnaire administered on 96 clients from public and private sector were analysed using Factor analysis, Mean Item Score and Relative Importance Index. Results showed that the Performance of large scale indigenous construction firms is well above average (PAR=0.83). High competences were found to be demonstrated by these firms in technical and managerial aspects of construction. Results further showed that labour working overtime and stacking of trade had very high impact on the firms' construction productivity. Appropriate project planning among others were strategies for improving their productivity. However, lack of alignment to set goals and contractual conflict were identified barriers to improving productivity. Finally, it is recommended that indigenous construction firms should be given equal opportunity to execute capital intensive construction projects like their expatriate counterpart as results showed that their performances were above average.

Keywords: Competence, Construction Productivity, Construction Sector, Indigenous Construction Firms, Performance Ability Ratio

INTRODUCTION

The construction industry is one of the very important sectors in the economy of every nation. Kazaz and Ulubeyli (2004) opined that the importance stems from a wide range of reasons associated with peculiar features of the industry such as the uniqueness of its products. It covers half of the whole field of fixed capital accumulation; thus, constitutes the most single sector of capital formulation in any national economy (Fagbenle, 2009). Dlakwa and Culpin (2010) hinted that construction investment accounts for over 60% of the Gross Fixed Capital Formation (GFCF) i.e. the total national investment in Nigeria. The industry is also seen as the barometer for the performance of the economy in most developing countries (Kazaz and Ulubeyli, 2004).

Ugochukwu and Onyekwena (2014) opined that the construction process is capital intensive. From inception to completion, cost is incurred at every stage. However, the major cost is incurred during the actual construction stage where irreversible commitment of fund is undertaken in the procurement and deployment of resources such as labour, plant, materials and managerial expertise to achieve the finished product. The contractor is the party who uses these resources to bring the works to fruition. Idoro (2007) explained that these contractors are either foreigners or indigenes; in which case, they originate locally and operate within the immediate project vicinity, state or country.

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Oladapo (2007) concluded that Nigerian indigenous contractors have not had a fair share of major construction activities in the country, as they are often awarded to their foreign counterparts whom are considered more technically and managerially superior and efficient in funds acquisition and project execution. Productivity is considered as one of the most important factors affecting the success and overall performance of every organization, whether large or small, in today's competitive market (Enshassi, Mohammed, and Abushaban, 2009) The construction industry with its several organizations not exempted. Walker and Vine (2000) hinted that construction productivity was traditionally identified as one of the three main critical success factors together with cost and quality for a construction project.

Statement of Research Problem/Question

The need for this study stems from the unproven accusations on indigenous contractors that has forced a lot of them out of business. These accusations added to the problems of high rate of cost and time overrun encountered through inefficient working capital management of majority of indigenous firms (Akinmoladun, 2015). According to Iyagba and Ayodele (1998), the Government is the majority of clients patronising contractors. Idoro (2007) affirmed that the expatriate firms formed majority of the government construction vendors in Nigeria. Unproven accusations on indigenous contractors were, among others, high level of incompetence, lack of technical know-how, shabby quality of work delivered and low managerial capacity (Balogun, 2006). Thus, they do not perform to the satisfaction of the clients.

This discrimination on indigenous contractors by the Government in Nigeria created an atmosphere of fear and uncertainty among indigenous firms in Nigeria. It is in the light of the foregoing, that this research assesses the construction productivity of indigenous construction firms in Nigeria via determination of their various productivity levels, competence levels on construction matters, strategies to improve their productivity and possible barriers to improvement.

Aim and Objectives

The aim of this research is to evaluate the productivity level of indigenous construction firms in other to ascertain their readiness for competition with their expatriate counterparts.
The specific objectives include:

i. To measure on site, the labour productivity level of selected indigenous contractors in the study area through work sampling.
ii. Assess the competence of indigenous firms in construction industry
iii. Identify and assess the factors influencing the productivity of indigenous construction firms;
iv. Identify strategies to improving the productivity of indigenous firms on construction sites;
v. Identify the possible barriers to improving construction productivity of indigenous construction firms.

LITERATURE REVIEW

Emmanuel (2009) opined that productivity has been an essential contributor to corporate success. It corroborated Mojahed (2005), who noted that it is as a result of its direct translation into cost savings and profitability. Productivity has been a key to long-term growth and sustainable improvement and when associated with economic growth and development generates non-inflationary increases in wages and salaries (Mojahed, 2005). An enhanced productivity in the construction industry has a positive effect on the gross domestic product (GDP) of every nation because the industry generally plays a vital role in a national

economy due to the usage of its products such as roads, buildings and dams for the production of goods and services. However, the productivity of the construction industry, according to Haskell (2004), is one of the controversial and least understood factors despite the immense significance of the industry to the economy. Thomas, Skitmore and Lam (2004), opined that site workers in the industry accounts for about 40% of direct capital cost of large construction projects and there is the need to maximise the productivity of human resources. Furthermore, he iterated that about 30% - 50% of workers time is spent directly on the work and, hence, there is the need for proper utilisation. In Nigeria's construction industry for instance, companies are currently applying various non-financial incentive schemes aimed at improving operatives' productivity. This has significantly improved bricklayers' productive time and accounted for 6% to 26% of variations in output between block laying and concreting activities measured (Olabosipo, Aderemi and David, 2004).

Construction industries are faced with the problems of low productivity, poor safety and insufficient quality. Productivity is the one of the most important factor that affects overall performance of any small or medium or large construction industry. There are number of factors that directly affect construction productivity, thus it is important for any organization to study and identify those factors and take an appropriate action for improving their productivity. At the micro level, if productivity were improved, ultimately it reduces or decreases the unit cost of project and gives overall best performance of project. There are number of activities involved in the construction industry, thus the effective use and proper management regarding labour is very important in construction operations without which those activities may not be possible (Honer and Duff 2001).

Productivity is defined as "the ratio of output of required quality to the inputs for a specific production situation. In the construction industry, it is generally accepted as "work output per man-hours worked" (Nabil and Gidado, 2010). Libre (2013) posited that as in many developing economies, productivity is an issue of particular importance all over the world. Nabil and Gidado (2010) opined that productivity is the one of the most important factor that affects overall performance of any small or medium or large construction industry. There are number of factors that directly affect the productivity, thus it is important for any organization to study and identify those factors and take appropriate actions for improving the productivity.

Libre (2013) defined labour productivity as the ratio of the output quantities to the input work hours, or as ratio of the work hours to the quantities (also called the unit rate). For the purpose of this study, the former definition is adopted and labour productivity is expressed as follows:

$$Labour\ Productivity\ = \frac{Output\ Quantity}{Work\ hour}$$

In construction, productivity is usually taken to mean labour productivity, that is, units of work placed or produced per man hour (Nabil and Gidado, 2010). Productivity is the ratio of output to all or some of the resources used to produce that output. According to Libre (2013), output can be homogenous or heterogeneous. Labour productivity has been identified as an index for measuring efficiency because labour is acknowledged as the most important factor of production since it is one of the major factors that creates value and sets the general level of productivity (Ameh and Odusami, 2002). Enshassi, Mohammed, Mustafa and Mayer (2007) identified labour productivity as the key factor contributing to the inability of many indigenous construction contractors to achieve their project goals which include most importantly, the profit margin amongst others.

METHODOLOGY

The study adopted the use of simple random sampling method since data are to be collected from indigenous construction firms across the southwestern States of Nigeria. The data for this research was collected from two major sources, the secondary and primary sources. The secondary data were collected through journals articles, conference proceeding and previous studies to achieve objectives 3-5. The primary data involved data from field survey which consisted direct measurement of output of the operatives on site and data from structured questionnaire which were used to achieve objective 1-2. Twenty Five (25) indigenous construction firms were sampled randomly from the population of the indigenous construction firms (five firms from each State in the Geo-political zones). These five indigenous firms from each State were gathered using the Snowball Sampling method, where one operation active indigenous firm (large scale firm) gave a lead to another large scale operation active indigenous firm. These formed a reflection of the indigenous firms in Southwestern Nigeria. Southwestern Nigeria comprises six (6) States namely: Lagos, Ogun, Oyo, Ondo, Osun and Ekiti State. The researcher ensured that each of the five indigenous firms were located and are in operation in that State.

Data for direct measurement of output on site were collected through work sampling with craftsmen at active operative level as the target group. A well-structured questionnaire was designed on likert scale of 1-5, having the client as the target group. On the scale, Extremely High = 5, High=4, Moderate = 3, Low = 2 and Very Low = 1. The clients were sampled at random from private, individuals and government organizations across the six States which form the population for the clients (Majorly MDAs in Government for Public and Private Institutions such as Banks, Schools and NGOs). A total of 120 questionnaires were administered across the selected sampled population out of which 96 questionnaires were dully completed and returned for analysis. Data collected through work sampling on site was analysed using formula for calculating performance, performance Ability Ratio as adopted from Ugochukwu and Onyekwena (2014). The performance scale ranges from 0-1.

$$\text{Performance} = \frac{\text{Accomplishment}}{Work\ hour} \quad \ldots\ldots\ldots \text{Eq. 1.}$$

$$\text{Performance Ability Ratio} = \frac{\text{Current performance (Pcur.)}}{\text{Exemplar Performance (Pexm)}} \quad \ldots\ldots\ldots \text{Eq. 2}$$

$$= \frac{\text{Pcur.}}{\text{Pexm}}$$

Data collected through questionnaire was analysed using Mean Item Scores (MIS) and Relative Importance Index (RII)

$$\text{MIS} = \frac{5F_5 + 4F_4 + 3F_3 + 2F_2 + F_1}{F_5 + F_4 + F_3 + F_2 + F_1} \quad \ldots\ldots\ldots \text{Eq. 3}$$

$$\text{RII} = \frac{5F_5 + 4F_4 + 3F_3 + 2F_2 + F_1}{5(F_5 + F_4 + F_3 + F_2 + F_1)} \quad \ldots\ldots\ldots \text{Eq. 4}$$

RESULTS AND DISCUSSION OF FINDINGS

Labour Productivity Level of Indigenous Construction Firms

Table 1 showed the average efficient performance of labour output working with the 25 firms on various and significant construction work items while Table 2 showed the best achievable performance of labour output for same activities on the standard radar. For instance, the average Labour output for trench excavation in Firm No.1 is 0.32m^3/hr (From Table 1), while the best achievable output for same work item is 0.33m^3/hr (as shown in Table 2). The

Performance Ability Ratio for firm No.1 on Trench excavation is 0.97 (as shown in Table 3) indicating Firm No.1 is just 3% away from achieving best output on the work item. The overall labour output performance on Trench Excavation for the 25 firms is 0.31m^3/hr. amounting to an average PAR of 0.94, Pit excavation (Output=0.26m3/hr; PAR=0.92) Concrete work (Output=0.10m3/hr. PAR= 0.76), Block laying (Output=0.41m2/hr. PAR=0.40), painting (output=2.16m2/hr. PAR=0.87), making and fixing formwork (output=0.20m2/hr. PAR=0.87), Roofing and Carcassing members (output=0.61m2/hr. PAR=0.88) and so on.

Table 1: Current Performance ($P_{cur.}$) of Indigenous Firms

Work Section	Trench Exc'n	Pit Exc'n	Concrete Work	BlockLaying	Painting	Formwork(Mak'g & Fix'g)	Roof & Carcassing	Laying Floor Tiles	Laying Wall tiles	Reinforcement Mak'g & Fix'g
Firms	**(m^3/hr)**	**(m^3/hr)**	**(m^3/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(Ton/hr)**
1	0.32	0.25	0.09	0.43	2.15	0.19	0.63	1.8	0.18	0.018
2	0.33	0.23	0.11	0.43	2.17	0.22	0.63	1.78	0.2	0.021
3	0.31	0.25	0.1	0.4	2.19	0.18	0.63	1.83	0.18	0.019
4	0.31	0.28	0.11	0.43	2.14	0.23	0.6	1.85	0.19	0.019
5	0.3	0.26	0.08	0.43	2.15	0.2	0.59	1.79	0.19	0.023
6	0.28	0.3	0.11	0.42	2.2	0.19	0.61	1.78	0.17	0.017
7	0.32	0.27	0.09	0.39	2.15	0.2	0.59	1.81	0.18	0.02
8	0.31	0.25	0.11	0.38	2.18	0.23	0.6	1.81	0.22	0.021
9	0.33	0.25	0.1	0.44	2.17	0.22	0.6	1.8	0.23	0.023
10	0.34	0.23	0.11	0.43	2.18	0.23	0.61	1.83	0.19	0.019
11	0.29	0.25	0.08	0.38	2.15	0.19	0.6	1.79	0.23	0.018
12	0.31	0.26	0.09	0.39	2.15	0.18	0.63	1.79	0.19	0.018
13	0.32	0.27	0.09	0.42	2.15	0.19	0.62	1.84	0.19	0.018
14	0.32	0.27	0.11	0.42	2.18	0.2	0.59	1.78	0.23	0.022
15	0.29	0.25	0.1	0.39	2.17	0.2	0.63	1.8	0.16	0.023
16	0.3	0.28	0.11	0.39	2.15	0.21	0.62	1.81	0.19	0.019
17	0.31	0.24	0.08	0.43	2.19	0.22	0.6	1.79	0.19	0.019
18	0.33	0.23	0.11	0.44	2.15	0.19	0.61	1.8	0.22	0.02
19	0.29	0.25	0.09	0.43	2.16	0.18	0.63	1.84	0.22	0.018
20	0.32	0.26	0.11	0.39	2.16	0.19	0.63	1.83	0.18	0.022
21	0.31	0.27	0.1	0.43	2.15	0.2	0.61	1.8	0.21	0.023
22	0.32	0.25	0.11	0.44	2.19	0.2	0.62	1.83	0.18	0.019
23	0.29	0.24	0.08	0.4	2.18	0.21	0.62	1.79	0.18	0.021
24	0.3	0.26	0.09	0.4	2.15	0.19	0.63	1.78	0.2	0.023
25	0.33	0.27	0.12	0.42	2.15	0.18	0.63	1.78	0.19	0.019
Ave $P_{cur.}$	**0.31**	**0.26**	**0.10**	**0.41**	**2.16**	**0.2**	**0.61**	**1.81**	**0.20**	**0.020**

Table 2: Exemplar Performance ($P_{exm.}$)

Work Section	Trench Exc'n	Pit Exc'n	Concrete Work	Block Laying	Painting	Formwork (Mak'g & Fix'g)	Roof & Carcassing	Laying Floor Tiles	Laying Wall tiles	Reinforcement Mak'g & Fix'g
	(m^3/hr)	**(m^3/hr)**	**(m^3/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(m^2/hr)**	**(Ton/hr)**
	0.33	0.28	0.13	1.05	2.50	0.23	0.70	1.85	0.23	0.025

This indicates that the indigenous construction firms from measurement of labour output on site performed a well above average. This is an improvement on the Ugochukwu and Onyekwena (2014) where they recorded a little above average. Thus, debunking the negative perception on the performance of indigenous firms and confirming the fact that indigenous firms can perform well on capital intensive projects. However, the indigenous firm still need to improve on the work output on block laying as it is one of the critical work item, most especially on load bearing structures.

Table 3: Performance Ability Ratio (PAR) of Indigenous Firms

Work Section	Trench Exc'n	Pit Exc'n	Concrete Work	BlockLaying	Painting	Formwork (Mak'g & Fix'g)	Roof & Carcassing	Laying Floor Tiles	Laying Wall tiles	Reinforcement Mak'g & Fix'g
Firms										
1	0.97	0.89	0.69	0.39	0.86	0.83	0.90	0.97	0.78	0.72
2	1.00	0.82	0.85	0.39	0.87	0.96	0.90	0.96	0.87	0.84
3	0.94	0.89	0.77	0.36	0.88	0.78	0.90	0.99	0.78	0.76
4	0.94	1.00	0.85	0.39	0.86	1.00	0.86	1.00	0.83	0.76
5	0.91	0.93	0.62	0.39	0.86	0.87	0.84	0.97	0.83	0.92
6	0.85	1.07	0.85	0.38	0.88	0.83	0.87	0.96	0.74	0.68
7	0.97	0.96	0.69	0.35	0.86	0.87	0.84	0.98	0.78	0.80
8	0.94	0.89	0.85	0.34	0.87	1.00	0.86	0.98	0.96	0.84
9	1.00	0.89	0.77	0.40	0.87	0.96	0.86	0.97	1.00	0.92
10	1.03	0.82	0.85	0.39	0.87	1.00	0.87	0.99	0.83	0.76
11	0.88	0.89	0.62	0.34	0.86	0.83	0.86	0.97	1.00	0.72
12	0.94	0.93	0.69	0.35	0.86	0.78	0.90	0.97	0.83	0.72
13	0.97	0.96	0.69	0.38	0.86	0.83	0.89	0.99	0.83	0.72
14	0.97	0.96	0.85	0.38	0.87	0.87	0.84	0.96	1.00	0.88
15	0.88	0.89	0.77	0.35	0.87	0.87	0.90	0.97	0.70	0.92
16	0.91	1.00	0.85	0.35	0.86	0.91	0.89	0.98	0.83	0.76
17	0.94	0.86	0.62	0.39	0.88	0.96	0.86	0.97	0.83	0.76
18	1.00	0.82	0.85	0.40	0.86	0.83	0.87	0.97	0.96	0.80
19	0.88	0.89	0.69	0.48	0.86	0.78	0.90	0.99	0.96	0.72
20	0.97	0.93	0.85	0.43	0.86	0.83	0.90	0.99	0.78	0.88
21	0.94	0.96	0.77	0.48	0.86	0.87	0.87	0.97	0.91	0.92
22	0.97	0.89	0.85	0.49	0.88	0.87	0.89	0.99	0.78	0.76
23	0.88	0.86	0.62	0.44	0.87	0.91	0.89	0.97	0.78	0.84
24	0.91	0.93	0.69	0.44	0.86	0.83	0.90	0.96	0.87	0.92
25	1.00	0.96	0.92	0.47	0.86	0.78	0.90	0.96	0.83	0.76
Average PAR$_{ave}$.	**0.94**	0.92	0.76	0.40	0.87	0.87	0.88	0.98	0.85	1.80
						0.83				

The performance Ability Ratio (PAR) was computed. The PAR can be used to compare current performance of the company/firm to the exemplar performance. It is used as a measure of relative worth of jobsite performance. Balogun (2006) submitted that the higher the PAR values the more chances of improvement for the firm. Performance Ability Ratio value of 0.8-1.0 shows that there are chances of improvement for such firms. The overall average PAR for the sampled population for this study was 0.83; indicating that in all the construction firms sampled, there are greater potentials of improvement in their performance. From the data collected through questionnaire. The numerical scores were transformed to Mean Item Scores (MIS) so as to determine the ranking of the measures of performance. The mean item scale ranges from 0 -5. Table 3 showed the result:

Table 4: Assessment of Competence of Indigenous Firms

S/N	Measures of Competence	MIS	Rank	Remarks
1	Technical Competence	4.15	1	High
2	Managerial Competence	3.90	2	High
3	Quality of Work	3.80	3	High
4	Material Management	3.65	4	High
5	Schedule Variance Management	3.55	5	High
6	Security Consciousness	3.55	5	High
7	Relationship Management	3.55	5	High
8	Workers' Welfare and Safety	3.40	8	High
9	Claims Management	3.15	9	High

From table 4, the study revealed that indigenous firms possessed high competence in technicality (MIS=4.15), management (MIS=3.90), Quality of Work (MIS=3.80), Material

Management (MIS=3.65), Schedule Variance Management (MIS=3.55), Security Consciousness (MIS=3.55), Relationship Management (MIS=3.55), Workers' Welfare and Safety (MIS=3.40) and Claims Management (MIS=3.15).

About 32 factors influencing the productivity of indigenous firms were identified in literature in accordance with previous studies (Alfred (2008), Iyagba and Ayodele (2008), Elgin and Egger (2000), and Libre (2013)). The Bartlett of Sphericity test (Table 5) was conducted to indicate the overall significance of the correlations within the correlation matrix of the identified 32 factors. With the significant p-value (0.000) less than 0.05, it shows that there is significant correlation among the variables and thus they can be reduced. The KMO test (Table 5) carried out on the variables indicated that the use of factor analysis is suitable.

Table 5: KMO and Bartlett's Test of Suitability

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.501
Bartlett's Test of Sphericity	Approx. Chi-Square	1.093E3
	Df	528
	Sig.	.000

Table 6: Rotated Component Matrix of Factors influencing Labour Productivity

Variables	1	2	3	4	5	6	7	8	9	10
Overtime					0.605					
Moral and Attitude	0.623									
Fatigue	0.526									
Stacking of Trade									0.499	
Joint Occupancy	0.675									
Beneficial Occupancy							0.508			
Concurrent Operations			0.590							
Absenteeism and			0.675							
Turnover			0.625							
Mobilization/	0.525									
Demobilization		0.439								
Errors and Omissions		0.704								
Start/ Stop		0.668								
Re-assignment of		0.522								
Manpower	0.657									
Late Crew Build up	0.560									
Crew Size inefficiency	0.637									
Site Access										
Logistics				0.784						
Security Check				0.798						
Learning Curve				0.666						
Ripple effect		0.564								
Confined Space										0.399
Hazardous Work Area		0.724								
Dilution of Supervision		0.602								
Holidays										
Shorter Daylight Hours						0.473				
Weather & Season			0.454			0.438				
Changes								0.598		
Rain			0.473							
Shift Work										
Working in Operating Area		0.581				0.513				
Over-Manning										
Tool & Equipment Shortage										
Area Practices										
Proximity of Work										

The rotated component matrix contained the rotated factor loadings, which are the correlation between the variable and the factor. Weak correlations to each of the factors had been deleted to make the table more interpretable. The reduced factors are shown in Table 7

Table 7: Assessment of the Impact of Factors influencing Construction Productivity for Indigenous Firms'

S/n	Factors	RII	Rank	Remark
1	Overtime	0.905	1	Very High
2	Stacking of trade	0.807	2	Very High
3	Weather and Area practices	0.779	3	High
4	Beneficial occupancy	0.779	3	High
5	Attitude of labourers to work	0.778	5	High
6	Holidays	0.768	6	High
7	Nature of site	0.764	7	High
8	Managerial decisions	0.754	8	High
9	Degree of Site safety	0.746	9	High
10	Over-manning	0.726	10	High

From Table 7, it was observed that working overtime for labour and stacking of trade had very high impact on labour productivity of indigenous firms with Relative Importance Index (RII= 0.905 and 0.807) respectively. From the above, it could be gathered that the issue of overtime and stacking trade during construction should be looked into to enhance construction productivity. Other factors should also be put into consideration as they have high impact on construction productivity.

Table 8: Strategies to Improving Construction Productivity of Indigenous Firms

S/N	Strategies	RII	Rank	Remark
1	Appropriate Project Planning	0.782	1	Agree
2	Labour Management Plans	0.775	2	Agree
3	Regular Meetings with crew	0.768	3	Agree
4	Advanced Equipment and Material planning	0.758	4	Agree
5	Effective Supervision	0.754	5	Agree
6	Training Labour Force	0.744	6	Agree
7	Use of New Technology	0.740	7	Agree
8	Effective Motivation Plan	0.723	8	Agree

The design and use of appropriate project planning and labour management had RII=0.782, Labour Management plan (RII=0.775), having regular site meetings with labourers (RII=0.768), advanced equipment and material planning (RII=0.758), effective supervision (RII=0.754), training labour force (RII=0.744), use of new technology (RII=0.740) and motivation plans (RII=0.723) respectively.

Table 9: Assessment of Barriers to Improving Labour Productivity

S/N	Barriers	RII	Rank	Remark.
1	Lack of alignment to goal	0.853	1	Strongly Agree
2	Contractual conflict	0.849	2	Strongly Agree
3	Difficulties in measuring productivity	0.800	3	Strongly Agree
4	Weak Commitment to continuous improvement	0.793	4	Agree
5	Lack of Labour force focus	0.779	5	Agree
6	Government policies	0.768	6	Agree

A total of six possible barriers to improving indigenous construction productivity were identified in literature. The levels of agreement of the respondent were collected as evaluated in Table 9. According to the table, the respondent strongly agreed that lack of alignment to set goals (RII=0.853), contractual conflict (RII=0.849) and difficulties in measuring productivity (RII=0.800) as great set of barriers to labour productivity. However, respondents agreed to the fact that weak commitment to continuous improvement (RII=0.793), lack of labour force focus (RII=0.779) and Government policies (RII=0.768) could be another set of barriers to labour productivity.

CONCLUSION

Base on the findings of the research, it could be concluded that the performance of Indigenous contractors had improved beyond and should be given equal work opportunity with their expatriate counterpart since they were rated high in core competence of construction works. Result showed that working overtime of labourers and stacking of trade had very high impact on indigenous firms' construction productivity. Also, other factors such as attitude of labourers to work, managerial decisions, nature of site, safety of site, weather and area practices, beneficial occupancy, stacking of trade and holidays were discovered to record high impact on construction productivity.

Among the strategies to improve construction productivity of indigenous firms, appropriate project planning and use of labour management plan were the most supported strategies to improving construction productivity. Regular site meetings of the construction crew, Effective supervision, Good contractual strategy implementation, Adequate communication, Training Supervisors, Training labour Force, Adequate Safety plan and analysing the construction process were also supported strategies for improving productivity in construction works. However, the use of new technology and Effective Motivation Plans were quite supported. Lack of alignment to goals, contractual conflict, difficulties in measuring productivity, weak commitment to continuous improvement, lack of labour force focus and government policies were discovered to be the barriers to improving construction productivity of indigenous contractor in Southwestern Nigeria.

RECOMMENDATION

Based on the study, the following are recommended:

i. Indigenous contractors should carry out periodic studies on client's need evaluation to ascertain the current needs of clients so as to meet their expectation.
ii. Indigenous contractors should enhance the welfare of their workers especially the technical staff to improve their output on site and their general performance.
iii. Indigenous firms should be given equal opportunity to execute capital intensive construction projects like their expatriate counterpart as results showed that the performance of the indigenous contractors are above average.

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Assessment of Lean Construction Practice in the Nigerian Construction Industry

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ABSTRACT

Lean Construction offers valuable techniques to manage construction at improved workflows and minimal waste generation. This research therefore seeks to assess Lean Construction practices in the Nigerian Construction industry by exploring construction practitioners' extent of knowledge of Lean Construction and its approaches as well as evaluate how often these approaches are being utilized, to assess its benefits and the barriers hindering its implementation in the Nigerian construction industry. The target populations were construction professionals in the construction industry, consisting of Architects, Quantity Surveyor, Builders and Engineers. Data collection was done through the use of a structured questionnaire administered to these professionals. The data were analyzed using Mean score ranking statistical tool and results were presented in tables. The results showed that most of the construction professionals are aware of Lean Construction and its approaches. Also, Project needing immediate attention given more importance, Identification of client needs and Look – ahead schedule (program of work) were the most utilized approaches in the construction industry, while improvement of project delivery methods, more satisfied clients and the delivery of products or services that enable clients to better accomplish their goals were the major benefits identified. The study therefore recommends that more should be done on lean awareness and understanding as well as training for exposure to the need to adopt the lean concept.

Keywords: Construction, Lean Construction, Professionals

INTRODUCTION

The construction Industry not only provides infrastructure for all other industries, but also constitutes one of the largest single sectors in the economy on its own (International Investment and Services Directorate, 1999).In many large cities in the world, Waste has been considered to be a major problem in the construction industry (Al-Moghany, 2006). Non-value adding activities (NVA) in the construction process such as waiting time, material handling, over production, inventories, re-work and movement of workers have been discovered to constitute waste which forms about 30% of construction cost (Koskela, 2000). Lean Construction has therefore been introduced into the construction industry as it is a concept in construction specifically set out to increase the sector's productivity level through the elimination of activities and actions deemed to generate waste in the construction process (Abdullah,Abdul-Razak, Abubakar and Mohammad2009).

The emergence of the lean construction concept is seen as a current approach that can be used to produce best practices because it was viewed as an effort to bring construction industry towards a more optimum productivity level with the efficient usage of resources as well as to produce the utmost value. Lean construction is understood as a new paradigm for project management, thereby challenging the traditional thinking about construction and project management (Ballard and Howell, 2004).The direct application of the lean construction concept in a construction project will bring an effect of change towards the way work is conducted by an organization responsible in realizing the related construction activities. This will then forcibly alter the traditional work practices normally undertaken by the construction firms according to the needs and suitability in line with the objectives and principles established in the lean construction concept itself (Abdullah *et al.* 2009).According to Howell (1999), managing construction under Lean is different from typical contemporary practice

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because it; has a clear set of objectives for the delivery process; it is aimed at maximizing performance for the customer at the project level; t designs concurrently product and process, and it applies production control throughout the life of the project.

According to Johansen and Walter (2007), the application of the lean concept in the construction industry is still very restricted and sluggish, although various countries gained large benefits by adopting Lean Construction concepts, there seems to be little implementation of lean in the United Kingdom construction industry over the last two decades, because there appears to be some barriers preventing its successful implementation (Mossman, 2009).One of the major barriers to implementation of lean concepts in construction is the low level of awareness among construction professionals in the construction industry. In relation to this, a research work carried out by Olatunji (2008) in Nigeria to determine the awareness level of construction professionals about lean indicates that the level of awareness is very low stating that only two out of the ten respondents signify that they have heard about lean.

Thus, the aim of this study is to assess lean construction practices with a view to know the present state in the Nigerian construction industry. To achieve this, the level of awareness of lean concept among construction professionals in the Nigerian construction industry and the lean principles used in the Nigerian construction industry were assessed.

LITERATURE REVIEW

The Construction Industry in Nigeria

The construction industry according to Leibing (2001) is the tool through which society goals of urban and rural development can be achieved. It embraces a wide range of loosely integrated organizations that collectively construct, alter, refurbish and repair a wide range of different building and civil engineering structures. The industry all over the world has not been static and the reasons for this include: clients' growing demand, complexity of construction projects, advancement in technology and introduction of new innovations amongst others (Oke, 2009).

Construction work covers site acquisition, design, contract, site operation (construction), operations and management. It has a great impact on the economy of all countries (Leibing, 2001). In Nigeria, the construction industry continues to occupy an important position in the nation's economy even though it contributes less than the manufacturing or other service industries, (Aibinu and Jagboro, 2002). Olowo-Okere (1985) gave the genesis of construction in Nigeria as far back as the 1940s when few foreign companies came together under an organized construction contracting in Nigeria and began operation. Since then the Nigeria's economic growth over the last decade according to Isa, Jimoh and Achuenu (2003) has been high and the contribution of construction sector has risen steadily leading to sustainability.

The Nigerian construction is no different from its counterpart around the world where waste abounds. Thus, it is the duty of the professionals to gear up and put into action, new ways of avoiding this common problem.

Professionals in the Construction Industry

In most cases, construction professional who are regularly engaged by the government and other clients include but not limited to: Architects, Quantity Surveyors, Engineers, Builders and Project Managers. All these construction professionals according to Gyadu-Asiedu (2009) are regulated by their professional institutions. On a general note, the *Architect* is a person involved in the planning, designing and over-seeing of a building's construction. He translates the user's need into the builder's requirements and he thoroughly understands the building and operational codes under which his or her design must conform. The Architect is

charged with being generally familiar with the work and reporting the general progress and quality of the work, as completed, to the client. Hence, the standard of care is that the Architect should be responsible for discovering and reporting nonconforming work that is available to be seen (Simson and Atkins, 2006; Anyanwu, 2013). Anyanwu (2013) observed that the *Engineers* (civil, structural and building services) are very important members of the design team whose responsibilities are to assist in the overall design of the project within the scope of their specialist fields. They also produce drawings, specifications, schedules and other relevant data that may be required for the overall construction of the project. The *Quantity surveyor* according to Hussin (2009) is concerned with managing and controlling costs within construction projects and may involve the use of a range of management procedures and technical tools to achieve this goal. A *Builder* is a professional at the centre of the physical construction of buildings (Anyanwu, 2013). He is a man-power capable of interpreting the specifications of other survey and design professionals. A *Project Manager* represents the client on the site and his role is to inspect quality of materials and the workmanship to ensure that they all comply with the drawings and specifications. According to Russell (2006), the services offered by Project Managers vary considerably, as do the qualifications and experience of the people that act in this capacity. The qualifications and experience of people practicing as Project Managers may come from the professional side of the construction industry, as in Architects, Quantity Surveyors or Engineers, or may stem from the contracting side, such as in the management teams of major main contractors.

All these professionals are saddled with achieving one goal, which is delivering the construction project within the budget, at the shortest possible time and with the best quality achievable. Therefore, avoiding waste in terms of time, cost, labour, materials and the likes which according to Al-Moghany (2006) have been a major problem in the construction industry, should be paramount to these professionals.

Lean Construction

Lean concept is a Western interpretation of the Japanese Production Philosophy in the car manufacturing industry (Bertelsen and Koskela 2005).The core concept behind Lean Production is to enable the flow of value creating work steps while eliminating non-value steps (Dulaimi and Tanamas 2001). Howell (1999) highlighted Lean production concepts as: identifying and delivering value to customer by eliminating anything that does not add value, organizing production as a continuous flow, perfecting the product and creating reliable flow through stopping the line, pulling inventory, distributing information and decision-making and pursuing perfection by delivering on order a product meeting customer requirements with nothing in inventory. Abdul-Razek*et al.* (2007) believe that the core idea of Lean Construction is to reduce or eliminate waste, represented in non-value adding activities, and increase the efficiency of value adding activities.

Lean is essentially all about getting the right things to the right place at the right time, in the right quantity and at the same time, minimizing waste and being open and responsive to change. Lean production has an underlying philosophy that, by eliminating waste, quality can be improved, and production times and costs reduced (Kempton, 2006). According to Koskela (1999), lean construction shares the goals of lean production which is; elimination of waste, cycle time reduction, and variability reduction. Lean thinking is lean because it provides a way to do more with less human effort, less equipment, less time and less space, while coming closer to providing customers satisfaction (Mossman, 2009).

Lean Principles and approaches to achieving Lean in Construction

Lean concept is all about getting the right things to the right place at the right time, in the right quantity whilst minimizing waste and being open and responsive to change (Kempton,

2006). Lean primary principles were observed to include: reduction of waste within the value stream; synchronising, aligning and providing transparency as part of the planning process; and integrating Transformation Flow Value production theory as part of the lean implementation process (Chestworth et. al, 2011). Kempton (2006) further argued that the principles of Lean include: perfect first- time quality - achieving zero defects, revealing and solving problems at the source; waste minimization - eliminating all non-value-adding activities and maximizing the use of resources; continuous improvement - reduction of costs, increase quality and productivity; pull processing - products pulled from the consumer end; flexibility - production of different mixes and/ or greater diversity of products, without compromising efficiency; and Relationships - building and maintaining long-term relationships with suppliers. Other researchers have proposed wider principles (Liker, 2004; Ballard, 2006; Robert & Granja, 2006; London, 2004) but the application might differ from one organization to the other (Liker, 2004).

In achieving these principles within a construction project, several approaches are available to the construction professionals. This include from; identification of client needs, project needing immediate attention given more importance, look – ahead schedule, timely delivery of construction materials to site, continuous improvement, conducting of weekly meetings, regular performance measurement of site workers, strict criteria for the selection of subcontractor, involvement of project participants in making of schedules, uninterrupted workflow etc (Chestworth et. al, 2011; Liker, 2004)

Benefits of Lean Construction

The introduction of the Lean Construction concept and its application within the construction industry is reported to have birth a lot of benefits (Abdullah *et al.*, 2009). Evidence of the use of lean thinking has shown that there are many benefits to be made from applying lean principles to construction. These benefits claimed include: improved productivity, increased reliability, improved quality, more client satisfaction, increased predictability, shortened schedules, less waste, reduced cost, enhanced build-ability improvements to design, and improved safety (Mossman, 2009). Also the implementation of Lean Construction in the construction industries will lead to improvement of project delivery methods, delivery of products or services that enable clients to better accomplish their goals, more satisfied clients, productivity gains, minimization of risks and maximization of opportunities, greater predictability, shorter construction periods/ reduced project time, injection of reliability, accountability, certainty and honesty into the project environment, improved design just to mention a few.

Barriers to the Implementation of Lean Construction

There seems to be a number of barriers militating against successful lean implementation. Several studies have been carried out in different countries worldwide to identify the barriers in implementing the Lean construction (Mossman, 2009). Bashir *et al*. (2010) classified these barriers different categories based on a thorough and critical review of international literature relating to the take up of lean practice. These include; lack of training, lack of interest from the client, waste accepted as inevitable, delay in material delivery, etc. According to Abdullah *et al.*(2009) lack of attentiveness and commitment from top management, difficulties in understanding the concept of lean construction, lack of exposure on the need to adopt the lean construction concept, lack of proper training, weak communication among clients, consultants and contractors, the tendency of construction firms to apply traditional management concepts as opposed to productivity and quality management concepts, attitude and ability to work in group, and long implementation period of lean concept in construction processes, are some of the major barriers to the implementation of Lean construction in the construction industry. Bashir *et al*. (2010)

therefore suggested that the measures to these barriers are timely delivery of materials to site, organizing of trainings employees on lean concept and companies being client focused.

METHODOLOGY

The aim of this paper is to assess the Lean construction practice in the Nigerian construction industry with a view to know the present state in the Nigerian construction industry. In achieving this, a survey design was used. This involved the use of questionnaires administered to Quantity surveyors, Architects, Civil Engineers and Builders in the Ondo state, Nigeria. A total of 93 questionnaires were distributed with 77 returned out of which 74 were deemed fit for analysis. This represents a response rate of 79.57% which is far above the usual response rate of 20-30% for questionnaire surveys in construction management studies, as suggested by Akintoye (2000). Mean Item Score (MIS) was used to analyze data gathered using the formula:

$$M = \frac{5(FX^5) + 4(FX^4) + 3(FX^3) + 2(FX^2) + (FX^1)}{X^5 + 4 + X^3 + X^2 + X^1}$$

Where M = Mean Item Score
X = range 1 – 5 with 5 being the highest and 1 being the lowest
F = Frequency of respondent in each factor

The MIS is ranked in descending order with the highest MIS ranked 1st and others in such subsequent descending order.

FINDINGS AND DISCUSSIONS

Respondents Background Information

The respondents sampled include 37.8% Quantity surveyors, 29.7% Engineers, 17.7% Architects and 14.9% Builders. 36.5% of the respondents have between 1 to 5years of working experience while 32.5% have between 6 to 10 years experience. 12.2% of the professionals have 11-15years, 5.4% have between 16 to 20years while 13.5% have above 20years of experience in building construction. Thus, it can be said that the data gathered from the respondents can be relied upon since 63.5% of the respondents have above 5years working experience, hence information would have been given based on their wealth of experience. Research also shows that 50% of the respondents are aware of Lean Construction either through professional practice, school, seminar/conference, printed material/literature, or from colleagues, while 28.4% are strongly aware, 12.2% are somewhat aware while a meager percentage (9.5%) of the respondents are not aware of Lean Construction in Ondo State. This huge percentage of awareness can be attributed to the vast years of experience and exposure of the respondents in the construction sector.

Level of awareness and adoption of the different ways of delivering Lean construction

From table 1 below, it shows that there is an appreciable level of awareness of the different approaches through which lean construction can be delivered in any construction project. These approaches were slightly rewritten as a means to simplify potential awareness and understanding by the respondents. Result reveal that identification of clients need has the highest level of awareness among construction professional with a mean score of 4.22 while Project needing immediate attention given more importance and Look –ahead schedule and Continuous improvement ranked 2nd and 3rd with a mean score of 4.17, and 4.07 respectively. Continuous improvement and involvement of construction professionals right from the inception ranked 4th with a mean score of 4.06 each while direct involvement of foremen in decision making is the least on the table with a mean score of 3.36.

Result showed that in practice, project needing immediate attention is given more priority as this ranked 1st with a mean score of 3.84, while identification of clients' needs and Look – ahead schedule follows with a mean score of 3.78 each. Just-in-Time (JIT) delivery, Continuous improvement and involvement of construction professionals right from the inception ranked 3rd, 4th and 5th with a mean score of 3.73, 3.72, and 3.68 respectively, while and while direct involvement of foremen in decision making is the least on the table with a mean score of 2.89.

Table 1: Level of awareness and adoption of the different ways of delivering Lean construction

Approaches	Level of awareness		Level of Adoption	
	MIS	Ranking	MIS	Ranking
Identification of client needs	4.22	1	3.78	2
Project needing immediate attention given more importance	4.17	2	3.84	1
Look –ahead schedule (program of work)	4.07	3	3.78	2
Continuous improvement	4.06	4	3.72	4
All parties involved in the design (involvement of construction professionals right from the inception)	4.06	4	3.68	5
Weekly meetings	3.94	5	3.59	7
Percent Plan Complete	3.91	6	3.37	12
Regular performance measurement of site workers	3.89	7	3.47	9
Just-in-Time (JIT) delivery (timely delivery of construction materials to site)	3.86	8	3.73	3
Using computer software for estimating	3.85	9	3.61	6
Training of employee	3.83	10	2.98	15
Personnel responsible for procurement	3.83	10	3.52	8
Strict criteria for the selection of subcontractor	3.79	11	3.43	10
Involvement of project participants in making of schedules	3.70	12	3.39	11
Uninterrupted workflow	3.69	13	3.25	13
Site daily meetings	3.56	14	3.14	14
Direct involvement of foremen in decision making	3.36	15	2.89	16

Benefits of Lean construction

Result in table 2 reveals the respondents view of the benefits of Lean Construction in the construction industry. Improvement of project delivery methods was ranked the highest, having the mean score of 4.40 while more satisfied clients and Delivery of products or services that enable clients to better accomplish their goals followed respectively having mean scores 4.07 and 4.00. However, lower degree of disruption of activities (i.e. reduction in variation), less idle time and Increment in workers motivation were the least ranked of the benefits having mean scores of 3.68, 3.56 and 3.49 respectively.

Table 2: Benefits of Lean construction

Benefits	MIS	Ranking
Improvement of project delivery methods	4.40	1
More satisfied clients	4.07	2
Delivery of products or services that enable clients to better accomplish their goals	4.00	3
Promotion of continuous improvement in project delivery methods through lessons learned	3.99	4
Minimization of risk and maximization of opportunities	3.97	5
Delivery of products or services on time and within budget	3.93	6
Delivery of customers product instantly without waste	3.92	7
Increased Percent Plan complete	3.90	8
Less rework	3.86	9
Minimization of direct costs through effective project delivery management	3.85	10
Injection of reliability, accountability, certainty and honesty into the project environment	3.85	10
Reduced project time	3.75	11
Lower degree of disruption of activities (i.e. reduction in variation)	3.68	12
Less idle time	3.56	13
Increment in workers motivation	3.49	14

Barriers to the Implementation of Lean Construction

Result in Table 3 below shows the various barriers to the implementation of Lean Construction. Lack of lean awareness and understanding and Lack of exposure to the need to adopt the lean concept were ranked the highest having mean scores of 4.27 each, while lack of proper training and difficulty in understanding lean concepts were ranked second and third with mean scores 4.11 and 3.94 respectively. Meanwhile, Lack of buildable designs, Fragmented nature of the industry and lack of long term relationship with suppliers were ranked least with mean scores of 3.58, 3.51 and 3.32 respectively.

Table 3: Barriers to the Implementation of Lean Construction

Barriers	Mean	Ranking
Lack of lean awareness and understanding	4.27	1
Lack of exposure to the need to adopt the lean concept	4.27	1
Lack of proper training	4.11	2
Difficulty in understanding lean concepts	3.94	3
Weak communication among clients, consultants and contractors	3.90	4
Waste accepted as inevitable	3.86	5
Inefficient use of quality standards	3.85	6
Poor communication	3.83	7
Delays in material delivery	3.79	8
Delays in decision making	3.79	8
Lack of agreed implementation methodology	3.77	9
Lack of attentiveness and commitment from top management	3.75	10
Incomplete designs	3.74	11
Lack of interest from clients	3.73	12
Lack of long term commitment to change and innovation	3.73	12
Inefficient use of quality materials	3.71	13
Lack of information or help from other organizations	3.65	14
Long implementation period	3.65	14
Ability to work in group (teamwork)	3.59	15
Lack of buildable designs	3.58	16
Fragmented nature of the industry	3.51	17
Lack of long term relationship with suppliers	3.32	18

Discussion of Findings

Findings revealed that a greater number of the respondents of this study are seemingly aware of the term Lean Construction and its techniques. However, this is contrary to Olatunji research in 2008 in Nigeria which indicates that the level of awareness and knowledge of lean is low stating that only two out of the ten respondents signified that they have heard about lean. The level of awareness might have increased drastically considering the year interval between 2008 and 2015.

Also findings revealed that that project needing immediate attention given more importance, identification of client needs and Look –ahead schedule (program of work) are the most utilized approach to Lean construction in the construction industry in Ondo State, Nigeria. This was proven in a study carried out by Satish *et. al.* (2005) were identification of client needs and the Look- ahead schedule (program of works) were mostly used. They were part of the most utilized method of delivery Lean construction used by 16 companies in New York City and various benefits were recorded like cost savings, reduced project time, reduced rework and increased Percent Plan Complete (PPC). Findings from the research shows that the use of lean approach in construction will lead to improvement of project delivery methods, provide more client satisfaction and delivery of products or services that enable clients to better accomplish their goals followed respectively.

Lack of lean awareness and understanding, lack of exposure to the need to adopt the lean concept and lack of proper training were the major identified barriers to the implementation

of Lean construction in Nigeria. This was in concordance with the research study carried out by Sarhan *et.al.* (2013) in United Kingdom (UK) were lack of Lean awareness and understanding was a major barrier identified. This can be mitigated through adequate public awareness and organizing of training of employees on lean concept as suggested by Bashir *et al*. (2010).

CONCLUSION AND RECOMMENDATION

Conclusion

This study assessed Lean Construction in the Nigerian Construction Industry which afterwards reveal the following conclusions;

i. A good number of construction professionals in Ondo State are well aware of Lean Construction through professional practice.
ii. Identification of client needs, project needing immediate attention given more importance and look – ahead schedule are the popular approaches of delivering lean construction among professionals, while the most used is project needing immediate attention given more importance.
iii. Improvement of project delivery methods, provision of client satisfaction and delivery of products or services that enable clients to better accomplish their goals are some of the main benefits of applying lean in construction. Also lack of lean awareness and understanding, lack of exposure to the need to adopt the lean concept and lack of proper training are the major barriers to the implementation of lean construction in the Nigerian construction industry.

RECOMMENDATION

Based on the conclusions the study therefore recommends that Lean Construction should be incorporated in the school's curriculum so that students can have better knowledge of it and can easily build on the foundational knowledge during practice. Also Lean Construction trainings should also be organized in construction companies, government parastatals, and consultancy firms which will be very helpful in moving lean thinking faster into the mainstream of construction education. The findings of the study provide possible directions for further studies in that the researcher was able to assess Lean Construction practice in the construction industry in Ondo State, Nigeria. Further studies can be extended to other locations so as to have a wider study area and also to know the level of awareness in other locations in Nigeria.

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Validated Indicators of Sustainability in Construction Project Management Activities - Stakeholders' Perception

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ABSTRACT

The research space in sustainable project management tends to focus on skills and knowledge; the specific indicators of sustainability that these competencies generate in projects are less developed. This study validated set of empirically weighted sustainability indicators for evaluating sustainable project management. The sustainability practices were evaluated based on comprehensive environmental management outputs, community engagement and education and training. Explorative research involving questionnaire survey was conducted. The survey engaged 112 stakeholders including (quantity surveyors, civil engineers, builders, architects, and project/construction managers) in Akwa Ibom and Ondo State, Nigeria. Respondents' value judgement of 66 indicators generated from literature and practice were weighted for consistency using pairwise analytical hierarchical process (AHP); test of hypothesis involved analysis of variance (ANOVA). The validated indicators generated varying degrees of important. The social perspective was the most important sustainability objective, environmental, important and economic least important. The test of comparison in respondents' opinion about the indicators in three sectors specified variation. The result was valid in supporting (i) test hypothesis, (ii) context variance in sustainability practices and (iii) validation of the indicators. The outcome buttressed stakeholders' penchant towards sustainability must be improved. The study has evaluated measurable results of sustainable project management towards understanding and embedding sustainability in project management.

Keywords: Indicators, Construction projects, Sustainability, Sustainable construction and Validation

INTRODUCTION

The discourse of sustainability is widespread under varying perspectives and topics generally. The assessment perspective has attracted considerate attention in global view as seen in the succeeding literature section. Increase awareness about sustainability discourse originates mainly from the prominence of assessment (Ghumra, Glass, Frost and Mundy, 2011). However, construction project management sustainability activities are less developed and its context is not apparent. This is seen to be a baseline towards creating a comprehensive standard assessment tool. Advances in current global ecstasy about sustainability are infrequently translated into tangible implementation at the project level (Boyd and Schweber, 2012, Ugwu and Haupt, 2007). Accordingly, a need for a significant departure from sustainability agenda setting currently pursued to reeling out real-time sustainability goals is establish notably for the developing countries. The research problem addressed in this study is to validate sustainability indicators for construction project management activities and to determine prioritised sustainability objective(s). The inclusive need for developing countries to be able to assess their sustainability practices is acknowledged (Ugwu and Haupt, 2007). Such necessities include sustainability being case-custom; and the development of sustainable construction practices depending on local value assessment of social, economic and environmental objectives (Asmar and Underwood, 2013). To achieve local value assessment, indicators are increasingly developed; but are limited at project delivery level. When compared to other phases in project delivery, sustainability assessments have seen focal interest in research. This study seeks to operationalize sustainable project management by

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validating indicators of sustainability in project management activities. The expanding discusses of project management skills and competencies in sustainable construction practice are acknowledged. The prominent question is how to evaluate the outcome of sustainable project management input.

The use of indicators for assessing sustainability is popular among decision/policy makers and the academics (Gilmour, Blackwood, Falconer, Isaac and Simpson, 2015). Critically selected indicator has been christened appropriate tools for sustainability assessment (Reed, 2007). Porta & Renne (2005) assert indicator clearly demystify the sustainable development concept and provide a clearer understanding and meaning. Indicators can translate engineering and technological knowledge into useful information for decision-making (Gilmour et al. 2015). Dahl (2012) argues it problematize visibly, creating awareness that will smoothens decision-making when the information is well managed. Gilmour et al. (2015) therefore believe developing indicators is perhaps the first step towards operationalizing sustainability.

The global community have come to the agreement that despite multiple understanding of sustainability, the principles have not differ from Bruntland's (1987) view cited in diverse literatures (Brandon and Lombardi, 2011, and Ihuah, Kakulu and Eaton, 2014). Bruntland perspective advocates a development practice that takes care of current needs without jeopardising the chances of future generations to meet their own needs. This understanding has been interpreted variously across sectors including construction. De varies and Peterson (2008) reported there are over 300 world views about the concept of sustainability. The common understanding is that sustainability provides a spring board for environmental, social and economic development of the society (Ding, 2008). But the theme has been significantly interpreted along environmental perspectives. Ruggieri et al (2009) provided one of the simplest framing of the meaning of sustainability. According to Ruggieri et al (2009), sustainability implies methods and techniques in the process of implementing construction projects that involve less harm to the environment. Schipper (2013) assert sustainability seeks harmony amongst the economic, social and environmental dimensions. Perspectives of cultural, societal, bio-diversity are also very popular. Brandon and Lombardi (2011) attribute the divergent framing to interest, assessment and evaluation strategy (Ihuah, Kakulu and Eaton, 2014). The key emerging problem however, is the determination of whether across sector practice have been utilised in accordance with universal objectives. Accordingly, a common understanding exists in differentiating what constitute appropriate and inappropriate development practices. This is particularly a big concern for project management.

Sustainability Indicators in Project Management

Comprehensive studies of critical sustainability indicators have been undertaken (Matinuzzi, Kudlax, Faber, Wiman, 2012). These include cultural, social and environmental perspectives suggested by Building Research Establishment (Warnock, 2007). Raw material extraction and consumption, land use change (Sev, 2009). Energy consumption and materials, generation of waste and dust, and pollution of air, water. Human wellbeing (Du Plessis, 2007) and enhancing the natural environment (Pitt, Tucker, Riley, and Longden, 2009) are widely used. Construction of durable infrastructure, making future environment safe, using materials from sustainable resources and indoor environment (Arjen, Mark, and Lucas, 2005). Within this thinking, feasibility studies and environmental impact assessment and social performance are deployed to evaluate firms' sustainability practice (Shen, Tam, Tan, and Ji, 2010). Health and safety (disruption of life-quality, security and community engagement are pronounced (Glass and Simmond, 2007). A study by Lingard (2008) adopted fair working hours and adequacy of compensation. Training and education, gender equality, sustainable supply chains and use of natural resources are also projected (Jones, Comfort and Hillier (2006).

Others include Bribery and corruption, illegal price agreement, evasion of taxes and development of cartels (Kolk and Pinkse, 2006).

Generally therefore, attempt to embed sustainability in construction have generated a flagship of indicators including energy and carbon reduction, material usage, minimization of life cycle cost, reduction of land use, increase use of local raw materials and the use of recycled materials. These indicators have targeted inception, design and post construction stages. Design related discusses are also very popular in literature including Iwaro and Mwasha, 2013). Few studies however consider indicators of sustainability at the project delivery (construction stage). Project management success factors for sustainable social housing examined by Ihuah, Kakulu and Eaton (2014) is acknowledged. However, this study focused on social housing thereby failing to explore the critical indicators of sustainability in the wider infrastructure construction project delivery. During project execution, it is sustainable, when project management activities (work breakdown, scheduling and control) are patterned to reduce environmental impact, improve social and economic benefits (Ihuah, Kakulu and Eaton, 2014). But traditional project management is dedicated to cost, time and quality objectives thereby ignoring the long-term impacts that are harmful sustainability of projects (Mishra Dangayach, and Mittal, 2011). Ineffective long-term project management activities and processes orientation impedes quality of life, health and safety and productivity. It remains to be determined what the indicators of sustainable project management are in project delivery.

The need for sustainability-focused project management practiced has been widely advocated. Accordingly, across sector studies have been conducted including mining (Gibson, 2006), general stakeholder approach (Brucker, Macharis, and Verbeke, 2014), approaches for delivering sustainability in infrastructure projects (Jos and Faith-Ell, 2012) and assessment of sustainability in infrastructure (Ugwu and Haupt, 2007). The impact of project management on sustainable development was studied by Chen (2011). Chen's study appraised internal environment of projects and it remains to be determined the external project environment. Aspect of sustainable relationship management was examined by Kumaraswamy and Anvuur (2008). This study proposed a framework to elect sustainable teams for joint venture projects. Learning professional competence in project management model in sustainable development was developed by Guerrero De los Rios (2012). The model provided a blend of expert and experiential knowledge. Related study Hwang and Ng (2013) explored relevant expertise of project managers in delivering 'green construction. A set of skills were validated as essential to internal and external project management coordination.

In Nigeria, the researchers' mind tools are yet focus on sustainable construction embedding issues. These includes perception and awareness (Abolere, 2015 and Nduka and Sotunbo, 2014), sustainable facilities management (Magagi, 2015), and sustainability embedding with construction organisations (Dania, Larsen and Yao, 2013). Others are renewable energy and energy efficiency (Ahmed and Gidado, 2008; Bugaje, 2006 and Odunfa, Ojo, Odunfa and Ohunakin, 2015) and green buildings (Olanipekun, 2015). The needs for assessment rating tool (Adegbile, 2012; Prucnal-Ogunbote, 2013 and Dodo, Kandar and Ossen, 2010) are other areas the research interests in Nigeria have considered.

From these related literatures, it seen that previous studies merely appended sustainable development to differing context that are not related to project management activities. Studies on project management indicators have not wafted from evaluating traditional project management purview. The imminent question yet largely unanswered is what criteria can be used to evaluate the project management success in sustainable construction projects? Wang, Yao, Wu and Jiang (2015) explored critical success factors for sustainable project

management. The study's validated criteria lean towards the traditional success criteria for project management evaluation. There are few studies that detail sustainable indicators for project management (Fernandez-Sanchez and Rodriguez-Lopez, 2010). This study adopted various aspects of project and project management activities, but what project activities are indicative of the project management practice is not apparent. Others came close in its environmental performance criteria but failed to identify the respective indicators. Fernandez-Sanchez and Rodriguez-Lopez (2010) social, economic and environmental indicators are too generic to be linked to respective site activities. The problem identification difficulty in extant studies is linked to human and natural system interface of sustainability. The problem is extended to the definition of sustainable project management. Accordingly, a broad range of traditional project management success criteria still infiltrates understandings of sustainable project management criteria. These include relationship and team management, human resources, communication and internal stakeholder management. To answer imminent research question, a departure is advocated to envision project management as activities that interact internally and externally to realise a project with a duty of care to the environment. The implication is the need to focus on the external perspectives that addresses the social, economic and environmental objectives. The availability of related studies in the overseas context is acknowledged but in-country validation is necessary in the growing quest for standard rating tool in Nigeria.

Research Methodology

The study was an empirical research with explorative strategy character. Therefore extensive literature on the general theme of sustainability assessment was conducted. The literature survey generated 406 indicators but 66 were strictly project management related. These indicators were presented for value rating by selected stakeholders. The survey involved a purposive sample of 112 respondents selected from construction organisations; engineering consultancy services and the general built environment practice specialising in buildings. The population consists of engineers, quantity surveyors, project managers, construction managers, builders, architects and allied professionals such as town planners and land surveyors based in Akwa Ibom State and Ondo, Nigeria. Research design validity, construct validity and scale coherency were conducted using Lee Cronbach's test. Alpha value greater 0.70 was obtained; this is indication of high quality, well captured concept hemisphere and high scale inter-correlation. Analytical Hierarchical Process (AHP) pairwise comparison was conducted to obtain the rating consistency indices. AHP was used for the study because respondents of sustainability perception are capricious, in this case, the relationship between constructs can be examined in a probability sense. The AHP had been used to examine trust as volatile issue in alliancing (She, 2013). The merit of the tool is independence on a statistically significant sample size (Dias and Ioannou, 1996). The pairwise comparison involved a 9-point value rating scale. The Consistency Index is given as Mean Item Score/Number of Items on the value rating scale. The pairwise was used at two levels first, to estimate the relative importance of the sustainability objectives; and second, the estimation of the preference of the indicators. The interpretation is according to She (2013): 1 = indicator equally preferred; 0.33 = moderately preferred; 0.20 = strongly preferred; 0.14 = very strongly preferred; and 0.11 = absolutely preferred.

Hypothesis of the Study

In view to generalising the weighted indicators, a comparison of means and test of homogeneity were conducted. The population was stratified into three means groups that is, construction organisation (CO); engineering consultancy (EC) and building practice (BP). The hypothesis states that there is no significant statistical variation in the opinion of respondents in the three populations. The test involved analysis of variance and Levene

homogeneity tests; and was conducted using SPSS. Validation was based on the critical p-value (accept H_o if $p < 0.05$; and H_1 if $p =< 0.05$).

RESULTS

Forty (40) valid responses was obtained (35% response rate); the proportion is valid for a typical construction related survey. The population consists of built environment professionals; quantity surveyors are more (Table 1). Thirty two (32, 80%) first degrees and higher degrees; 20% possessed Higher National Diploma. Similar proportion are registered and probationers. The average working experience is 15years and 15% of the population below to this category. There are averagely 13 respondents in each category of knowledge of sustainability. The 'very good' category is 50%; 'excellent' (10%) and 'good' (16%). The overall population depicts relevance and suitability to understanding the context, the practice and the principles of sustainable construction.

Table 1: Respondents Characteristics

Profession		**Registration**		**Years of Experience**	
Architecture	5(12%)	Registered	32(80%)	0-10 years	34(85%)
Building	2(5%)	Probationers	8(205)	Above 10 years	6(15%)
Engineering	10(24%)	**Education**		**Context Understanding**	
Project Managers	5(12%)	HND	8(20%)	Excellent	4(10%)
Quantity surveying	15(37%)	BSc	22(55%)	Very good	20(50%0
Town Planners	2(5%)	MSc	10(25%)	Good	16(40%)

Validated Indicators

The total of sixty (66) indicators representing the relevant social, economic and environmental perspectives of sustainability were generated and rated for consistency. Twenty five (25, 37%) each are social and environmental objectives indicators; and (16, 24%) economic indicators. The dominance of the environmental and social objectives aligns to the increasing emphasis placed on these objectives in the mainstream sustainability pursuits. The respondents' value rating of 11 (16%) indicators scored a consistency index score of 0.30 and above. The meaning is that these indicators are 'moderately' preferred indicators of sustainability in construction project management activities. Seventeen (17, 25%) obtained the scores (>0.2 but < 0.3). These set of indicators received 'strong' preference value rating. Nine (9, 13%) others received 'very strong' preference value judgement. Twenty six (26, 39%) others are 'equally' preferred; and 4(6%) are 'absolutely' preferred by all the respondents. Indicators with value rating (< 0.11) are most significant.

In the respective objectives, 11(16%) environmental indicators are equally preferred indicators; 9(13%) are strongly, moderately and equally preferred, and 5(7%), absolutely preferred or very strongly preferred. In economic objective, 12(18%) are equally, moderately or strongly preferred; 2(3%) are strongly and very strongly preferred and 1(1%) received absolute preference rating. Also, in the social objective, 13(19%) are moderately or equally preferred; 6(9%) are strongly preferred, and 6(9%) achieved very strong and absolute rating scores. On the whole, it is seen that, the environmental indicators has the highest 5(21%) indicators with significant value judgement of 'strong', 'very strong' and 'absolute preference'. The social 12(18%) objective retains the second highest number of indicators with three high value rating benchmark (strong, very strong and absolute preference). The economic objective has 3(4%) with strong, very strong and absolutely preference rating. However, the highest 'very strong' and 'absolute' preference rating is the social objective. Based on the objective rating, social perspective is the most important sustainability objective with group consistency index (CI_W 0.29-strong preference); environmental 2nd most important (CI_W 0.32-moderate preference); and economic least important (CI_W 0.34-moderate preference); see Table 2.

Analysis of Variance and Test of Homogeneity

The consistency index score depended invariably on the mean item score, it is therefore requisite to compare the means of the three categories of respondents that is, construction organisations, engineering consultancy and others in general building practice. Similarly, a test of error variance in value judgement is necessary to compare ANOVA outcome. The objective of the hypothesis testing was to evaluate statistical comparison of value judgement across three strata of respondents. The tests involved analysis of variance and Levene Homogeneity test. Validation was based on the critical p-value (accept H_o if $p < 0.05$; and H_1 if $p =< 0.05$); the result is presented in Table 3a and 3b. The result yielded a significant *F* values at varying degrees of freedom. The results are accepted for the three population means. The hypothesis accepted, explaining an insignificant variation in the three population means. The univariate ANOVAs outputs CO (F (2) = 4.59, p = 0.654); EC (F (2) = 0.672, p = 0.849); and BP (F (2) = 18.592, p = 0.620) (Table 5). The homogeneity test of error variance in judgement across the population means are also significant CO (F (2, 2) = 9.678, p = 0.489); EC (F (2, 2) = 3.456, p = 0.838); P_3 (F (2, 2) = 3.450, p = 0.510); and P_4 (F (2, 2) = 3.200, p = 0.238).

DISCUSSIONS

Table 2: Weighted Indicators based on Value Judgement

SN	Objectives	CI_W	Sub-Indicators	CI	Level of Preference
1	Environmental	0.32	Open space maximization	0.29	Strong preference
2			Mitigating pollution	0.27	Strong preference
3			Preserving cultural heritage	0.28	Strong preference
4			Protect wildlife	0.17	Very strong preference
5			Provide post construction management plan	0.26	Strong preference
6			Protect development against future weather	0.24	Strong preference
7			Avoid damaging habitat (green areas)	0.31	Strong preference
8			Promote natural day lighting in designs	0.31	Strong preference
9			Promote recycling waste management appliances	0.32	Strong preference
10			Appointing environmental coordinator for site	0.22	Very strong preference
11			On-site renewable energy use	0.23	Very strong preference
12			Use of environmental management systems	0.20	Very strong preference
13			Identify sustainable waste management guidance	0.17	Very strong preference
14			Covering of hauled waste	0.13	Very strong preference
15			Waste separation on site	0.29	Strong preference
16			Inclusion of waste management in contracts	0.11	Absolute preference
17	Social	0.29	Gender equality (employing women)	0.13	Very strong preference
18			Display work programme in public square to show when heavy shipments are expected	0.11	Absolute preference
19			Provide access for disabled and elderly	0.31	Strong agreement
20			Encourage walking and cycling	0.31	Strong agreement
21			Conducting EIA in project before site works	0.17	Very strong preference
22			Security at construction site in tensed environment	0.25	Strong preference
23			Reward for safety observance	0.20	Strong preference
24			Attending community council meetings	0.11	Very strong preference
25			Exchanging pleasantries with workers	0.29	Strong preference
26			Undertake social responsibilities	0.22	Strong preference
27			Ensure design conform with locals needs	0.16	Very strong preference
28			Provide for academic/industry interface (excursions/exchange)	0.25	Strong preference
29			Encourage staff development through seminars/CPD	0.11	Absolute preference
30			Permit schooling while working opportunity	0.25	Strong preference
31	Economic	0.34	Use of innovative materials (recycled)	0.31	Strong preference
31			Assist low income/disadvantaged groups	0.25	Strong preference
32			Provide employment opportunities	0.31	Strong preference
33			Life cycle cost analysis	0.25	Strong preference
34			Taxes evasion and levies	0.19	Very strong preference
35			Bribery and corruption	0.28	Strong preference

CI = Consistency Index; CI_G = Consistency Index Group

The value preference of the respondents merits a second reflection. The outcome of the social objective represents a significant departure from the global trend that sees emphasis placed on environmental concern. Successive literatures account for this development (Emmanuel, 2011); the result is therefore a surprise. Assessment tools and systems are also environment focus (BREEAM, 2009; LEED, 2007). Various regulations and governmental interventions support environmental sustainability. Nevertheless, two possibilities are devised, first, placing critical importance is placed on social sustainability, second, an improvement on social sustainability objective in contrary to the widely held documented evidences in the literature. Stakeholders in the study environment assign deserving emphasis on the need to address social perspective that affect the employees and community in which the project situates. Responsible factors for the respondents value although not obvious from the survey is attributed to nature of the research environment. The region is rich in oil deposit and production exposes the social dimensions to multi-nationals that come with intensive financial packages. The failings of the successive government to address basic needs saw the community result to arm taking aggression that was transferred to many sector initiatives including construction. Hence, successful construction project management organisations understood the importance of social dimensions in project delivery.

The literature retains deviant view to the study's finding including Teo and Loosemore's (2012) 'NIMBY' controversy in Australia, Ekung, Ogboji and Okonkwo's (2013) community protest in controversial scenarios, Niger Delta, Nigeria, Glass and Simmonds (2007) dearth of training and knowledge are responsible for poor community stakeholders' engagement under CCS. The environmental objective came second, most important objective, and economic least important. Overly, due to the general low value judgement, the implication leans towards the need to improve general practice and economic objectives in particular. The system is infamous in the use of traditional project management practice (Ogunsami; 2012). The failings of this system are popular in the related literature; but the laggard implication to the sagacious objectives of sustainable development calls for immediate improvement.

Table 3a: Analysis of Variance Test

Dependents	df	Mean Square	F	Sig.
CO	2	8.043	4.590	0.654
EC	2	0.849	0.672	0.849
BP	2	4.115	18.592	0.620

CO = construction organisation; EC = engineering consultancy and BP = building practice

Table 3b: Levene Test of Equality of Error Variances

Dependents	F	df1	df2	Sig.
CO	9.678	2	2	0.489
EC	3.456	2	2	0.838
BP	3.450	2	2	0.510

Respondents' value rating perceptions show variation although, insignificant in the population means. Responsible factors are understood in the context of multiple framing, differing understanding, and practices of sustainability (Boyd and Schweber, 2012; Magaji, 2015 and Dania, Larsen and Ewart, 2014). The varying perception is appropriate and useful to validate the weighted indicators for use in assessment. The test of the hypothesis strongly supports desired variation in the three population means. This is true to the extent of explaining the likeness of the weighted indicators to literature. However, the indicators presented in Table 2 are not exhaustive but high value judgement factors and never implies others are irrelevant. In fact all 66 indicators with varying valid degrees of consistency rating are suitable for use in assessment.

CONCLUSION

Based on the persistent lack of standard assessment tools for sustainability evaluation, many developing countries have responded through bespoke indicators validation that resulted in standard rating tool. The growing importance of in-context assessment tool is predicated on sustainability being scene-custom; and developing sustainable construction practices depending on local value assessment of social, economic and environmental objectives. The research problem addressed in this study was to validate sustainability assessment indicators and to determine prioritised sustainability objective(s). Set objectives were achieved through extensive literature review, field survey and analysis using AHP value judgement consistency index. Sixty six (66) indicators received varying degrees of consistency judgement and thirty (35) were validated at value judgements: strongly; very strongly; and absolute preference. Thirty (31) others were moderately or equally preferred. The social indicators were most important sustainability objective, environmental important and economic least important. A test of variation in perception in three sectors using Analysis of Variance (ANOVA) indicated variation. The test result was valid in supporting (i) test hypothesis; and (ii) context variance in sustainability practices. It further validated the 66 validated indicators for assessment of construction organisation project management activities for sustainability.

Despite extant results, the study circumspect that the validated indicators are based on stakeholders' perception thereby not reflecting real-life project scenery. It is therefore needful to apply validated criteria on real-life project assessment to extend it boundaries and validity. It is equally necessary to validate the criteria using samples in other regions to compare and improve existing result for widespread in-country application.

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An Appraisal of Key Performance Indicators (KPIs) for Public Private Partnership (PPP) Projects in Nigeria

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ABSTRACT

Despite concerted efforts by government in Nigeria to improve infrastructure project delivery through Public Private Partnership (PPP), many of such projects continue to fail. Previous researches on PPP projects mainly concentrated on the procurement, success factors and risk management of PPP projects, but paid little attention to the process factors that can strongly influence the performance of PPP projects. This study appraises the key performance indicators (KPIs) for Public Private Partnership (PPP) projects in Nigeria. Questionnaire survey was adopted to elicit data from 76 PPP project participants within the Nigerian construction industry. Data collected was coded and analysed using Statistical Packages for Social Sciences (SPSS) 20.0. The test statistic involved descriptive statistics and Chi-Square test was conducted to investigate the level of agreement amongst the respondents. The internal coherency of respondents ranking was further checked by conducting Cronbach's alpha test. The results of the study revealed the most influential performance indicator as appropriate risk allocation, risk sharing, and risk transfer while the least performance indicator is establishment of learning organisation. The implication is that although all of the 48 performance indicators are important and can be used to monitor project performance, the significance of the indicators from the five packages vary and contribute differently to the overall project performance. With this result, underlying factors influencing PPP project performance are projected and an insightful perspective provided to guide the developing of decision framework for PPP projects in Nigeria.

Keywords: Performance Indicators, Public Private Partnership, Project, Measurement, Nigeria

INTRODUCTION

Over the last two decades, governments in an increasing number of countries across the continents initiated Public Private Partnership (PPP) to involve the private sector in the provision and building of an infrastructure and subsequently operating it to provide public goods or services. This is because PPP employs private sector expertise and skill to provide public goods and services (Nisar, 2013). As pointed out by Kwak et al (2009), if PPP is properly formulated and managed, it can provide a number of benefits to the public sector such as: alleviating the financial burden on the public sector due to rising infrastructure development costs; allowing risks to be transferred from the public to the private sector; and increasing the value for money (VfM) spent for infrastructure services by providing more efficient, lower cost, and reliable services. The policy to involve the private sector in the provision of public services is, however, fraught with a number of difficulties and shortcomings (Nisar, 2013). One major concern is the problem associated with performance measurement for PPP projects. As submitted by Liu et al., (2014) unsatisfactory performance of a PPP project is not costless. Yuan et al., (2012) clarifies that the absence of effective performance measurement in PPP projects acts as a trigger for producing below optimum service quality of infrastructure. However, Yu et al., (2007) in their research established that the core function of performance measurement is to identify, measure, and manage appropriate Key Performance Indicators (KPIs). These findings suggest that a study on key

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performance indicators (KPIs) for PPP projects would be of increasing interest to both the public and the private sectors.

In the past, many of the researches conducted in PPP mainly concentrated on the procurement, success factors and risk management of PPP, but paid little attention to the process factors that can strongly influence the performance of PPP. However, Yuan et al., (2009) in their extensive research, developed a set of key performance indicators for PPP projects that comprises five (5) performance packages. The packages include: physical characteristics of PPP projects (KPI 1); requirements of stakeholders from the perspective of financing and marketing (KPI 2); requirements of stakeholders from the perspective of innovation and learning (KPI 3); requirements of stakeholders from the perspective of stakeholders (KPI 4); and project process (KPI 5). They suggested that the key performance indicators should be tested by an empirical study/research to investigate their significances. They further suggested that the number of KPIs should be kept low, and a consensus should be obtained from future work surveys, with professionals in the industry for effective application in project practice. Therefore, this study is particular related to the research conducted by Yuan et al., (2009) on Key Performance Indicators (KPIs) and aim to appraise key performance indicators (KPIs) for Public Private Partnership (PPP) projects in Nigeria. This aim shall be achieved through the following objectives: to identify key performance indicators for Public Private Partnership (PPP) projects; to determine the level of importance of each indicator on a PPP project in Nigeria and to establish the extent to which each indicator affects the performance of PPP projects in Nigeria.

LITERATURE REVIEW

The Concept of Public Private Partnership (PPP) Projects

Traditionally, most public facilities are developed by the public sector using public money (Li et al., 2001). Thus, the ownership belongs to the public sector (Kurniawan et al., 2010). However, recent transactional evidence points to the benefits of privately financed and managed infrastructure and particularly Public Private Partnership (PPP) through improved procurement outcomes at lower cost than conventional procurement methods (Nisar, 2013). Hence, the whole concept of Public Private Partnership (PPP) is a government policy to tackle financial problems in facility provision, and an integrated private management skill to increase efficiency, effectiveness and quality (Her Majesty's Treasury, 2000). These concepts have been used for decades worldwide to procure economic and social infrastructure (Kwak et al., 2009). Many academics, public agencies and international organisations have given various definitions of PPP in a bid to explain this important method of project procurement that is being increasingly adopted worldwide. However, this study adopts the definition of PPP as given by Kwak et al (2009) that PPP is cooperative arrangements between the public and private sectors that involve the sharing of resources, risks, responsibilities, and rewards with others for the achievement of joint objectives.

Key Performance Indicators (KPIs) for PPP Projects

Considering the large amount of projects that have come to be implemented with PPP model of procurement, it is important to do some serious reflections about the key factors that

characterize them and that have more influence on their success. These factors should serve as support to the definition of key performance indicators (KPIs). There is, to a certain extent, consensus amongst construction management academics and practitioners about which performance objectives are the main critical success factors (CSF) for a construction project. These objectives according to Latorre and Riley (2010) have been coined as 'the iron triangle' and consider three CSF; namely cost, quality and time. They have been the criteria traditionally used to assess the success of a construction project (Chua et al., 1999). However, recent empirical research highlights how traditional project performance objectives (cost, time and quality) are insufficient for the whole life management of long-term projects. Similarly, the performance objectives of a stakeholder group in a PPP project differ due to different expectations (Yuan et al., 2010). Achieving best value for public service and product is the ultimate objective of PPP (Zhang, 2006). Akintoye et al., (2003) submitted that in PPP, best value emphasizes quality, efficiency/ effectiveness, value for money (VfM) and performance standards. In a related research, Robinson and Scott (2009) found that value for money in a PPP/PFI project depends crucially on performance monitoring to provide incentives for improvement and to ensure that service delivery is in accordance with the output specification.

Similarly, Liu et al., (2014) emphasized that based on the characteristics of PPP, a performance measurement framework that deals with multiple-stakeholder complexity is an ideal tool to underpin the performance measurement of PPP projects. Accurate analysis of performance can be achieved only after the Key Performance Indicators (KPIs) are determined and monitored. In fact, according to Chan and Chan (2004) and Ikediashi et tal., (2012) these indicators depend on the objectives of each project and are the basis of incentives and penalties, especially during the exploration phase, since they allow to compare actual performance with the estimated in terms of effectiveness, efficiency and quality. Solomon and Young (2007) submitted that KPIs define 'how good' a system is, in objectively measurable terms. Deriving from the aforementioned definitions, compilations of data measures used to assess and evaluate the performance of PPP operations are hereby refers to as Key Performance Indicators (KPIs) in this study.

METHODOLOGY

The paper adopted quantitative research design with questionnaire chosen as the data collection instrument. The focus of interest in this study is PPP stakeholders in Federal capital territory (FCT) Abuja. This city was selected for the survey because of it strategic importance in terms of volume of construction activities and population performance (Dada, 2005). Also, Abuja, being the Federal Capital Territory of Nigeria houses most of the headquarters and head offices of Government establishments and quite a number of consultant firms (Alao, 2009) with branch offices in other States of the federation. Most of these Government establishments and consultant firms have their PPP projects in Abuja and other States of the Federation but coordinating/managing these projects from their head offices at Abuja.

To ensure adequate representation of respondents, the number of stakeholders used in this survey was drawn from the directories of professional organisations in the federal capital territory-Abuja, Nigeria. They include the Nigerian Institute of Architects, Nigerian Institute of Builders, Nigerian Society of Engineers, Nigerian Institute of Quantity Surveyors and Nigeria Institute of Town planners. A total of 6238 stakeholders/practicing professionals

registered with their respective professional bodies were identified. Because it was impractical to collect data from all the stakeholders in the population, sampling was necessary to make the survey possible. In order to determine a suitable size for the sample, the following formula from Krejcie and Morgan (1970) and Creative Research System (2003) was applied:

$$N = \frac{Z^2 x\, P(1-P)}{C^2}$$

Where: N = sample size; Z = standardised variable; P = percentage picking a choice, expressed as a decimal; C = confidence interval, expressed as a decimal.

As with most other research, a confidence level of 95% was assumed (Creative Research System, 2003). For 95% confidence level (i.e. significance level of α = 0.05), z = 1.96. Based on the need to find a balance between the level of precision, resources available and usefulness of the findings (Krejcie and Morgan, 1970), a confidence interval (c) of ±10% was also assumed for this research. Krejcie and Morgan, (1970) also explained that when determining the sample size for a given level of accuracy, the worst case percentage picking a choice (p) should be assumed. This is given as 50% or 0.5. Based on these assumptions, the sample size was computed as follows:

$$N = \frac{1.96^2 x\ 0.5(1-0.5)}{0.1^2} = 96.04$$

This means that the required sample size for the questionnaire survey is 96 PPP stakeholders. Creative Research Systems (2003) further explained that the figure requires a further correction for finite populations. The formula for finite population is given as:

$$New\ N = \frac{Sample\ size}{1 + \frac{96.04 - 1}{Pop}}$$

$Where: Pop = Population$
Inputting these data, we now have;

$$New\ N = \frac{96.04}{1 + \frac{96.04 - 1}{6238}} = 95.49$$

Therefore the sample size for a finite population is approximately 95 PPP stakeholders. However, to make a round figure and ensure optimal result from the stakeholders identified, 100 questionnaires were administered. Overall, seventy-six (76) completed questionnaires were properly answered and usable. This represents a 76% effective response rate. Questionnaire survey conducted in Nigeria by Ikediashi et al., (2012) for a similar research received a response rate of 64%.

FINDINGS AND DISCUSSIONS

In this research, the ranking of the KPIs was based on arithmetic mean value scores. A lower value indicates a lower level of importance. As shown in table 1, the mean response rating values for the 48 indicators offered to respondents range from a maximum of mean score of 4.80 (Appropriate risk allocation, risk sharing and risk transfer) to a minimum mean score of 2.08 (Establishment of learning organisation). It thus has been shown by the response that there appears to be close correlation between the ranking of the indicators in terms of the

level of importance and the extent of effects of each indicator on a PPP project. In each of the five (5) performance packages, it is obvious that the higher the level of importance of the indicator the higher the extent of effects and vice versa in a PPP project. No indicator mean value scores fell into the 'not important' (< 1.5) category, which indicates that all of the 48 indicators are considered important and can be used to monitor the PPP project performance. From the results of the analysis above, it is obvious that although the survey results show that all indicators are important, performance packages contribute differently to the overall project performance.

Table 1.0: Summary of Key Performance indicators (KPIs), level of importance and extent of effect of each indicator on a PPP project performance

Key Performance Indicators	Mean	S.D	Rank	Level of Importance	Extent of Effect
Physical Characteristics of Ppp Projects					
Type of construction	2.12	1.275	47	Fairly important	Low
Level of design complexity	2.24	1.253	45	Fairly important	Low
Level of construction complexity	2.39	1.287	43	Fairly important	Low
Level of technological advancement	2.37	1.459	44	Fairly important	Low
Concessionaire's knowledge of PPPs	4.20	.693	9	Very important	High
Government's knowledge of PPPs	4.00	.712	11	Very important	High
Competitive tender procedure	3.33	.737	26	Important	Moderate
Standard PPP contract with enough flexibility	3.70	1.007	17	Important	Moderate
General public/social support	2.71	1.043	34	Important	Moderate
Stable and favourable macroeconomic conditions	3.59	.926	23	Very important	High
Stable and favourable legal environment	3.97	.748	12	Very important	High
Stable and favourable political environment	3.64	.934	20	Very important	High
Commitment and responsibility between public and private sector	4.74	.472	2	Extremely important	Very high
Project technical feasibility, constructability, and maintainability	4.05	.671	10	Very important	High
Appropriate risk allocation, risk sharing, and risk transfer	4.80	.433	1	Extremely important	Very high
FINANCING AND MARKETING					
Sound financial analysis	4.24	.690	8	Very important	High
Sustainable profitability	3.20	.783	27	Important	Moderate
Increased marketability	2.96	1.171	29	Important	Moderate
Financial ability of whole shareholders	3.57	.899	24	Very important	High
Perfect tariff/tolls or price adjustment mechanism for the project	3.54	.958	25	Very important	High
Financing cost	2.61	1.721	36	Important	Moderate
Realistic schedule of investment and revenue	2.78	.988	32	Important	Moderate
Insurance coverage	2.12	1.306	46	Important	Moderate
Construction and concession period	3.67	1.012	19	Very important	High
INNOVATION AND LEARNING					
Investment in research and development of new technology	2.42	1.594	42	Fairly important	Low
Establishment of learning organization	2.08	1.294	48	Fairly important	Low
Employee training	2.43	.884	40	Fairly important	Low
Technology innovation (e.g., designing, construction, planning etc)	2.62	.894	35	Important	Moderate
Technology transfer	2.59	.836	37	Important	Moderate
Financial innovation (i.e creative financial package)	3.83	.870	16	Very important	High
STAKEHOLDERS					
Public client's satisfaction	3.86	.989	15	Very important	High
General public/Social satisfaction	4.28	.704	7	Very important	High
Good relationship among the concessionaire, subcontractors, and suppliers	3.63	.907	21	Very important	High
Good relationships within project team	3.68	.927	18	Very important	High
PPP PROJECT PROCESS					
High quality control	4.37	1.005	3	Very important	High
Safety management	3.92	.707	14	Very important	High
Health control	2.45	.944	39	Fairly important	Low
Environmental protection	3.08	.726	28	Important	Moderate
Effective risk management system	3.93	.822	13	Very important	High
Facility management	2.75	1.145	33	Important	Moderate
Stress/Conflict management	2.42	1.691	41	Fairly important	Low
Resource utilization (material and equipment)	2.95	.893	30	Important	Moderate
Contract management	2.79	1.644	31	Important	Moderate
Prominent technical management and skill	2.54	1.012	38	Important	Moderate
Interface management between organization and stages	3.61	.981	22	Very important	High
Cost management (during construction and operation periods)	4.36	1.116	4	Very important	High
Time management (during construction and operation periods)	4.34	.601	5	Very important	High
Good governance	4.29	.935	6	Very important	High

Among the top 10 ranked key performance indicators for PPP projects, appropriate risk allocation, risk sharing, and risk transfer had the highest mean of 4.80, demonstrating that the

improvement of project performance in PPP strongly depends on effective risk management and allocation. Similarly, Akintoye et al., (2003) identified risk transfer as a major performance factor in PPP. As a general approach to risk management and allocation, the risk should be transferred to the party that is best able to control it. The second is Commitment and responsibility between public and private sector with a mean of 4.74, suggesting that the improvement of project performance in PPP strongly depends on cooperation and support among different stakeholders. The result of this survey is generic and consistent with the findings of the previous author. Tutesigensi and Hj-Mohammad (2008) identified commitment of the public and private sectors as a key indicator for the successful implementation of PPP projects. Stonehouse et al., (1996) agreed that successful PPP require commitment, mutual understanding and a high degree of enthusiasm.

Table 2.0: 10 Top Key Performance Indicators for PPP projects in Nigeria

KEY PEATORSRFORMANCE INDIC	MEAN	S.D	RANK
Appropriate risk allocation, risk sharing, and risk transfer	4.80	.433	1
Commitment and responsibility between public and private sector	4.74	.472	2
High quality control	4.37	1.005	3
Cost management (during construction and operation periods)	4.36	1.116	4
Time management (during construction and operation periods)	4.34	.601	5
Good governance	4.29	.935	6
General public/Social satisfaction	4.28	.704	7
Sound financial analysis	4.24	.690	8
Concessionaire's knowledge of PPP	4.20	.693	9
Project technical feasibility, constructability, and maintainability	4.05	.671	10

The third is High quality control with a mean score of 4.37 follow by Cost management (during construction and operation periods) and Time management (during construction and operation periods) with a mean value of 4.36 and 4.34 respectively. These findings also affirm the earlier assertion of (Ibrahim et al, 2006; Yuan et al., 2009; Yuan et al., 2010; Ibrahim et al., 2012; Yuan et al., 2012) that the factors for successful implementation of PPP include acceleration of infrastructure provision, better risk allocation, whole of life cost savings, improved quality of services, access additional revenue sources, benefits for local economic and social development, and improved project scrutiny. Other indicators consistently perceived as highly rated (in order of significance) from the results are: Good governance; General public/Social satisfaction; and Sound financial analysis with a mean score of 4.29, 4.28 and 4.24 respectively. The finding was in tune with Tutesigensi and Hj-Mohammad, (2008). They asserted that good governance, well organised public agency, effective cost/benefit analysis and social/political support are the important factors for successful implementation of PPP. Moreover, Concessionaire's knowledge of PPP had a mean score of 4.20 and is ranked as the ninth top indicator while Project technical feasibility, constructability, and maintainability had the mean score of 4.05 and is ranked as tenth. Similarly, El-Gohary et al., (2006) supported the argument that, knowledge of PPP in both the public and private sectors is very important to the success of PPP projects because many difficulties result from inexperienced participants.

CONCLUSION

Based on the results of this study, it has been established that the identified key performance indicators for public private partnership projects are considered important and can be used to monitor PPP project performance. Forty eight (48) KPIs were identified and was prioritised along the level of their importance. Some of the indicators ranking differ across continent most especially Asia and Europe and may be accounted for by the infancy nature of PPP adoption in Nigeria as a country in procuring public infrastructure. The research also

concluded that the most influential performance indicator revealed by the research is appropriate risk allocation, risk sharing, and risk transfer while the least performance indicator is establishment of learning organisation.

Finally, it is acknowledged that although all of the 48 indicators are important and can be used to monitor project performance, the significances of the indicators from the five packages vary and contribute differently to the overall project performance. Thus, the stakeholders assign greater value to decision-making in the early stages of development and in conjunction with process control during project implementation. Significantly, it has been shown by the response that there is a close correlation between the ranking of the indicators in terms of the level of importance and the extent of effects of each indicator on a PPP project. In each of the five (5) performance packages, it is obvious that the higher the level of importance of the indicator the higher the extent of effects and vice versa in a PPP project. One can then deduce that there is high level of confidence by the PPP stakeholders in using the indicators to monitor their PPP projects. With this result, underlying factors influencing PPP project performance are projected and an insightful perspective provided to guide the developing of decision framework for PPP projects in Nigeria.

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Sustainability of Compressed Stabilized Interlocking Earth Blocks (CSIEB) for Building Construction in Nigeria

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ABSTRACT

In the construction industry today, construction professionals are concerned with providing construction that encourages the preservation of the natural environment, promotes social well being of the occupants and provides reasonable economic stands for the investors. This is the concept of sustainability in construction. To achieve this, diverse methods of construction and materials are being developed and one of such materials is the Compressed Stabilized Interlocking Earth Block (CSIEB) which is gaining popularity among construction professionals in Nigeria and other developing countries around the world. This research therefore assessed the sustainability of CSIEB for building construction in Nigeria. A questionnaire survey was used and 48 professionals in the construction industry were sampled. Seven sustainability features of CSIEB were identified and assessed for each of the three dimensions of sustainability (economic, environmental and social). Data collected were analyzed using Relative Importance Index and an average percentage performance of CSIEB in each dimension was derived. Findings revealed that the use of CSIEB will amongst other benefits, save cost of raw materials use for masonry construction, provide faster revenue generation due to its fast construction time, provide a structure that can adapt to the tropical climate, minimize CO_2 emission, and provide an aesthetically pleasing and thermally conducive building. Also, findings showed that the use of CSIEB for building construction will create a balance between the social, economic and environmental pillars of sustainability with percentage of 34%, 33% and 33% respectively. This study therefore recommends that the use of CSIEB should be encouraged among stakeholders as a material for sustainable building construction.

Keywords: Building construction, CSIEB, Sustainability, Nigeria

INTRODUCTION

The world today is moving towards a sustainable environment; one that encourages the preservation of the natural habitat, promotes social well being of the occupants and provides reasonable economic stand for the investors. Chartered Institute of Building (CIOB) (2009) observed that this is as a result of concern that the ever rising population poses tremendous threat to the limited earth resources. The solution according to Brundtland Report (1987) is to provide construction projects that meet the needs of the present without compromising the ability of future generations to meet their own needs. Bearing this in mind, the need to diversify and try other methods of building construction and materials that will yield the expected result and provide sustainable environment is necessary.

Arayela (2002) stated that the building industry place much emphasis on the use of sophisticated building materials and construction methods that are expensive and energy consuming, while Waziri, Kadai and Biu (2014) observed that as a result of limited means within developing countries, the need to reduce construction costs is necessary. This, according to Adam and Agib (2001) can be achieved through the production and use of cheap yet durable locally available building materials. Adedeji (2005) stated that the enormous waste associated with conventional masonry works facilitated the search and subsequent development of more rapid and less workmanship dependent building methods and materials. One of such development is the use of CSIEB for building construction.

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CSIEB is made from laterite, stabilized with cement (in most cases) and compressed in an interlocking block making machine. It has proven to be a sustainable material for building construction due to its adaptability to tropical climate, use of locally available raw material, cost effectiveness and huge aesthetic quality (Adedeji and Fasakin, 2008). According to Abeysundara, Babel and Gheewala (2009) the combination of all environmental, economic and social factors can give a clear description of a material, and helps in a decision making process regarding the selection of the materials suitable for buildings. This paper therefore assessed the sustainability nature of CSIEB for building construction in Ondo state, Nigeria, taking into consideration its environmental, economic and social features and its perceived benefits, with a view of providing sustainable homes for individuals through its usage.

LITERATURE REVIEW

Overview of CSIEB for Building Construction

The use of CSIEB for building construction follows the principle of dry stacking. In dry stacking construction, the interlocking blocks are laid without mortar thereby leading to considerable savings in cost associated with mortar. The major material needed for the production of CSIEB is earth, which according to Adewole (2009) is readily available. The soil is gotten from at least 1m below the top soil and must be free of dirt in other to achieve a fine finish product. The soil is mixed with cement in predetermined ratios by hand or in a pan mixer and water added at an average proportion, making sure that the mixture is not watery. The mixture is loaded into the block making machine in which it is hydraulically compressed. It takes an approximate 15-20 seconds per block, after which the compressed block is then stacked and left to cure (Hydraform, 2004).

CSIEB is moulded by pressing along its length from the ends. It is also a solid block, slightly short, wide and thick in size (225x225x112mm). It has a Bed underneath and a Ridge at the top. The recessed under surface of the block is referred to as the bed while the raised top surface of the block is called the Ridge. The ridge of one interlocking block is designed to key in to the bed of another, thereby providing a perfect lock in masonry (Hydraform, 2004; Bansal, 2010).

Williams *et al.* (2010) posited that the structural and thermal aspects of earth block walling meets the current UK Building Regulation requirements for wall strength and thermal performance hence making it suitable for masonry construction. Also, several researches have been carried out on the strength of CSIEB and it has been proven that it is structurally suitable for any type of construction (Bansal, 2010; Chaibeddra and Kharchi, 2013).

In Nigeria, earth blocks are used majorly for walls while their usages in other part of the building like beams and columns are yet to be explored. Adewole (2008) stated that the construction of interlocking earth block structures is limited, since builders pick this particular material mostly for ecological reasons and this special demand normally comes from only a small group of environmentalists, ecologists or people with a keen sense of environmental protection. This notwithstanding, the interlocking building system is gaining recognition among construction professionals and its usage is increasing in most developing countries like Nigeria (Waziri et. al, 2014). Olusanya (2001) observed that the first documented usage of the interlocking masonry in Nigeria was that of a 60-unit housing estate experimented in 1991 at the University of Lagos, Lagos state. Since then interlocking masonry has gradually gained recognition within the country, especially with the introduction of the Hydraform system of building. Evidence of this is its usage in the construction of a clinic, hostels and staff quarters at Elizarde University, Ilara-mokin, Ondo State, the

Electronic Testing Centre at the Federal University of Technology, Akure, and the caring heart Mega School at Famese Isokan, Akure, Ondo State.

Figure 1: CSIEB used for the construction of a caring heart mega school, Famese, Isokan, Akure, Ondo state

Sustainable Development in Building Construction

Sustainable development could be born out of the emerging environmental movement of the 1960s which was concerned that human activity was having severe and negative impacts on the planet (Romiguer, 2011). Meadows, Randers and Behrens (1972) was one of the key works that highlighted this thinking while the Brundtland Report (1987) provided sustainable development as the solution to this problem. Since then there has been various definitions aimed at describing sustainable development. One of such definitions is that of the Forum for the future (2011) which defines sustainable development as a dynamic process which enables everyone to realise their potential and improve their quality of life in ways which simultaneously protect and enhance the earth's life support systems. Awodele (2015) stated that sustainable development focuses on improving the quality of life for all of the earth's citizens without increasing the use of natural resources beyond the capacity of the environment to supply them indefinitely.

According to Langston and Ding (2001) and Raynsford (2000), a sustainable construction ensures that environmental responsibility, social awareness, and economic gains are the major objectives of the key players in the built environment. Akbiyikli, Dikmen and Eaton (2009) observed that a sustainable construction can be seen as a path way through which the construction industry can move towards a sustainable development, bearing in mind the environmental, socio-economic and cultural pillars as observed by Chaharbaghi and Willis (1999) who opined that sustainable development is a concept based on a structure which stands on three pillars, namely economic, social and environmental. Thus, a sustainable development can be said to be a way of finding balance between economic, environmental and social factors in the design, construction, use and maintenance of buildings.

Economic Sustainability of CSIEB

To the lay man, laterite means earth or any type of soil but in the sense of it, it simply demonstrates the ready availability and abundance of laterite (Adewole, 2008) which can lead to cheap and quick onsite production of earth blocks. Ngowi (2005) observed that the great cost saving is made when CSIEB is used; this is as a result of the use of local laterite and only 5% cement in the block production. During construction, the blocks are dry staked, saving more cement, reducing labour costs and recording savings up to 27% compared to conventional mortared masonry. This was further corroborated by Adedeji and Fasakin (2008) assertion that the use of interlocking earth blocks gives an overall reduction in the cost of masonry of about 65%.

Appreciable savings can also be made in area of plastering as the CSIEB may be left unplastered to showcase the different aesthetic colours of the blocks (Adewole, 2008). Anand and Ramamurthy (2003) stated that the conventional blocks require the use of mortar for the laying of the blocks, coupled with the non contributory activities that affect its cost and the net output. All these are eliminated in the operation of interlocking blocks due to its dry stacking method. Muinde (2013) also observed that since the machine for making the blocks can be towed to the site of construction, appreciable savings can be made on cost of transporting blocks.

Environmental Sustainability of CSIEB

The use of stabilized earth blocks, in place of conventional fired bricks, can to a large extent reduce the energy usage and CO_2 emissions (Joseph, 2010). Muinde (2013) further affirmed this by stating that compressed earth technology provides an alternative to the commonly used fired brick, which is responsible for grave environmental degradation due to deforestation, and destruction of wetlands. Adedeji (2005) observed that the use of interlocking blocks minimizes the enormous waste associated with conventional masonry works while Taiwo and Adeboye (2013) observed that since the materials used for construction of stabilized earth blocks are collected onsite, any error can be repaired quickly with little environmental impact.

Lemougnan *et al.* (2011) observed that due to the permeability of CSIEB to water vapour, earth walls remarkably regulate the humidity of indoor air and their production is generally in-situ with no emission of greenhouse gases and without using high amount of energy. Radhi (2009) also observed that the thermal insulation and thermal mass properties of the interlocking stabilized earth blocks have been proven to significantly affect the amount of energy required for heating or cooling and, consequently the total amount of electricity used in buildings. CSIEB require no burning, thus destructive deforestation is avoided, and they are cured under plastic sheeting so very little water is needed. In addition to the water and tree saving benefits, the blocks can be locally manufactured, reducing transport pollution and carbon footprint (Hydraform, 2004).

Social Sustainability of CSIEB

A sustainable structure should be safe, thermally, acoustically and visually comfortable (Queensland department of public works, 2008). To this effect, Radhi (2009) observed that due to its high density and valuable thermal inertia qualities, walls made with laterite earth allows the storage of solar heat during the day and its slow release during the night, thus contributing to indoor comfort. Also compressed earth blocks are generally non-combustible with high fire resistance (Alagbe, 2011), hence providing some measures of safety for occupants during fire outbreak.

No doubt, CSIEB when used in building is aesthetic in nature and very pleasing to the sight (Adewole, 2008). They are extremely beautiful if well arranged and gives some predetermined shapes and patterns after installation. The blocks could also be given different pigmentation to show various glowing colours, thus providing a pleasing structure to which other would-be developers can emulate. This can lead to a beautiful streetscape.

Benefits of using CSIEB as a material for sustainable construction

The use of sustainable building materials can lead to immense benefits for the owner such as: energy conservation, reduction in maintenance and replacement cost, improved occupant's health and productivity, lower costs associated with changing space configurations, greater flexibility in design, improving public image and overall cost savings (Zainul-Abidin *et. al*, 2003). These to a large extent can be achieved using CSIEB.

Figure 2: CSIEB used for construction of school clinic and hostel in Elizade University, Ilara-Mokin, Ondo state

METHODOLOGY

The data for the study were collected with the use of questionnaires administered to selected professionals (Architect, Quantity Surveyors, Engineers and Builders) within the study area. A total of 60 questionnaires were randomly distributed to practising professionals within Ondo state and 53 were retrieved, out of which 48 were ascertained fit for analysis. This represents a response rate of 80%, which is far above the usual response rate of 20-30% for questionnaire surveys in construction management studies, as suggested by Akintoye (2000). In the questionnaire, 7 major features of CSIEB in each of the 3 sustainability dimensions were identified and respondents were asked to rate them in order of importance. Cronbach's α value for scale of measures of the research instruments ranged from 0.919 to 0.927 showing that the instrument is highly reliable since the degree of reliability of an instrument is more perfect as the value tends towards 1.0 (Moser and Kalton, 1999). Data gathered were analyzed using Relative Importance Index (RII) in order to determine the relative importance of CSIEB in the provision of sustainability in construction. A percentage performance of CSIEB in each dimension of sustainability was derived and results were presented in tables and chart. RII was employed for two purposes which are: ranking and determination of significance of different factors of the collected data. The premise of decision for the ranking is that the factor with the highest RII is ranked 1st and others in such subsequent descending order.

The Relative Importance Index (RII) according to Megha and Rajivis (2013) is written as:

$$\text{RII} = \frac{\sum W}{A * N}$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight, and N is the total number of respondents.

Table 1: Reliability Coefficients for the Measuring Scales

Scale of measures	Cronbach's α
Economic sustainability of CSIEB	0.923
Environmental sustainability of CSIEB	0.919
Social sustainability of CSIEB	0.927

FINDINGS AND DISCUSSIONS

General information of Respondents

Respondents profile showed that Quantity surveyors and Engineers formed the bulk of the respondents sampled with 39.6% and 25% respectively, while Architects and Builders were 18.8% and 16.7% respectively. 20.8% of the respondents have between 0 to 5 years working experience while 33.3 % have between 6 to10 years working experience. 16.7% have

between 10 to 15 and 16 to 20 years working experience each while only 12.5% have above 21 years working experience. Since a total of 79.2% of the respondents have between 6 to 30 years working experience, it therefore implies that the result gotten from the respondents can be relied upon as answers were given based on experience. Also 95.8% of the respondents are aware of CSIEB for building construction, while only 4.2% are not. This high awareness rate can be attributed to the vast years of experience of the respondents in the construction field. Seventy seven percent (77%) of the respondents are of the opinion that CSIEB can be adopted in place of the conventional masonry materials due to its immense benefits, while 18.8% believe it cannot be totally adopted. A little above four percent of the respondents (4.2%) did not state their opinion as they have never heard of the material.

Economic Sustainability of CSIEB

Result in the table 2 shows that the low cost of raw material and time saving during construction leading to faster generation of revenue from the proposed structure, are the main economic sustainability criteria of CSIEB with a RII of 0.862 and 0.800 respectively. The use of reduced labour was ranked the least with RII of 0.726.

Table 2: Economic sustainability of CSIEB

	RII	**Ranking**
Low cost of raw material	0.862	1
Time saving during construction leading to faster generation of revenue from the structure	0.800	2
Reduction in cost of finishes/maintenance	0.796	3
Considerable cost savings on elimination of mortar	0.788	4
Availability of materials thereby saving transportation cost	0.762	5
Considerable cost savings on air conditioning or mechanical cooling system	0.742	6
Use of reduced labour	0.726	7
Average RII	**0.782**	

Environmental Sustainability of CSIEB

Result in table 3 shows that the ability of CSIEB to adapt to tropical climate makes it a relatively good material for sustainable construction, as it is ranked highest with a RII of 0.842. Use of materials onsite thereby minimizing energy used for transportation, reduce CO_2 emissions and reduction of waste followed closely with a RII of 0.820, 0.804 and 0.800 respectively. The ability of CSIEB to last the life span of the building was ranked the least with RII of 0.688

Table 3: Environmental sustainability of CSIEB

Environmental Sustainability	**RII**	**Ranking**
Adaptability of blocks to tropical climate	0.842	1
Use of materials onsite thereby minimizing energy used on transportation	0.820	2
Reduce CO2 emissions	0.804	3
Reduction of waste	0.800	4
Minimize energy consumption since there is no need for air conditioning or mechanical cooling system due to its thermal properties	0.742	5
Ability to control construction and correct any error quickly on site with little environmental impact	0.734	6
Ability to last the lifespan of the building	0.688	7
Average RII	**0.776**	

Social Sustainability of CSIEB

Result in table 4 shows that the aesthetic nature of CSIEB makes it a very good material in area of social sustainability as it is ranked highest with an RII of 0.866. Also the thermal and acoustic comfort provided by CSIEB, aesthetic nature providing a pleasing structure to which other would-be developers can emulate and provision of employment for people within the

immediate locality follow closely with a RII of 0.850, 0.838 and 0.824 respectively. Better quality construction is ranked last with a RII of 0.730.

Table 4: Social sustainability of CSIEB

	RII	Ranking
Aesthetic nature of the system	0.866	1
Thermal and acoustic comfort	0.850	2
Aesthetic nature provides a pleasing structure to which other would-be developers can emulate. Hence creating a beautiful/pleasing streetscape	0.838	3
Provision of employment for people within the immediate locality	0.824	4
Fire resistance thereby providing some measure of safety for occupants	0.788	5
Provision of low cost housing due to its cost effective nature.	0.758	6
Better quality construction	0.730	7
Average RII	**0.808**	

Overall Sustainability Nature of CSIEB

Using the average RII of each sustainability dimension, a computation of the overall performance of CSIEB was done as seen in figure 3 below. Social sustainability of CSIEB has the highest of 34% followed by economic and environmental sustainability with 33% each.

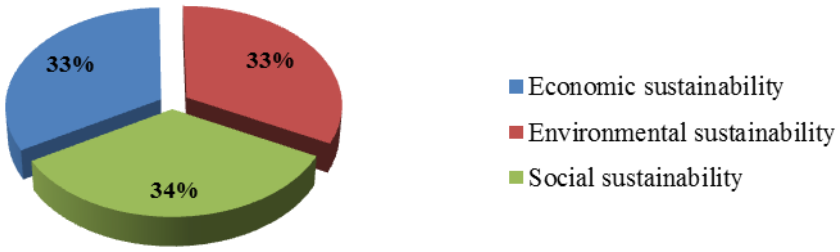

Figure 3: Overall performance of CSIEB in each sustainability dimension

Discussion of Findings

Findings showed that all the sustainability characters of CSIEB within the three pillars of sustainability (economic, environmental and social) performed well above average of 0.5 RII, hence proving that CSIEB is indeed a material worth using in the delivery of sustainability in building construction in Nigeria.

Economic sustainability of CSIEB

Findings showed that low cost of raw material is top of the economic sustainability character of CSIEB with a RII of 0.862. This further corroborates Adedeji and Fasakin (2008) findings that the stabilized interlocking earth block is highly cost effective when used for building construction. Findings also revealed that the use of CSIEB for income generating projects such as shopping complexes/malls, block of flats and estates, can lead to faster generation of revenue from the proposed structure due to considerable time savings during construction as it has a RII of 0.800. Reduction in cost of finishes and considerable cost savings on elimination of mortar were also noted as strong features of CSIEB with a RII of 0.796 and 0.788 respectively, hence affirming Ngowi (2005) statement that more cost saving is recorded in area of cement used for finishes and mortar for joining of blocks as experienced in the conventional masonry system. Findings also revealed that the use of CSIEB can lead to immense saving in transportation cost since materials needed for its production are readily available on site. RII of 0.762 was recorded in this aspect and this corroborates Taiwo and Adeboye (2013) observation that since the materials used for CSIEB are collected locally, no huge mines are required to supply building materials and Muinde (2012) observation that

since the machine for making the blocks can be towed to the site of construction, appreciable savings can be made on cost of transporting blocks.

Although, considerable cost savings on air conditioning or mechanical cooling system and the use of reduced labour ranked between 6th and 7th, they still have a RII of above 0.700. This showed that CSIEB if used for masonry construction can provide immense economic sustainability for an investor.

Environmental sustainability of CSIEB

The ability of CSIEB to adapt to tropical climate makes it a relatively good material for sustainable construction as it has a RII of 0.842. Also since onsite materials are used, energy used for transportation is minimized thereby reducing transport pollution and carbon footprint (Hydraform, 2004). CO_2 emissions experienced in the case of the conventional fired clay bricks (Deboucha and Hashim, 2011) is eliminated with the use of CSIEB as no firing is needed in its production, hence providing a safe and sustainable environment for its occupants.

Findings further corroborate Adedeji (2005) assertion that stabilized interlocking earth blocks minimizes the enormous waste associated with conventional masonry works as reduction of waste had a RII of 0.800. This can be attributed to the fact that faulty blocks can be broken down and reproduced using same material and where material is unused, excess can be recycled on site and reused.

The Ability to last the life span of the building is the least on the table with a RII of 0.688. This can be attributed to the fact that an actual case study on the life span of a building built with CSIEB has not been carried out. Hence little is known as to its life span expectancy.

Social Sustainability of CSIEB

Findings revealed that the main social sustainability nature of CSIEB is its aesthetic nature as it has a RII of 0.866. This corroborates Adewole (2009) observation that an aesthetically pleasing look is achieved if properly constructed. The use of CSIEB for building construction provides some considerable measure of thermal and acoustic comfort for its occupants as this has a RII of 0.85. This according to Radhi (2009) is due to its high density and valuable thermal inertia qualities, which allows the walls to store solar heat during the day and slowly release it at night.

Provision of a beautiful streetscape is an important factor for social sustainability in building construction (Queensland department of public works, 2008). Thus, findings showed that the aesthetic nature of CSIEB provides a pleasing structure to which other would-be developers can emulate, thereby creating a beautiful/pleasing streetscape. This has a RII of 0.838. Also, provision of employment has a RII of 0.824 which shows that most respondents believes that use of CSIEB can serve as a means of employment for people within the immediate locality.

CONCLUSION AND RECOMMENDATION

Due to the increasing popularity and usage of CSIEB for building construction, the need to ascertain its sustainability is necessary in other to achieve a sustainable environment. Using a survey method where construction professionals (Architect, Quantity Surveyors, Engineers and Builders) were sampled, this research was able to ascertain the main sustainability features of CSIEB with the view of increasing its level of usage in building construction in Nigeria, thereby creating a more sustainable environment. The study shows that the use of CSIEB for building construction will give 34% of social sustainability, 33% of economic sustainability and 33% environmental sustainability, thus creating a balance between the three pillars of sustainability.

The research further revealed that the use of CSIEB to a large extent will:

i. save cost of raw materials used for masonry construction, provide faster revenue generation due to its fast construction time, provide adequate savings in areas of finishes and mortar usage and provide adequate savings in cost of transportation of materials needed for masonry construction to site;
ii. provide a structure that can adapt to the tropical climate, minimize energy spent on transportation thereby reducing transport pollution, eliminate the emission of CO_2 and eventually reduce wastage of materials onsite;
iii. provide an aesthetically pleasing and thermally conducive structure, provide a beautiful streetscape and subsequently serve as a means of employment for people within the locality.

The study therefore recommends the use of CSIEB as a means of attaining sustainable building construction. The use of CSIEB should be encouraged among stakeholders as a material for building construction due to its enormous benefits.

The findings of the study provide possible directions for further studies in that the researcher was able to assess the sustainability of CSIEB in building construction in Nigeria. Further work can be done in comparing the sustainability of CSIEB with that of other conventional materials for masonry construction such as sandcrete blocks, fired bricks etc.

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Assessment of Organisational Culture and Employee Commitment in Construction Companies in Lagos State Nigeria

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ABSTRACT

The world of construction companies' business today is dynamic and regularly changing giving ways to challenges and opportunities. This implies that construction companies are expected to compete and survive in the dynamic business world. These changes in the business world impact on other aspects of the companies' corporate existence, such as organisational culture and employees' commitment which impact on organisational outcomes. The culture of an organisation brews the component of commitment exhibited by the employees. This study investigates the correlation and compatibility of existing type of organisational culture and exhibited component of employees' commitment in large, medium and small sized construction companies. The research design is a cross-sectional survey in which validated organisational culture and organisational commitment instruments were used and administered to management staff in 176 construction companies in 2015. Mixed statistical analysis which includes percentile, mean score, and Spearman rank correlation were used to analyse the data collected. The results of the study shows that the strength of relationship between the different types of organisational culture and components of commitment vary from the weakest to the strongest suggesting that certain types of organisational culture is more related and compatible with certain components of commitment. It also reveals that the Nigerian construction companies operate different types organisational culture perceived to be compatible with components of commitment exhibited by their employees. The study recommends that management of construction companies should conduct culture auditing or embark on culture change from top to bottom in order to ensure compatibility and enhance their performance.

Keywords: Compatibility, Construction Companies, Employees' Commitment, Management, Organisational Culture

INTRODUCTION

Organisational culture is a concept that characterises a work environment. Culture is the environment that surrounds the employee at work all of the time. While not simple to capture or define, organisational culture is a discernible, powerful force in any organisation which can be used to cultivate the commitment of its members to the realisation of its goals and objectives. Organisational culture and employees' commitments are necessary ingredients for construction companies to compete and survive in today's dynamic construction business environment which is regularly changing and giving ways to challenges and opportunities. If construction companies are to effectively compete and survive in the dynamic business environment, the management of such companies must focus attention not only on their organisational culture but also on the commitment of the employees.

In the opinion of Pandey (2014), organisational culture is responsible for laying the foundation of an organisation, building and nurturing it, defining its purpose, setting its direction, prioritizing its tasks, guiding its strategies and behaviour of its people in order to ultimately delivers its results. An organization's culture governs the attitude and behaviour of people in the workplace, including their commitment toward the organization and therefore a determinant of commitment (Neelam, Bhattacharya, Sinha and Tanksale (2015). It has also been argued that the culture of an organisation brews the component type of commitment exhibited by the employees. This suggests that there is a relationship between organisational culture and component of employees' commitment exhibited in any organisation. However

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the strength of the relationship has not been fully explored in order to know which type of organisational culture is most compatible with which component of the employees' commitment.

Two questions that arise from literature evidence of the relationship between organisational culture and employees' commitment are: (i) which type of organisational culture highly correlates with which component of employees' commitment? and (ii) Does the same type of organisational culture and component of employees, commitment exist in small, medium and large sized construction companies? It is therefore the aim of this study to investigate the correlation between the type of organisational culture and component of employees' commitment in construction companies with the aim of identifying the most compatible for adoption by the management of the companies.

LITERATURE REVIEW

Organisational Culture

By definition, organisational culture is a basic assumption, as well as the findings, invention, and development of an organisation in dealing with external adaptation and internal integration (Wu and Lin, 2013). Organisational culture is considered by some scholars as the glue that holds every member of an organisation together (Clark, Hartline and Jones, 2009). Some other scholars compare it to a compass providing direction for the ship of the organisation. Its function is to create a common ground for the employees and, provide a sense of order such that all employees know what is expected of them at any given time. The culture of any organisation is manifested in the values and business principles preached by its management, in the attitudes and behavior of its employees, in the legends people repeat about happenings in the organization (Sharma and Sharma, 2010).

Literature is replete with various definitions of culture hence it has no universal definition.However, one of the most commonly cited definition was offered by Schein (1985). It defined organisational culture is understood as a pattern of basic assumptions which is invented, discovered, or developed by a group since it learns to cope with its problems of external adaptation and internal integration that has worked well to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. Building the culture of an organization and shaping its development is essentially the function of leadership. Naturally whether the culture of an organisation is purposely planned or not, it will surely develop in due course. Generally, culture forms the context within which a group of people judge the appropriateness of their behaviour.

Culture at the Construction Industry Level

Industry cultures represent groups of organisations that share common values, assumptions, socialisation and norms; and includes all those organisations to which individual organisations have direct or indirect links (Bosch, Tait and Venter, 2006). The construction industry in Nigeria is not homogeneous like in any other country. It is a fragmented industry with the design and production aspects under different management umbrella and it comprises large number of privately-owned, small and medium sized companies; and a small number of large sized companies (Abiola-Falemu, 2013). Construction has an image of being a difficult, demanding and unbecoming occupation with an adversarial culture (Harvey and Ashworth, 1993).

The industry has historically been known more for its adversarial nature than for its collaborative spirit (Barbara, 2010). According to Ball (1988), the industry also has a culture of intimidation within the working environment where the many small companies tend to act

as subcontractors to the large companies. The physical nature of the industry's products which are manufactured in the client's premises; one-off designs and lack available prototype models; separation of design from construction; organisation of the construction process; and methods used for price determination are some of the characteristics that separate construction industry from other industries (Barthorpe, Duncan and Miller, 2000 reflecting Harvey and Ashworth, 1993). All these characteristics serve as agents that partly shape the construction organisation's culture and commitment of its employees.

Culture at the Organisational Level

Wu and Lin, (2013) suggests from his definition of culture that at the organisational level, culture evolves as members of the organisation carry out their jobs and interact with one another. Two decades earlier Rowe *et al.,* (1994), had observed that organisational culture develops as a result of many factors, some of which are the type of business interest of the organisation, its products, customers, size, location and operational methods. Further research into the construct by Barthorpe, Duncan and Miller (2000) revealed that culture within organisations is reflected in the way that people perform tasks, set goals and objectives and administer the necessary resources to achieve the goals and objectives. Culture knits a collection of individuals into an integrated entity called "organisation." A collection of a number of key elements, factors, observations and experiences that have been recognized as being inherent within an organisation is known as "organisational culture". It affects the way people in organisations make decisions, think, feel and act in response to the opportunities and threats affecting the organisation (Thompson, 1993).

Types of Organisational Culture

There are four types of organisational culture that have long been commonly referred to in the literature and which are still contemporary subject of research focus as indicated in Erdem and Keklik (2013). Construction companies can be identified with any one of the four types which are each described as follows:

People or Clan Culture

This is characterised as a family type of organisation; and a friendly place to work. It is an organisation that concentrates on internal matters. It shows flexibility, concern for people, and sensitivity for customers. The people culture views its leaders as having the role of mentors or facilitators. The glue that binds the organisation together is loyalty and tradition and its members exhibit a high level of commitment. People culture organisations emphasise individual development, morale, teamwork participation, and consensus (Cameron and Quinn, 1999). The goal of people culture is to manage the environment through teamwork, participation and consensus.

Task or Adhocracy culture

This refers to a non permanent organisation which focuses on realizing organizational goals (Aina, Adeyeye and Ige, 2012). It is a temporary organisation structured to solve a particular issue and is disbanded once the issue or task is completed (Hodge and Anthony, 1991). It is an organisation that concentrates on external positioning with a high degree of flexibility, individuality and discretion rather than seeking stability and control. Its key values are creativity and risk taking. Organisational charts are temporary or nonexistent. Roles and physical space are also temporary. This type of organisation typifies a construction organisations engaged in construction contracts.

Power or Market Culture

This is an organisation that focuses on external maintenance with a need for stability and control in order to have a competitive position. The power culture is valued for stability and control. It focuses more on external (market) rather than internal issues. This culture tends to

view the external environment as threatening, and seeks to identify threats and opportunities as it seeks competitive advantage and profits (Cameron and Quinn, 1999).

Role or hierarchy culture

This refers to an organisation that focuses on internal issues with the need for stability and control. It values tradition, consistency, cooperation, and conformity. The culture also values stability and control over flexibility and discretion. In this type of culture there are commands, written rules, job descriptions and standardization (Erdem and Keklik, 2013). It is the traditional "command and control" model of organisations, which works well if the goal is efficiency and the organisational environment is stable and simple with very few changes in customers, customer preferences, competition and technology. This type of organisation typifies large construction organisations that have established rules, regulations and procedures for the conduct of their business activities and have in the process become bureaucratic.

Framework and Instrument for Measuring Culture

Literature is replete with some frameworks for measuring culture. Competing Values Framework, Value Survey Module, Handy's Framework and Stakeholder Framework) are familiar frameworks for measuring culture. The Quinn (1988) Competing Values Framework was found most suitable because of its universal application. The framework is organised along two axes based on the four dominant culture types to complement the dimensions. The model uses quadrants to differentiate the four types of organisational culture in form of a 2 x 2 matrix in which the organisational culture types on the diagonals are competing with each other while those adjacent are complementary to each other (Maloney and Federle, 1993). Organisation that operates in the upper-half is oriented towards decentralization and differentiation with an emphasis on impulsiveness and flexibility. Organisation in the bottom-half of the figure is disposed towards centralisation and integration with emphasis on predictability and control. The organisation on the left side focuses on a long-term horizon while the right side is oriented towards the competitive position of the overall system and it focuses on short-term horizons. The values of organisations in the upper-half side are competing with the values of those of bottom side. Those values on the right side are also competing with those on the left side (Maloney and Federle, 1993).

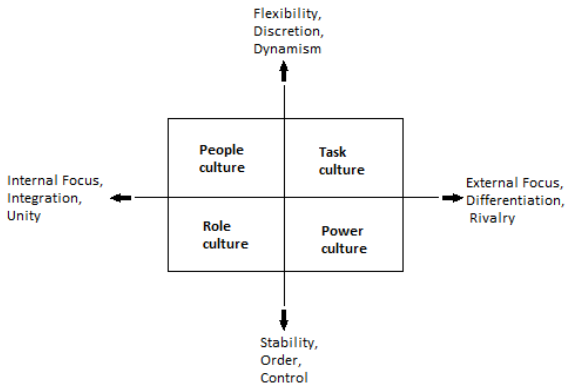

Figure 1: Competing Values Framework (CVF) Source: Adapted from Quinn (1988)

Employees' Commitment

Commitment is the bond employees experience in their working relationship with their organisation. Employees' commitment is about the attitudes of employees towards the entire organisation (Adeyinka, Ayeni and Popoola, 2007). Northcraft and Neale (1996) view commitment as an attitudinal issue reflecting an employee's loyalty to his or her current organisation; and as an ongoing process through which organisation members express their concern for the organisation and its continued success and well being. Employees'

commitment is believed by some scholars (Meyer and Allen, 1997) as multidimensional work attitudes which have different types or simply different components. It is therefore an important organisational issue that makes committed employees less likely to leave for another job and more likely to perform at higher levels.

Employees' Commitment Defined

Employee commitment has been defined in numerous ways (Lee, and Chen, 2013). Though many definitions of employees' commitment exist, there is no significant variability among them and hence one definition can suffice to convey understanding of the construct. Therefore, commitment is a condition in which members of a group give their abilities and loyalties to the organisation in which they work currently and the pursuit of its goals in return for satisfaction (Hodge and Anthony, 1991). Meyer and Allen (1991) and Meyer, Allen and Smith (1993) acknowledging the construct as multidimensional, have identified three aspects of commitment as affective commitment or desire-based (wanting to stay with the organisation), normative commitment or obligation-based (feeling obliged to stay), and continuance commitment or cost-based (staying because of the high cost associated with leaving the current organisation). Hence Meyer and Allen (1991) offer the following definition of the three types of employees' commitment

Affective or Desire-based Commitment

This refers to the employee's positive emotional attachment to, identification with, and involvement with the organisation. This translates to mean that employees with a strong affective commitment continue employment with their current organisation because they want to do so and not out of any influence. An employee who is affectively committed strongly identifies with the goals of his or her current organisation and desires to remain a part of the organisation. Affective commitment is different from normative commitment in that it is motivated by personal enjoyment rather than a sense of duty as in normative commitment.

Normative or Obligation-based Commitment

This reflects a feeling of compulsion to continue employment in the current organisation whatever the situation may be. It Normative commitment is a feeling of moral or legal duty by an employee to remain in his or her current organisation. This feeling of compulsion may be as a result of a combination of factors like investment (e.g. training, loans of any category, etc) made in the employee by the organisation, family ties, religious leaning and extra curricula activities. For example when an organisation trains an individual employee, such an employee feels duty-bound to serve the organisation or pay back the cost of training him. Some employees exhibit this component of commitment out of the belief that it is the norm to be loyal and dutiful to one's organization and reciprocate a good gesture. This is typically an African value

Continuance or Cost-based Commitment

This is the awareness by an employee of the costs associated with his or her leaving his or her current organisation. It is exhibited when an employee perceives high economic or social losses associated with leaving his or her present organization for another one. The reason for leaving is different from the obligation felt by those employees that exhibit normative commitment. This type of commitment emanates from a negative sense of fear regarding the consequences of leaving. Employees whose primary link to their organisation is based on continuance commitment remain with their current organisation because they need to do so out of fear. The cost of their leaving the organisation outweighs the cost of remaining with it otherwise they will leave no matter the amount invested in them by the organisation.

Organisational Culture and Employees' Commitment

Conflicting research outcomes of relationship between organisational culture and commitment have been reported. In 2012, Mahmudah reports that a significant relationship exists between organisational culture and commitment. On the other hand, Lahiry (1994) in his own report finds only a weak correlation between organisational culture and commitment. Nongo and Ikyanyon (2012) argue that when organisational culture is strong it enables employees understand and work towards the organisation's goals thereby increasing their level of commitment. Jermier and Berkes (1979) also show there is a relationship between job satisfaction and employees' commitment which impact on performance. Their findings show that job satisfaction yields higher levels of employees' commitment and by extension improved performance. Employees' commitment is a strong predicator for individual motivation, desire to leave, turnover, and job performance (DeCotiis and Summers, 1987) but it is driven by organisational culture.

Thus, having a committed workforce would be an added advantage to an organisation. However this is gained through integration and good management practices around a small number of key values inherent in the culture of the organisation. Oboh (2004) reflects this when he states that management concern for staff welfare and career development through structured training are means of ensuring staff commitment and loyalty and also means of entrenching the culture of service by workers.

RESEARCH METHODOLOGY

This is a cross-sectional survey research in which data was collected at one point in time in 2015. Modified Organisational Culture Assessment Instrument (OCAI) developed by Cameron and Quinn (1999) and Meyer and Allen's (2004) Organisational Commitment Instrument (OCI) for assessing employee commitment were used. The choice was based on their relative reliability and validity as attested to in the literature and compared to other tools. The research was based on census survey and the population consisted of 176 construction companies that registered with the Federation of Construction Industry (FOCI) and the Nigeria Business Directory (NBD). The questionnaire was administered on one management staff in each of the 176 companies. Since the research population is finite and manageable, it was considered appropriate to use the entire population for the study.

Questions were asked on a five point Likert type scales with 5 representing strongly agree and 1 representing strongly disagree with statements about organisational culture and employees' commitment. This score provides an indication of the cultural orientation and employees' commitment within the organisations with respect to each of the indices. Mixed statistical procedures were employed in the analyses of the data. Percentile, mean score, and Spearman rank correlation were employed.

FINDINGS AND DISCUSSIONS

Types of Organisational Culture in the Nigerian Construction Companies

From Table 1, it can be seen that the small sized (1-50 employees) construction companies predominantly operate task culture with a mean score of 3.85 while role culture appears to be the least common among the small sized companies. The highest mean score for the medium sized (51-300 employees) construction companies is 3.68 for role culture. Task culture has the least mean of 3.58. Therefore role culture is favoured among the medium sized companies in Nigeria. As for the large sized (> 300 employees) construction companies, the highest mean score of 3.90 is for the power culture which is their dominant culture. From broad perspective, the dominant type of organisational culture in the Nigerian construction industry is the power culture with a mean score of 3.73 which is only marginally higher than the mean

score of 3.72 for the task culture. This means that most of the construction companies are either operating power culture or task culture.

Power culture is dominant because no construction organisation can stay in business without competition which most often entails competitive bidding. Task culture is also common because of

the need for construction organisation to meet schedule and deliver to time. People culture appears to be the least common type of culture within the industry though the difference between role culture (3.66) and people culture (3.63) is equally marginal

Types of Employees' Commitment in the Nigerian Construction Companies

Table 1 show that employees in the small- sized construction companies exhibit all the three components of commitment. However, the prevalent component of commitment being exhibited by the employees is normative with a mean score of 3.59. This is followed by affective commitment while continuance commitment is least exhibited. This indicates that the employees are more committed in terms of normative and affective than continuance. In the medium-sized companies, employees' affective and normative commitments are stronger than continuance commitment which appears to be very weak. However, affective commitment seems to be the dominant type of commitment in the medium-sized companies with a mean score of 3.23 followed by normative commitment with a mean score of 3.07.

The commitment pattern of the employees in the large-sized companies is the same as that of the small sized companies. The employees appear to exhibit more of normative (ms = 3.20) and affective (ms = 3.10) than continuance (ms = 2.93). The overall mean score for each of the three types of commitment shows that normative component of commitment with a mean score of 3.29 is most prevalent in the Nigerian construction companies. This is followed by affective commitment with a mean score of 3.20 while continuance commitment with a mean score of 2.85 is least exhibited. The higher positive correlation with continuance commitment may be due to some attributes in the power culture. The role culture is positively correlated with all the types of employees' commitment. Both affective ($r = 0.346$, $p = .000$) and normative commitment ($r = 0.334$, $p = .000$) are more positively related to the role culture than continuance commitment ($r = 0.175$, $p = .023$). However affective commitment shows the highest coefficient of correlation with task culture ($r = 0.522$, $p = .000$) which may mean that affective commitment is the most compatible with this type of culture.

Table 1: Types of Organisational Culture and Commitments Components in Construction Companies

Variables	Small sized companies			Medium sized companies			Large sized companies			*OMS*	*OR*
	N	*Mean Score*	*Rank*	*N*	*Mean Score*	*Rank*	*N*	*Mean Score*	*Rank*		
People Culture	73	3.59	3	32	3.64	2	25	3.65	4	3.63	4
Task Culture	73	3.85	1	32	3.58	4	25	3.74	3	3.72	2
Power Culture	73	3.68	2	31	3.6	3	26	3.9	1	3.73	1
Role Culture	73	3.56	4	32	3.68	1	26	3.75	2	3.66	3
Affective Commitment	70	3.27	2	32	3.23	1	25	3.1	2	3.2	2
Normative Commitment	73	3.59	1	32	3.07	2	25	3.2	1	3.29	1
Continuance Commitment	73	3.08	3	31	2.53	3	26	2.93	3	2.85	3

Note: OMS = Overall Mean Score, OR = Overall Rank. The decision rule is based on <2.5 = strongly disagree; ≥2.5 but <3.0 = disagree; ≥3.0 but <3.5 = somehow agree; ≥3.5 but <4.5 = agree; 3.5; ≥ 4.5 but ≤ 5 = strongly agree

Types of Organisational Culture and Employees' Commitment

Judging from the attributes of power or task culture oriented companies, the result implies that most companies are oriented towards maximization of output as well as expansion and transformation. It further indicates that they are also competitive and goal oriented. People culture appears to be the least common type of culture within the industry. This is probably because most of the construction companies are not disposed to having an organisational setting where their employees would work as a family because this will hinder the

management from hiring and firing at will as is commonly the case. Human capital development which is one of the hallmarks of the people culture seems unimportant to most of the companies. The economic situation in Nigeria lends ready excuse as to why the companies appear not to favour people culture. The large pool of unemployed in the labour market gives the construction companies the opportunity to hire and fire at will especially as ICT has made recruitment much less difficult.

In terms of employees' commitment, normative form of commitment is generally prevalent. This is closely followed by affective commitment. One observable reason why normative commitment is prevalent in the industry is because, many construction employees are engaged through friends and family links and sometimes they receive one favour or the other from their employers; and they therefore have the moral obligation to stay with the company. Apart from this, the African culture teaches that one should reciprocate a kind gesture, and so this drives the commitment behaviour of the employees and they tend to exhibit normative commitment in appreciation of any investment made by their employer on them. However the results show that differences exist based on the size of company in the type of culture and employees' commitment most dominant in any construction company.

Small-sized construction companies

From Table 1, the small-sized construction companies predominantly operate the task culture. This is because they are still growing with the need for expansion and transformation. Hence, they need simple organisational structure for their operations. Based on the CVF (Fig.1) it can be said that small-sized construction companies value the end result of growth and acquisition of resources probably due to the need for expansion. Furthermore they encourage creativity and experimentation and are motivated and driven by the desire to achieve new and challenging vision. External positioning and the need to be recognised is their focus and hence they always strive to meet schedules. Innovativeness is assumed to be the key to their success.

The small-sized companies can equally be described as dynamic, entrepreneurial and creative. As such their employees would tend to embrace innovation and risk-taking. The binding force among their employees would most likely be a commitment to experimentation and freedom of thought. This is consistent with the views expressed by Tharp (2009) that experimentation and thinking differently is a unifying force of employees in small-sized companies. However, the end results will depend on the values placed on flexibility, adaptability and innovativeness.

In terms of employees' commitment, most employees working in the small-sized construction companies agree that they exhibit normative component of commitment with a mean score of 3.59. The prevalence of normative commitment indicates that a sense of obligation to maintain association with and loyalty to their respective companies appears to be common among the employees. Since the small-sized construction companies are more task culture-oriented than other types of culture with the desire for growth, investments are made in their loyal and trustworthy employees through various ways. Hence, the African norm of reciprocity that employees should remain loyal to an organisation that has invested in them seems to be responsible for the high level of employees' normative commitment in this category of construction companies.

Medium-sized Construction Companies

As for the medium-sized (51-300 employees) construction companies, role culture with a mean score of 3.68 is preferred. In the context of the CVF in Figure1, this could be attributed to the need to have formal laid down rules and procedures to govern their business conduct as well as the behaviour of their employees. This implies that they are formalized and structured

and also suggests that they are concerned with stability, predictability and efficiency in the long term. It is also most likely that the medium-sized companies place emphasis on creating a well-defined hierarchical structure where employees are given well-defined roles as well as provided with clear rules and policies which they are expected to follow to bring about stability, predictability and efficiency. Of course, experience has shown that this is the case with most medium-sized companies. Hence in agreement with Tharp (2009), managers in such companies are expected to be seen as good coordinators and organizers having efficiency at the back of their mind.

In terms of employees' commitment in the medium-sized companies, affective commitment with a mean score of 3.27 seems to be commonly exhibited by the employees. Affective commitment refers to the employee's emotional attachment to, identification with and involvement in the organisation on the basis of positive feelings or emotions toward the organisation. The extent to which employees could rely on their companies to cater for their interest; and the extent to which they could influence decisions and matters that concern them could be responsible for their being affectively committed. This means that dependability and participatory management could have played a role. Additionally, age, job satisfaction and organisational tenure which this category of company expressed as important to them could be attributed to the employees' affective commitment. Affectively committed employees stay with the organization out of their own volition rather than any underlie factors. However opportunity for growth in such companies cannot be ruled out as factor for being affectively committed. Hence, such employees tend to exhibit higher levels of commitment to their organisation and they also tend to perform more effectively in their managerial work than those that exhibit normative or continuance commitment. Therefore the level of performance of the medium-sized construction companies is expected to be better than small-sized companies whose employees exhibit normative form of commitment.

Large-sized Construction Companies

Large-sized (> 300 employees) construction companies operate power culture with a mean score of 3.90. This choice of power culture could be explained in the context of attainment of business development maturity level. As companies attain this level, they need not only to prospect and maintain customer relationships but also put in place business development entrepreneurship. This would make all their employees accept responsibility to identify and champion new opportunities for further business growth. Explaining this result in the context of CVF as in figure 1, it can also be said that large-sized construction companies value the end result of productivity and efficiency to a great extent. This is in agreement with the findings of Buckner and Williams (1995) that organisations operating power culture greatly value productivity and efficiency as end result.

Other attributes of such power-culture-oriented companies are emphases on producing as many services as possible, focused attention on bottom-line and profits; and employment of planning and goal setting as the means of achieving the results. Furthermore, goal and task clarification, direction, and decisiveness are the cultural values of such power-culture-oriented companies. Due to the pervasiveness of cultural dimensions in such companies, their employees are assumed to respond normally when given instructions by a superior who administer rewards for work well done. These attributes are evident in the way and manner the few large construction companies in Nigeria operate.

The employees in the large-sized companies are competitive, goal-oriented and motivated to increase productivity. They exhibit normative form of commitment as indicated in Table 1 with a mean score of 3.20 though marginally higher than affective commitment. Anecdotal evidence has shown that there is reasonable level of job security in large-sized construction

companies coupled with better conditions of service and welfare packages. It is therefore not surprising that there is tendency for the employees to be emotionally attached to the organisation which in turn reflect in their performance. Their managers are demanding and hard-driving with focus on external maintenance with a need for stability and control. The emphasis on winning unifies the organization; and reputation and success are common concerns. Such company is equally competitive and success means market share and penetration (Tharp, 2009). The foregoing might be the reason why the few large-sized construction companies in Nigeria are able to perform and attract more patronage from various quarters which give them the opportunity to dominate the Nigeria construction landscape.

Relationship between Types of Organisational Culture and Employees' Commitment

The dimensions of organisational culture play significant role in determining the component type of employees' commitment that should be expected in each of the organisational culture types as expressed in Table 2. This shows that all the types of organisational culture are positively correlated with the three components of employees' commitment in varying degree of strength. The implication of these results is that in the people culture, affective commitment would be more pervasive and most times be expected among the employees especially in medium-sized construction companies.

Both types of culture are common to medium-sized companies. Individual development and personal commitment in the people culture are most likely responsible for the emotional commitment of employees in medium-sized construction companies. Therefore, attachment of the employees with the organisation would be very high. This finding is also in agreement with Rashid, Sambasivan and Johari (2003) that affective commitment is more positively related to consensual (people) culture. This desire-based component of commitment coupled with a family type of organisational culture will no doubt produce job satisfaction which in turn impacts positively on organisational outcomes.

In the case of task culture; values like creativity, commitment to innovation and development; and risk taking associated with the culture would influence the emotional attachment of the employees to the companies that are task-culture oriented. These values could likewise place an obligation on some of the employees to be normatively committed. Therefore in task culture, normative commitment should be expected since it appears more compatible than the continuance commitment. This type of culture and commitment will work perfectly well in small-sized construction companies.

Table 2: Correlation between the types of organisational culture and employees' commitment

Types of Organisational Culture	Types of Employees' Commitment		
	Affective commitment	Normative commitment	Continuance commitment
People culture	.448**	.373**	.216*
Task culture	.522**	.461**	.273**
Power culture	.204*	.216*	.263**
Role culture	.346**	.334**	.175*

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)

The strong strength of relationship between power culture and continuance commitment suggests compatibility. This indicates that employees who exhibit continuance commitment remain in the employ of their companies due to the cost associated with leaving the organisation and also to values in the power culture that relate to stability; and competitive advantage and profits in agreement with Cameron and Quinn (1999). The results further show that the employees would stay with the organisation as a matter of necessity and not based on emotional factors. In accordance with thoughts of Rashid, Sambasivan and Johari (2003), this means that managers need to focus attention on boosting the morale of the employees

including their dedication to work so as to make them emotionally attached in order to improve their performance.

In role culture, affective commitment appears to be most compatible since it has the highest correlation coefficient. Values in role culture like cooperation, traditions and; formal rules and policies would influence the employees to be emotionally attached to companies that operate this type of culture. The medium-sized types of construction companies perfectly exhibit this match as both role culture and affective commitment were ranked first. The focus of medium-sized companies on internal than external issues as they strive for further growth, stability and control makes the perfect match possible. Alternative to this affective commitment is the normative type of commitment which can bring about the same results if properly channelled. Therefore either types of commitment can be cultivated in role-culture oriented companies as exemplified by medium-sized companies.

CONCLUSION

Organisational culture and commitment of employees in construction companies play important role as both are related and affect organisational outcomes through their interaction. The results of the study have provided important insight into the implications and strength of relationship between organisational culture and employees' commitment. To this end, certain type of organisational culture is more related to certain component of commitment suggesting compatibility. The Nigerian construction companies have been assessed as operating different types organisational culture perceived compatible with the component of commitment being exhibited by their employees. The small, medium and large-sized construction companies are characterised by different organisational culture and employees' commitment with power culture and normative commitment being generally the most prevalent in the overall assessment.

The management of these companies is encouraged to ensure compatibility of their respective organisational culture with the prevailing component of commitment being exhibited by their employees so as to derive the benefit of their interaction. This can be done by auditing their organisational culture and the commitment of their employees or by embarking on culture change which should be initiated from the top echelon of the management.

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Risks Associated with Stakeholders at the Pre-Contract Stage of Construction Projects in Ondo State, Nigeria

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ABSTRACT

Risk is an inevitable occurrence in all activities, which cannot be exempted from the different phases of construction and the influence it has on the performance of stakeholders. Therefore, this study assesses the risks associated with project stakeholders at the pre-contract stage of construction projects in Ondo state, Nigeria. The study objectives assesses the effects of risks on the performance of stakeholders and the effectiveness of the strategies adopted by stakeholders in reducing these risks. Primary data were collected through questionnaire survey from a total of seventy-eight (78) out of eighty-one (81) construction stakeholders comprising client, consulting and contracting organizations. Mean score and regression analysis was used to analyze the primary data. The study revealed that poor communication between project stakeholders, unethical conduct among project stakeholder, government building policies and delays in approval of design by the government are the risks with very high occurrence and which are most severe at the pre-contract stage. The most effective strategies adopted by stakeholders includes carrying out in-depth investigation of site conditions directly from site, identifying possible risk at the early stage and assessing them appropriately and clearly defining clients brief. Also, the significant value shows that the performance of stakeholders is affected by risks. The implication is that the stakeholders should ensure to work in collaboration based on recognized conduct and ethics and, operate with proper contract documentation in order to enhance their performance throughout the construction project's life.

Keywords: Construction Project, Ondo State, Pre-contract Stage, Risk, Stakeholder

INTRODUCTION

Risks cannot be exempted in construction from the pre-contract stage to the completion stages of a project's life and less information are available at the inception of a construction project, which makes the level of risks and uncertainties high at this stage (Winch, 2002). According to Diffi (2003), risk is defined as the conditions or events that may occur and negatively affect the attainment of objectives and they are assessed in relation to the likelihood of it occurring, and the expected consequences it will entail for attaining objectives if it occurs. The pre-contract stage of a construction project is regarded as the stage where the client makes his intention known to the consultants to the stage where contract terms are being agreed to and signed by the stakeholders involved and at this stage feasibility studies done leads to production of design of the project, bill of quantity and other documents necessary to make up a contract document. On the other hand, Fewing (2005) defined a stakeholder as anyone who has an interest in the process and outcome of a project. In a typical construction project, the stakeholders are the clients, project managers, architects, civil engineers, builders, service engineers, quantity surveyors and contractors. The performance of these stakeholders often determines the output of the projects (lester, 2007).

According to New South Wales department of finance (2012), risks are involved in every stage of construction right from its planning stage to the contractual agreement stage to the completion stage, so identification, assessment and treatment of problems, threat and risk are integrated to most process of projects and individual procurement.

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Risk is an inherent element of construction contract, so at the pre-contract stage construction organization must estimate the risk and make management decisions to reduce the level of risk to the barest minimum (Marcus and David, 2001). An effective risk assessment method can help to understand not only what kinds of risks are faced by the stakeholder at the pre-contract stage, but also how to manage these risks in different phases of a project. Owing to its increasing importance, risk assessment has been recognized as a necessity in the construction industry today. Thus, set of techniques have been developed to control the influences brought by potential risks (Luka and Ilyasu, 2014). Smith and Bohn (1991) opined that decision makers can take steps to minimize the impact of those problems and that effort expended in managing risk at the pre-contract stage should be consistent with estimated cost procurement cost and complexity, significant and nature of the process. Hence, this research work seeks to assess the various risks associated with stakeholders at the pre-contract stage of a contract so as to assist construction stakeholder i.e. clients, consultants and contractors in reducing or avoiding these risks. Flanagan & Norman (1991) purported that the adverse effect of risks will be financial loss either on the path of the client or the contractor. Chapman and Ward (1997) said that risk is viewed within the context of the probability of different outcomes and that the general attitude towards risk is its identification, assessment, control and management. Also Odeyinka (2006) asserted that risk at the pre-contract stage could be due to changes in design, inadequate program scheduling, poor selection of contractors, defects in design, under-estimation inadequate specification, feasibility of construction methods, corrupt/fraudulent practice and increase in interest rates. Baccanni and Arche (2001) discovered that the risks inherent in a construction project are responsible for the observable deviation between the tender sum and final account. Hence this research looks at what is the assessment of risk associated with stakeholders at the pre-contract stage of a construction contract and how they affect the execution of the contract at in the long run.

Several studies have been carried out to analyse and asses risks in various form of construction projects using different principles and theories (Duffey and Dorp, 2001; Odeyinka, 2006; Kikwasi, 2011; Luka and Ilyasu, 2014). Little has been done to assess the occurrence of risks at the different stages of construction and analyse the impact of risks on construction stakeholders. Therefore, the paper explore risks associated with the construction stakeholders based on its occurrence and severity, the strategies that can be adopted in reducing these risks and its effect on the performance of the stakeholders for public projects in Ondo state, Nigeria.

LITERATURE REVIEW

Risks in Construction

Risk has been defined in several studies to mean different thing based on individual's viewpoint, attitudes and experience. Baloi and Price (2001) concluded that risk is generally seen as an abstract concept which is very difficult to measure. Smith (1999) defines risk as a decision which has a range of possible outcomes and that a known probability can be attached to each of these potential outcomes. Diffi (2003) defined it as the conditions or events that may occur and negatively affect the attainment of objectives and they are assessed in relation to the likelihood of it occurring, and the expected consequences it will entail for attaining objectives if it occurs. Winch (2002) argued that in statistical terms risk refers to unexpected events where the outcome is either to the benefit or detriment of the decision maker. He also goes on to say that in common practice risk is only used to refer to the probability of a detrimental effect, with the word reward being used to signify the probability of a beneficial event occurring. Similarly, Wideman (2003) opined project risk as the chance of certain occurrences adversely affecting project objectives. Chapman (1999) asserted that

risk as an exposure to either economic loss or gain due to involvement in the construction process. However, this paper sees risk as an inevitable occurrence in all activities, in which the construction activity is not exempted and occurs at different stages of construction projects.

Risk Factors at Pre-Contract Stage of Construction Projects

According to Agerberg (2012), risk is always at the highest level at the pre-contract stage i.e. the stage where the client makes his intention known to the consultant team to the point where contractual agreements are being signed by the various parties involved in the contract. Worcester (2012) classified risk in various categories as they occur in several form. The risk factors listed in this study has been identified from different literature (Chapman & ward, 1997; Kumaraswamy and Chan, 1998; Frambach and Schilleweart, (2002); Morgan, 2004; Celvin, 2005; Noor, 2005; Harvey, 2006; Zou, 2006; Patrick and Guomin, 2006; Aiyetan, 2008; Yusof, 2011; Chereja, 2013; Al-Khatybih and AL-Qaralleh, 2013; Roxas, 2013; cunnigham, 2013) it include poor communication between project stakeholders, unethical conduct among project stakeholders, poor organization structuring of project team, government building policies, misuse of resources by stakeholders, dispute between consultants, reduction in firm, inadequate time at the pre-contract stage, clients delay in making decision, poor interpretation of client needs, insufficient site investigation, failure to adequately address enquiries from tenderers, insufficient number of responses from tenderers and high tender figure and breach of confidentiality in tendering process.

Activities at the Pre-Contract Stage

Traditionally, construction project activities can be split into two distinct but interdependent phases: pre-contract/design phase and post-contract/construction phase (Flanagan & Norman, 1991). The project stakeholders command and control the activities spanning both phases. The performance of project to time, cost and quality will not be realized unless effective pre-contract management has resulted in a contract that addresses all stakeholders' specifications with the utmost professional skill (Harvey, 2006). A failure in pre-contract phase will result in post-contract management time and effort being wasted on trying to resolve and correct omissions and failures of the earlier phase. Truman, (2014) categorises the pre-contract activities into three categories, which are:

a. The conceptual phase, including the owner's development of the project's first goals, design concepts, initial design calculations, and order of magnitude cost estimates, identification of financing mechanisms, taking the pulse of the public and regulatory agencies on the concept, etc.

b. The preliminary phase, including preliminary design calculations and preliminary plot plans and basic design drawings, development of permit packages and filing major permit applications, development of a contracting strategy, obtaining approval of major financing, ordering of long lead time equipment, and development of the Contract and bid package.

c. The bid phase, including identification of qualified bidders, solicitation and analysis of bids, clarification of the bids, and negotiation and awarding of Contract. According to him, all these stages are affected by the actions and in-actions of construction stakeholders.

Strategies Adopted in Reducing Risks

Strategy is been described in literature based on individual's opinion. Karen (2009) describes it as a reduction process which is the procedure that an organization follows to protect itself, its staff, its clients, and its volunteers. Reducing construction risk is more than just looking

out for potential problems and avoiding them. It is an ongoing process. These process guides and offer stakeholders ideas as to how risk can be reduced to the barest minimum.

Harvey (2006) describes it as a mitigating measure to curtailed risks. Large organizations may have formalized policies and managers whose job is to oversee risk management. However, for small and medium-sized organizations with little resources of larger groups, these policies may simply mean ensuring that a systematic, well-planned series of steps is readily available for program managers to follow in order to minimize risks. However, this study adopted Harvey (2006) list of risk reduction strategies used by stakeholders at the pre-contract stage. This strategy includes;

Constructing a well organized structure for the consultants

An organizational structure is the framework that helps employees achieve their goals and do their jobs (Lamar, 1991). An efficient company structure can benefit the organization in several ways, including making it easier to delegate responsibility and effect change throughout the organization' it also helps develop a good communication strategy and delegate responsibility without dispute (Harvey, 2006). To benefit from a strong framework, it is important to understand the advantages of organizational structure.

Clients should clearly define what they want in the brief

The responsibility of the consultants is to interpret and develop the Clients brief during the various stages of the project (Kikwasi, 2011). They will define the Client's requirements, identifying constraints, advise in terms of feasibility studies and option appraisals, arrange site investigations, establish the preferred solution, advise on sustainability, manage health and safety issues, develop the design, prepare room data sheets, obtain Client sign off of the design at appropriate stages and advise on materials selection etc and with due respect to the client's brief , prepare a design which meets all the clients requirements, including budget and timescale.

Carrying out site investigations directly from site for prompt approval

Inadequate geotechnical investigations can arise from lack of client awareness, inadequate finance, insufficient time and lack of geotechnical expertise. The reliability of the information contained in the geotechnical report has strong influence on design, construction, project cost and safety. Thus, it is quite important to have a clear, concise and accurate geotechnical report by qualified engineers in order to ensure the reliability of the investigation results. Inadequate geotechnical investigations usually force the geotechnical engineer to reduce the risk of failure by over-designing the foundation, thereby increasing the cost of the project (Zumrawi, 2014).

Maintaining close relationship with government officers

There is a great necessity to managed and diagnosed early in the most proper and efficient relationship so as to be acquainted with government bureaucracy. The relationship among the fundamental party of any project has the ability to mar or break the project success from the perspective of finance. It has been indicated that the partnership and ventures among the public and the private are the optimum and best way to alleviate the confliction occurrence among the parties (fewing, 2005).

Constantly reviewing contract documents before selecting a contractor

Good risk control system is more than just creating a simple check list. Extensive risk assessment procedures should be conducted at the first phase of the project and rigorous review of contract documents (Kikwasi, 2011). This review process should get directly and more detailed as project proceeds and new risk emerge.

METHODOLOGY

The paper adopted quantitative research approach. Primary data was collected from the size of eighty-one (81) selected randomly from one hundred and three (103) construction stakeholders including the clients, contractors, architects, quantity surveyors, and engineers who are cooperate members of their institute/professional bodies in Ondo state, Nigeria. The data was collected through the questionnaire on a 5-points likert scale and questions were asked on the background information of the respondents, risks associated with stakeholders at the pre-contract stage of construction project, strategies adopted by the stakeholders in reducing risk and the effect of risks on the performance of stakeholders at the pre-contract stage of construction project. Out of the eighty-one questionnaires administered, seventy-eight (78) which represents 96% healthy response rate was found suitable for the analysis. The background information of the respondents was analyzed using the frequency distribution and percentage while the main objectives of the study was analyzed using the mean score and multiple regression analysis.

FINDINGS AND DISCUSSION

The data was adequately analysed and the results presented on tables.

Risks associated with Stakeholders at Pre-Contract Stage

Risks associated with stakeholders at the pre-contract stage of construction were assessed based on the level of occurrence and level of severity.

Table 1 shows the level of occurrence of risk factors that are associated with stakeholders at the pre-contract stage of construction. The result shows that poor communication between stakeholders, unethical conduct by stakeholders and breach of confidentiality in tendering process are the risks with very high occurrence at the pre-contract stage of construction. Other risk factors have high occurrence except misuse of resources by stakeholders, inadvertently creating a contract without the delegate's prior approval, insufficient number of responses from tenderers and reduction in firm size of organization which occur low. This implies that most of the risks occurred at the pre-contract stage of construction projects.

Table 1: Level of Occurrence of Risks

Risk Factors	Mean	Rank
Poor communication between project stakeholders.	3.71	1
Unethical conduct among project stakeholders.	3.60	2
Breach of confidentiality in tendering process.	3.56	3
Government building policies.	3.43	4
Inadequate time at the pre-contract stage.	3.37	5
Delays in approval of design by the government.	3.36	6
Impractical timeframe.	3.36	6
Clients delay in making decision.	3.35	7
Dispute between consultants.	3.35	7
Misinterpretation of client needs.	3.32	8
Inadequate information dissemination.	3.32	8
High tender figure of tenderer.	3.30	9
Insufficient site investigation.	3.24	10
Poor organization structuring of project team.	3.19	11
Understatement of clients need.	3.06	12
Overstatement of clients need.	3.03	13
Failure to adequately address enquiries from tenderers.	3.03	13
Unfair requirements on the tenderer in the contract conditions.	3.01	14
Misuse of resources by stakeholders.	2.99	15
Inadvertently creating a contract without the delegate's prior approval.	2.81	16
Insufficient number of responses from tenderers.	2.67	17
Reduction in firm size of organization.	2.62	18

Table 2 shows the severity of the risk factors assessed. The result revealed that unethical conduct among project stakeholders, government building policies, delays in approval of design by the government; inadequate information dissemination, poor communication between project stakeholders, insufficient site investigation, etc are the most severe risks. Other risks are severe while inadvertently creating a contract without the delegate's prior approval, insufficient number of responses from tenderers and reduction in firm size of organization are the less severe risks. This implies that most of the risk are severe at the pre-contract stage of construction project.

Table 2: Level of severity of risks

Risk factors	Mean	Rank
Unethical conduct among project stakeholders.	4.07	1
Government building policies.	3.76	2
Delays in approval of design by the government.	3.72	3
Inadequate information dissemination.	3.59	4
Poor communication between project stakeholders.	3.58	5
Insufficient site investigation.	3.56	6
Overstatement of clients need.	3.53	7
Inadequate time at the pre-contract stage.	3.52	8
Impractical timeframe.	3.49	9
Misinterpretation of client needs.	3.47	10
Dispute between consultants.	3.45	11
Poor organization structuring of project team.	3.43	12
Misuse of resources by stakeholders.	3.41	13
Clients delay in making decision.	3.36	14
Breach of confidentiality in tendering process.	3.27	15
Understatement of clients need.	3.22	15
Unfair requirements on the tenderer in the contract conditions.	3.12	17
High tender figure of tenderer.	3.09	18
Failure to adequately address enquiries from tenderers.	3.08	19
Inadvertently creating a contract without the delegate's prior approval.	2.97	20
Insufficient number of responses from tenderers.	2.93	21
Reduction in firm size of organization.	2.76	22

Strategies adopted by Stakeholders in reducing Risks

Table 3: Strategies Used in Reducing Risks

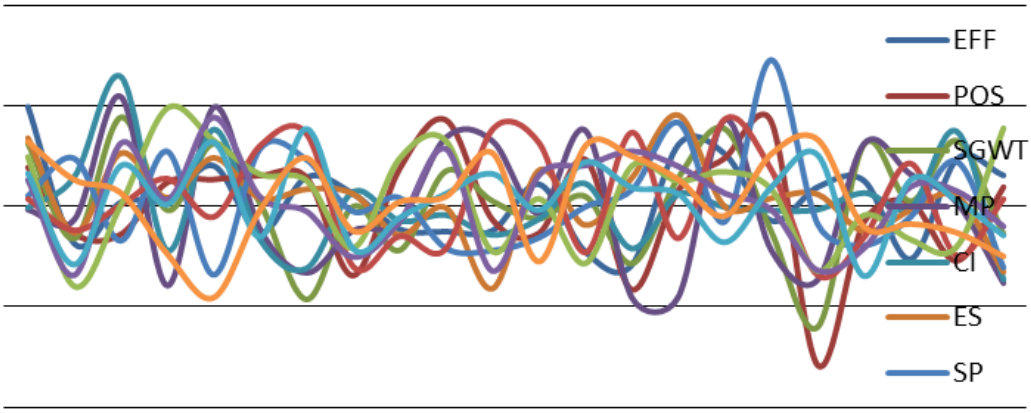
Strategies	Mean	Rank
Consultants should carry out in-depth investigation of site conditions directly from site for prompt approval.	4.36	1
Identify possible risk at the early stage and accessing them appropriately.	4.31	2
Clients should clearly define what they want in the brief.	4.21	3
Constantly reviewing all specification before selecting a contractor.	4.13	4
Client contingency is to be reviewed prior to the appointment of contractor.	3.97	5
Project team should always maintain close relationship with the government officers to shorten the time for approvals.	3.95	6
Constructing a well structured organization for the consultants.	3.86	7
Government bodies should avoid bureaucracy and create a swift environment to support the project development.	3.60	8

Table 3 shows the strategies that can be used by the stakeholders in reducing risks at the pre-contract stage. The result revealed that all the identified strategies are effective in reducing risks at the pre-contract stage of construction. Though the strategies which are consultants should carry out in-depth investigation of site conditions directly from site for prompt approval, identifying possible risk at the early stage and accessing them appropriately, clients should clearly define what they want in the brief and constantly reviewing all specification before selecting a contractor are the most effective strategies in reducing risks at the pre-contract stage.

The Effect of Risks on Performance of the Stakeholders at Pre-Contract Stage

The effect of risks on the performance of stakeholder was determined using the multiple regression analysis. The result in figure 1 shows the regression coefficient and this indicates that the identified severe risks has significant effect on the performance of the stakeholders though poor organization structuring of project team has no significant effect on the capital intensity of the stakeholders, so also unfair requirements on the tenderer in the contract conditions has no significant effect on stakeholders' profit.

Figure 1: The Effect of Risks on the Performance of Stakeholders



Discussions

This section of the report discusses the findings of the study with respect to past studies.

Risk Associated with Stakeholders at the Pre-contract Stage

From the data analyzed, it was discovered that risk occur at the pre-contract stage of construction projects in various forms such as poor communication between project stakeholders, unethical conduct among project stakeholders, breach of confidentiality in tendering process, government building policies, inadequate time at the pre-contract stage delays in approval of design by the government. This finding corroborates the assertion of Winch (2002), that the level of uncertainty is at the highest at the pre-contract stage and also that of Odeyinka (2006) which state that inadequate information at the pre construction stage often leads to design risk at the construction phase of construction project.

The severity of the risk factors was also assessed, the result shows that all the risk were severe at the pre-contract stage of construction project. Unethical conduct among project stakeholders, government building policies, delays in approval of design by the government, inadequate information dissemination, were rated as the most severe risk. This is in support of Winch (2002) assertion that the risk has severe impact at the design phase of construction and most of the impact are felt at construction phase of construction project.

Strategies Adopted by Stakeholders in Reducing Risk at Pre-contract Stage

Result from the study shows that stakeholders uses several strategies in other to reduce risk at the pre-contract stage among this strategies are consultants always carrying out in-depth investigation of site conditions directly from site for prompt approval, identifying possible risk at the early stage and accessing them appropriately, clients clearly defining what they want in the brief and constantly reviewing all specification before selecting a contractor. The strategies listed were all found relevant in reducing risk and this corroborate the findings of Harvey (2006) who purported that strategy adoption level is relatively high for risk adoption and mitigation and that 62 percent of firms believe that formal risk assessment and mitigation procedure are used for reducing risk by firms. The findings in this study is also in support of Kikwasi (2011) finding that good risk management involves more than creating a simple

check list of risk and that firms conduct extensive risk mitigating procedures as soon as they become involved in a project. While the findings in the this research work is in contrast with Zumrawi (2014) which stated that 55 percent risk is reduced by choosing the right procurement method and suggested that public private partnership reduces risk when used to build new project as it has helped in addressing shortfalls currently faced in U.S infrastructure.

The Effect of Risks on performance of stakeholders at the pre-contract stage

The effect of risks on the performance of stakeholders at the pre-contract stage of construction project was assessed and the finding showed that the listed performance variables are significantly affected by risk at the pre-contract stage of construction project. This corroborates the findings of Tesma (2002), that the performance of stakeholders efficiency of services rendered by stakeholders reduces due to the impact of risk.

CONCLUSION

The paper assesses the risks associated with stakeholders at the pre-contract stage of construction project. The findings shows that risk with very high occurrence at the pre-contract stage of construction includes poor communication between project stakeholders, unethical conducts among project stakeholders, breach of confidentiality in tendering process and government building policies. Unethical conduct among project stakeholders, government building policies, delays in approval of design by the government and inadequate information dissemination among others are the most severe risks associated with stakeholders at the pre-contract stage. The most effective strategies used by stakeholders in reducing risk includes carrying out in-depth investigation of site conditions directly from site for prompt approval, identification of possible risk at the early stage and accessing them appropriately and clients should clearly define what they want in the brief.

The performance of stakeholders at the pre-contract stage is significantly affected by risks at the pre-contract stage of construction. The implications of the study are that project managers should construct the project organisation structure and coordinate other stakeholders in other to avoid the very high occurring risks at the pre-contract stage and delays in approval of design by the government. The project stakeholders should maintain swift relationship with government agencies and building policies so as to guide against the most severe risks. Also, the most effective strategies should be continuously adopted by stakeholders at the pre-contract stage of construction project since risks can be transferred to the post contract stage of construction. Lastly, stakeholders should carefully assess and manage the risks which can affect the efficiency of their service, growth, quality and quantity of resources and so on

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Impact of Macroeconomic Factors on Production Costs of Building Project in South-South Region of Nigeria

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ABSTRACT

This study examined the impact of macroeconomic factors on production costs of selected storey building elements in the South-South region of Nigeria. Cost data of two hundred and forty (240) projects were collected from building contractors using stratified sampling technique. The survey covered the period between 2003 and 2012. Multiple regression technique was used in examining the relationships between dependent and independent variables of the study. Pearson product moment correlation coefficient (r) was used for assessing the contribution and direction of the relationships among the variables of the study. The major finding is that macroeconomic variables impact production cost of building project in the study area. The paper recommends that Government should adopt appropriate measures in curbing inflation and also minimize high and fluctuated exchange rate of the Naira to US dollar in order to achieve reliable cost estimate and enhance overall project cost performance.

Keywords: Building project, Macroeconomic indicators, Production cost

INTRODUCTION

The building industry plays a major role in the economic growth and socio-economic development of a nation. This industry is a subset of the construction industry and is rated as one of the most important sectors of the Nigeria economy (Adedeji, 2008). Some achievements of Nigerian building industry are the construction of housing estates, industrial complexes, public and institutional buildings (Jambol & Yusufu, 2004). Lam, Chan and Chan (2010) view building as valuable assets of a nation that provides people with shelter and facilities for work and leisure. The nature of the industry allows the participation of both private and government institutions as its key players. However, government influences most of the actions of the industry through its institutions, policies and economic/regulating tools. The unique features of the industry, number of stakeholders, myriad of tasks and environment it operates makes the building process complex. Prediction and realization of project objectives in terms of cost, time and quality form a global phenomenon which calls for the concern of every stakeholder in the industry. Researchers have therefore continued to intensify studies to proffer solutions to the various challenges of the industry because of its roles and contribution to the nation at large.

Building projects consume a lot of resources which oftentimes increase production cost. Prominent among the resources are material, labour, plant and equipment, finance, and other overhead costs. These resources are critical to the achievement of the final product of building project because of the contributory effect on production costs. Researchers have different view of what constitutes production cost. Chitkara (2008) defines production cost as the direct and indirect costs of resources associated with construction activity which are classified as cost of material, plant, and other costs (overhead costs). Haron and Mutalib (2012) view production cost as contractor's expenditure which includes all the resources involved during production excluding profit. These resources according to Rahman, Memon, Azis and Abdullah (2013), include material, manpower, machines and finance. The study

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observes that since the first three resources have element of finance, it will amount to repetition to classify finance as part of the resources. Production cost in this study is therefore identified as the direct and indirect costs of material, labour and plant for completing a construction activity.

A typical building cost component for social housing schemes in Denmark, according to Bertelsen and Nielsen (1997), is divided into materials 50 percent, labour 30 percent, heavy equipment 5 percent, while construction management and supervision absorb the other 15 percent. The result of the study by Skoyles (2000) confirmed that the cost proportion of material in building construction projects vary from 55% to 65% while materials, according to the findings of Ibrahim, Roy, Ahmed, and Imtiaz (2010), account for 50-60% of the total project cost in Nigeria. Labour on the other hand is an indispensable input in construction and one of the largest parts of construction cost (Nwachukwu & Emoh, 2011). The study by Hanna, Taylor, and Sullivan (2005) indicates that labour cost in construction industry is estimated at 33%- 50% of the entire project cost. Plant and equipment are also crucial in achieving time and cost objectives of project work. Plant and equipment being a vital input play the role of transformation in construction projects though most Nigeria construction industry compared to other developed countries still depends on manual methods.

Establishing accurate production cost of building project at tendering stage is one of the challenges facing the industry. The industry is reputed for project construction beyond the initial budget. This concurs with observation by Achuenu (1994) that one of the major problems facing the Nigerian Construction Industry is the fact that almost all projects are completed at sums higher than their initial contract sum. Factors that are affecting cost prediction in the industry are diverse and can be traced to a large extent to the economic situation of the nation in which it operates. This is due to the ripple effect of a change in the economic indicators over other sectors including the building industry. For instance, high rate of inflation increase the cost of living and a shift of resources from investments to consumption. Conversely, low inflation implies lower cost of borrowing. Prices of construction resources including material and labour increase during inflation and this will invariably increase production cost.

Abimbola (2000) attributed the rising trends of construction cost to government policies, inflation in the economy and project design variables. Dwindling of the macroeconomic indicators has presents a big challenge to the cost estimator in ensuring that the gap between initial and final budgets is kept close. The problem of inaccurate cost prediction is as old as the building industry. Several studies have been carried out to ensure that the "big monster", inaccurate cost prediction is surmounted (Enshassi, Mohamed, & Abdel-Hadi, 2013; Dysert, 2006; Odusami & Onukwube, 2008) but the realization of accurate production cost estimate is still far from reach which is the main concern of this study. There is need to understand the trend and impact of macroeconomic factors on building project in order to increase accuracy of cost prediction. The study observes that little research has been done to establish the relationships between construction cost especially production cost which is a major component of the overall project cost and macroeconomic indicators.

Macroeconomic indicators unleash much impact on construction industry as such, this study intends to investigate the effect of selected macroeconomic variables on production cost with the view of enhancing the contractor`s bidding decisions and to be informed in advance of the factors to focus on during construction. The research objective is to establish if there is a relationship between macroeconomic factors and production cost of building project in Nigeria. The key macroeconomic indicators selected for this study are inflation rate, interest rate, exchange rates, money supply, and Gross National Product (GNP). The hypothesis for

the study is stated as: macroeconomic indicators have no impact on the production cost of building projects. The result of the study will better inform the contractors for their bidding decisions based on macroeconomic performance and to develop strategies to achieve cost performance of their building projects.

LITERATURE REVIEW

Effect of Macroeconomic Indicators on Building Production Cost

One of the key factors affecting building production cost is the overall health of the nation`s economy. This is generally measured by economic indicators such as the GDP, employment data, manufac turing activity, the prices of goods, etc. Khalid, Iqtidar, Muhammad, Mehboob (2012) identify macro-economic factors which are real GDP, the unemployment rate, the inflation rate, the interest rate, the level of the stock market, and the exchange rate. Macroeconomic indicators influencing housing prices in Malaysia according to Tse (2013) include interest rate, cost of construction, population and inflation rate. Oladipo and Oni (2012) opine that economic indicators that are significant the overall construction cost in Nigeria include exchange rate of local currency to other currencies, inflation rate and interest rate charge on loans. Gambo and Ashen (2012) observe that the declining Nigeria economy with its effect on construction pricing have posed a major problem to both public and private sectors, clients and contractors.

Macroeconomic indicators are directly or indirectly responsible for increase in production cost of construction project. This is as a result of their direct and indirect effects on production components such as material, labour, and equipment/plant which collectively affect overall project cost. Since construction industry is import dependent, Udeh (1991) stated that about 50% of the building materials and components used in the industry are sourced from overseas. Plant and machinery used in the construction industry are manufactured in developed nations and imported to the developing countries which are equally subjected to inflation rate of the local currency and foreign exchange. Raw materials used for the manufacturing of the building materials are imported (e.g., clinker for making cement) (Humphrey and Dorothy, 2013). Gyntelberg (2007) also realizes that most machine and equipment used in the developing nations are foreign sourced and their costs may be influenced by government fiscal policy; these factors and many more are affected by variables such as inflation rate, exchange rate, money supply and GDP. Oyediran (2006) opine that projects that are financed solely by the contractor during an inflationary period may put the contractor in a difficult position financially except a serious calculation of cost increases for both anticipated and unanticipated increase had been included in the estimate process.

Research questionnaire carried out by Oladipo and Oni (2012) revealed five most significant factors impacting building material prices in developing countries. The factors are inflation, exchange rate, import, interest rate and money supply. Aliyu, Kasim and Martin (2011) identified scarcity and high cost of imported building materials or those with foreign components as factors affecting housing development. Ogun, Ogunsina, and Ugochukwu (2014) undertook a study on assessment of the impact of inflation on construction material prices in Nigeria, with a focus on Lagos for the period 1998 to 2007. The study employed descriptive analysis and regression model in inferential analysis. The result of the study showed that increase in construction material prices is not only caused by inflation, but also other macro-economy factors such as importation, interest rate and GDP. High cost of building materials has been identified as one of the major problems militating against the construction industry in most developing countries (Humphrey & Dorothy, 2013). Oladipo and Oni (2012) strongly believe that increase in prices of building materials (which constitute

a major component of building production) would have multiplier effect on construction industry. David, Umeh and Ameh (2010) also examined the effect of exchange rate fluctuations on Nigerian manufacturing industry. They employed multiple regression econometric tools which revealed a negative relationship between exchange rate volatility and manufacturing sector performance. In a study of the Nigerian Construction Industry, Omoregie and Radfort (2005) sampled the opinions of contractors, consultants and clients and they discovered 15 factors responsible for project delays and construction cost escalation in Nigeria. Their survey revealed price fluctuation as the most severe cause of project cost escalation which is attributed to the limitation in exchange rate which in turn affects construction material prices and general price level. Obansa, Okoroafor, Aluko and Millicent (2013) also examined the relationship between exchange rate and economic growth in Nigeria between 1970-2010. The result indicated that exchange rate has a strong impact on economic growth. The key macroeconomic indicators adopted in this study are discussed below.

Inflation rate

Demberg and McDouglall referred to inflation as continuing rise in prices as measured by an index such as the Consumer Price Index (CPI) or by the implicit price deflator for Gross National Product (Jhingans, 2002). According to Fatukasi (2004) inflation is characterized by a fall in the value of the country's currency and a rise in her exchange rate with other nation's currencies. Leaders all over the world see inflation as an economic phenomenon to worry about (Oyediran, 2006) and are one of the most important macroeconomic indicators that truly influence economy of any nation**.** Exchange rate is a major determinant of inflationary rate in Nigeria (Fatukasi, 2014). When inflation begins to move upward, it likely leads to tight monetary policies which result in increase in the discount rate. The effects of inflation on the economy are diverse and can be both positive and negative. Fatukasi (2014) states that inflation has had adverse effects on savings, investment, productivity and balance of payment in the Nigerian economy, hence the fall in the growth rate of the GDP from 26.8% (1981) to 5.4% (2000) and 3.5% (2002). Oyediran (2006) explains that the effects of inflation on the construction industry may be as a result of the nature of the process and the rate of return for work undertaken on construction projects. The negative effects are however more pronounced and comprise a decrease in the real value of money as well as other monetary variables over time (Blanchard, 2000). This has caused serious effects on building production cost in Nigeria.

Interest Rate

The primary role of interest rate is to help in the mobilization of financial resources and to ensure efficient utilization of resources for the promotion of economic growth and development (CBN 1970). If the financial banks increase the availability of credit, it means that the bank will provide lower lending rates and encourage current and future activity (Tse, 2013). When interest rates increase, investment, net exports and consumption tend to go down. The case is the opposite when it comes to decreasing interest rates. An increase in interest rate means that the consumer i.e., households have to pay more to finance their consumption. High interest rate regimes lead to high cost of borrowing and hence a reduction in economic activity (Victor and Kuwornu, 2011) especially in construction which also impacts on production cost and corporate profit. High interest rates for financing of equipment and machinery discourage firms to invest in construction.

Exchange Rate

Exchange rate is the price of one country's currency expressed in terms of some other currency (Adeniran, Yusuf & Adeyemi, 2014). Exchange rate defines the price of Nigeria's naira expressed in terms of one unit of the United States dollar. It can affect the relative

prices especially foreign products required in a given construction project. Arize, Osang, and Slottje (2000) found a significant negative relationship between increases in exchange rate volatility and exports in developing countries. Exchange rate changes can affect the relative prices, thereby the competitiveness of domestic and foreign producers (Fatukasi, 2014). When the domestic currency depreciates against foreign currencies, export product prices will decrease, and consequently, the volume of the country's export will increase, assuming that the demand for this product is elastic. According to Ewa (2011) the exchange rate of the naira was relatively stable between 1973 and 1979 during the oil boom era and when agricultural products accounted for more than 70% of the nation's GDP. The reverse is the case as the naira has depreciated since 80`s despite various efforts by the government to maintain a stable exchange rate. Exchange rate as an indicator of a currency is a monetary variable that affects the building industry in a way similar to inflation variables.

Money supply

Money is a collection of liquid assets that is generally accepted as a medium of exchange and for repayment of Debt (Singh, Mehta, & Varsha (2011). There is a strong link between money supply and inflation rate. When the money supply increases, the inflation rate decreases. If the inflation rate increases the money paper demand drops to get in balance (Blanchard, 2003). Increasing in money supply in an economy also leads to decrease in interest rate and construction industry in activities during this period as a response to a higher demand by the clients.

Gross Domestic Product

The gross domestic product (GDP) is the total market value overall for all final goods and services produced in a country in a particular year (Tze, 2013). The formula for the GDP is equal to the total consumer, investment and government spending, plus the value of exports minus the value of imports.

METHODOLOGY

The study area is the South-South region of Nigeria comprising Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers State. Data for the study consists of average production cost of six selected building elements of storey building projects and key Nigerian macroeconomic indicators such as inflation rate, interest rate, exchange rate, money supply and GDP. The six selected one to two storey building elements are substructure, frame, upper floor, internal and external walls, roof and finishing. The choice of the select building elements was on the basis of characteristic and availability of data from educational and office building projects completed during the study period. The production cost of each of these elements was sourced from contractors` cost files of completed federal and state storey building projects in each state. The data on macroeconomic indicators were sourced from various annual reports and statements of account of Central Bank of Nigeria and issues of Statistical Bulletin. The sample covers 2003 to 2012. The time frame was considered adequate to reflect the economic climates and political influence in Nigeria during the period. The study uses stratified random sampling technique. The study was carried out from the state capital of each state being the hub of each state where most construction activities are concentrated.

The mean of building production cost per square meter of 240 projects of the selected building elements over the study period were computed on yearly average using excel package and presented together with macroeconomic indicators as presented in Table 1. Multiple regressions were used in determining the existence of relationships if any between the dependent and independent variables of the study. Pearson moment correlation was used in assessing the magnitude and the direction of the relationships between and among the variables of the study. The Y variable of the multiple regressions is given as the building

production cost per square meter while the X variable is the macroeconomic indicators specified in its functional form as follows:

$$BPC = Bo + \beta 1INF + \beta 2INR + \beta 3EXR + \beta 4MNS + \beta 5GNP + \varepsilon$$

Where:
BPC= the building production cost
B_o= the intercept,
β_1 to β_5 = the partial slope coefficient,
ε= the stochastic disturbance term,
INF= inflation rate (percent),
β_2INR= interest rate (percent),
β_3EXR= exchange rate (₦: US$),
β_4MNS= money supply,
GNP= gross national product.

Presentation and Analysis of Data

This section presents data for the study and empirical analysis of the impact of macroeconomic indicators on production cost of storey building projects. The obtained data spanned the period between years 2002 to 2013. The secondary data was organized in excel spread sheets and analyzed using SPSS version 17.0.

Table 1: Inflation rate, interest rate, exchange rate, money supply and GDP (2002-2013) and Average Production Cost/m²

No.	Year	Mean Cost/m²	Average Annual Inflation Rate (%)	Average Annual Interest rate (%)	Average Annual Exchange rate (₦)	Average Annual Money supply M² (₦)	Average Annual GDP Growth rate (₦)
1	2003	19,667.23	14.03	13.04	129.36	1952922.28	10.34
2	2004	20,138.47	15.00	19.18	133.50	2131820.08	10.50
3	2005	21,027.95	19.90	17.95	131.66	2637913.73	5.39
4	2006	21,949.84	8.22	16.90	128.65	3799538.05	6.21
5	2007	23,686.03	5.42	16.94	134.05	5138700.94	6.97
6	2008	23,973.71	11.58	15.48	132.37	8029088.61	5.98
7	2009	25,640.34	12.54	18.36	132.60	9456480.31	6.96
8	2010	25,925.52	13.72	17.59	148.68	11034940.93	7.16
9	2011	27,175.59	10.80	16.02	146.20	11555220.12	7.36
10	2012	27,929.69	12.20	12.00	150.20	12135220.12	6.32

Source: CBN Annual Report and Accounts various issues; Gambo and Ashen (2012)

Correlation Analysis

Data sampled were employed for the analysis of the Pearson moment correlation between and among the variables of the study. The Pearson correlation coefficient is a measure of strength of association between two variables. Pearson correlation coefficients assume the data are normally distributed. The values of the correlation coefficient range from -1 to 1. The sign of the correlation coefficient indicates the direction of the relationship (positive or negative). The Pearson Moment Correlation was used in analyzing the data obtained in Table 1. The results of the Pearson Moment Correlation coefficients for each pair of the variables selected for the study are presented in Table 2.

Table 2: Results of Correlation Coefficients computed between Building Production Cost and Macroeconomic Indicators

VARIABLE CODE	VARIABLES	BPC	INF	INR	EXR	MNS	GDP
BPC	Building Production Cost						
INF	Inflation Rate	-.309					
INR	Interest Rate	-.248	.143				
EXR	Exchange Rate	.806**	-.017	-.295			
MNS	Money Supply	.980**	-.214	-.255	.825**		
GDP	Gross Domestic Product	-.475	.111	-.009	-.159	-.403	

* * Correlation is significant at 0.01 level (2-tailed)

The Table shows the existence of an inverse and weak relationship between inflation, interest rate, Gross Domestic Product and building production cost at $p < 0.01$ level of significance (2-tailed). The relationships between each of the variable and building production cost indicated in the Table by their Pearson Moment Correlation coefficient in Table 2 are -.309, -.248 and -.475 respectively. However, the results from Table 2 revealed the existence of a positive and strong relationship between exchange rate, money supply and building production cost with their Pearson Moment Correlation coefficient of 0.806 and 0.980 respectively.

Regression Analysis

The dependent variable was regressed against independent variables: inflation rate, interest rate, exchange rate, money supply and GDP. The regression analysis was undertaken at 5% confidence level. The criteria for comparing whether the predictor variables were significant in the model was done by relating the corresponding probability value obtained and $\alpha = 0.05$. F-table statistic was compared with the one obtained from the regression analysis. If the one from the table was smaller than the computed value from regression analysis, the value was significant in predicting a change on the dependent variable. Otherwise, the variable was insignificant in the model. The result of regression analysis is presented below.

Model Summary Statistics

The study obtained the model summary statistics as shown in Table 3 below.

Table 3: Model Summary ([b])

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					F Change	Sig. F Change
1	.990[a]	.981	.957	612.06636	40.795	.002

a. Predictors: (Constant), Gross Domestic Product, Interest rate, Inflation rate, Exchange rate, Money supply

b. Dependent Variable: Production cost / m^2

The coefficient of determination or adjusted R^2 shows the extent to which changes in the building production cost in Nigeria varies with the independent variables, inflation rate, interest rate, exchange rate, money supply and GDP. Research findings indicate that there is a very strong positive relationship between the variables with an adjusted R square of 0.957. The study therefore establishes that any variability in building production cost is explained in inflation rate, interest rate, exchange rate, money supply and GDP. The results from Table 3 also indicate the value of R^2 as 0.981 which implies that the macroeconomic indicators used as predictor variables used in this study contribute to an equivalent of 98.1% of variability in building production cost as indicated by the R-Square value of 0.981.

Analysis of Variance

The study conducted an Analysis of Variance, in order to test the significance of the model. The results of the analysis are presented in Table 4 below.

Model		Sum of Squares	Mean Square	F	Sig.
1	Regression	7.641E7	1.528E7	40.795	.002[a]
	Residual	1498500.895	374625.224		
	Total	7.791E7			

Results from Table 4 indicate that probability value of 0.002 was obtained implying that the regression model was significant in predicting the relationship between building production cost and the predictor variables as it was less than α=0.05.

Model Coefficients (a)

The results of the analysis obtained the model coefficients and corresponding statistics as shown in Table 5 below.

Model		Unstandardized Coefficients			
		B	Std. Error	t	Sig.
1	(Constant)	16190.57	6198.173	2.612	0.059
	Inflation rate	-92.246	56.663	-1.628	0.179
	Interest rate	13.954	94.158	0.148	0.889
	Exchange rate	43.427	49.247	0.882	0.428
	Money supply	0.001	0	5.398	0.006
	Gross Domestic Product	-196.385	136.795	-1.436	0.224

a. Dependent Variable: Production cost / m^2

The regression analysis results indicated that the relationship between real estate investment growth and the predictor variables can be expressed using the following regression equation:

$$Y = 16190.57 - 92.246X1 + 13.954X2 + 43.427X3 + .0.001X4 - 196.385X5 + \mu e$$

The results showed that inflation rate and GDP have negative relationship with building production cost; while interest rate, exchange rate and money supply displayed positive relationship. The level of significance of results is acceptable for inflation with p-values not greater than 0.05. However, p-values of inflation rate, interest rate, exchange rate and GDP with corresponding values of 0.179, 0.889, 0. 0.428 and 0.224 respectively > 0.05 while money supply value is 0.001< 0.01.

Interpretation of the Findings

The results in Table 2 indicate the existence of an inverse and weak relationship between inflation, interest rate, GDP and building production cost. Conversely the results from Table 2 also reveal the existence of a positive and strong relationship between exchange rate, money supply and building production cost. The results of regression analysis establish a strong statistical relationship between the selected macroeconomic variables - inflation rate, interest rate, exchange rate, money supply and GDP and the building production cost since R and R-Square was 0.953 and 0.908 respectively. This suggests that macroeconomic indicators contribute 98.1% to changes in building production cost among other factors that affect building production cost. The R value of 0.953 shows that the relationship between building production cost, on one hand, and macroeconomic indicators, on the other hand, is also highly significant. The R-Square value in this study was greater than R-Square (0.5133) in predicting project cost performance level by assessing risk factors of building construction in South Korea by Cha & Shin (2011). Based on the results of regression analysis the relationship between building production cost and the predictor variables can be expressed using the following regression equation: $Y = 16190.57 - 92.246X_1 + 13.954X_2 + 43.427X_3 + .0.001X_4 - 196.385X_5 + \mu e$. The coefficients corresponding to inflation rate and GDP are negative; the study therefore establishes a negative relationship between building production cost and inflation rate and GDP. The results of the analysis also indicate coefficients corresponding to interest rate, exchange rate and money supply are positive which proves a

positive relationship between building production cost and each of the macroeconomic variables. As a result, the study establishes a positive relationship between building production cost and interest rate, exchange rate and money supply. The level of significance of results is acceptable for money supply with corresponding p-value less than 0.05. Inflation rate, interest rate, exchange rate and GDP have their p values greater than 0.05, an indication of an insignificant relationship. The results of ANOVA further establishes a p-value of 0.002 which implies that the regression model is statistically significant in predicting the relationship between building production cost and the predictor variables as it was less than α=0.05.

The study agrees with the study of Zhu (2004) who establishes a strong and long-lasting link between inflation and housing price which is a product of production cost. The finding is also consistent with the work of Chileshe and Berko (2010) that identified inflation as the third most important factor contributing to project overrun in Ghana. Harrison (1981) attributes increasing costs to inflation of project. The results of the study are however at variance with Gambo and Ashen (2012) who establish negative coefficient of interest rate and positive coefficient of inflation rate in predicting construction cost escalation for residential buildings in Nigeria using economic indicators. Inflation causes price fluctuation of building production components which eventually could cause general project cost increase especially in the developing countries. The construction industry in Nigeria is foreign driven where majority of cost elements in building production are sourced abroad. Chan and Park (2005) attributed high cost of machineries to market related problems which has severely affected building production

CONCLUSION AND RECOMMENDATIONS

This study is on the evaluation of the impact of macroeconomic factors on production costs of building project. Macroeconomic variables used in this study are inflation rate, interest rate, exchange rate, money supply and GDP. From correlation analysis, exchange rate and money supply have a linear relationship with building production cost but evidence from regression analysis indicated that only the P-value of money supply is < 0.05 while P-value of exchange rate is > 0.05. Others variables including inflation rate, interest rate and GDP did not have a linear relationship with P-values > 0.05. From the findings in this study, the study concludes that there is a strong relationship between macroeconomic variables and production cost of building project. The study also concludes that there is negative relationship between building production cost and inflation rate and GDP. Conversely, there is a positive relationship between building production cost and interest rate, exchange rate and money supply. The model is expected to form a basis for decision making by providing reliable estimates for production cost of building projects. Based on the findings of the study, it is recommended that Government should adopt appropriate measures to curbing inflation and also minimize high and fluctuated exchange rate of the Naira to US dollar. Contractors should adopt suitable contractual strategies to cushion the effects of inflation and other macroeconomic variables in their projects. The model developed in this study if adopted will provide reliable estimates at early project stage and further enhance overall project cost performance.

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In-Land Water Based Transport in Lagos State: Challenges and Remedies

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ABSTRACT

Transportation is an essential need for humanity, be it land, air or sea based. It should devoid of operational handicaps. However, in Lagos State, In-land water based transportation encounters various kinds of impairments ranging from human induced to natural cause. To this end, this study explores the challenges encountering In-land water based transportation system in Lagos state. Adopting survey research design, both secondary and primary data were employed for the study. Secondary data were sourced from libraries, journals and relevant institutions such as Lagos State Waterways Authority (LASWA) wherein patronage data was gotten, while primary data were gotten through field observations, interview and structured questionnaires. Total of 228 (0.05%) users in three most patronized jetties, one each in a local government were purposively sampled, and administered a set of questionnaires, using accidental sampling technique. The study hypothesized that In-land water based transportation varies significantly between the Local governments areas (P=0.000). However, they encountered similar challenges according to findings. The study revealed that 34.6% of the respondents complained of the presence of water hyacinth. 44.3% of the respondents complained of poor safety measures. 26.8% of the respondents suggested clearing of the water hyacinth. 25.0% of the respondents suggested that the obstacles can be resolved through adequate funding and investment on Inland Waterways Transportation. This study recommends an integrated control method which is biological and mechanical removal of the water hyacinth for easy navigation on the waterways.

Keywords: In-land water, Transportation, Jetty, Water hyacinth, Lagos

INTRODUCTION

Movement is a basic activity of man and it is impossible for man to do without it. Based on this need, and pursuit of development through science and technology, movement of man is aided through transportation. Transportation represents one of the most important human activities worldwide. Transportation is defined according to Oni (2009), as the conveyance of goods and people over land, across water, and through the air from one location to another.

Ighodalo (2009) observed that several modes of transportation exist for both man and goods; and that these modes, can be grouped into four basic categories, namely: rail, road, water and air. Water transport is associated with inland waterways, coastal waters and the deep sea (Ismaila, 2008). Inland waterways are navigable water bodies which include: rivers, lakes, coastal creeks, lagoons and canals, found within the geographical dimensions of a state (Aderemo and Mogaji, 2010). The movement of goods and services along inland waterways is one of the oldest means of transporting goods and services from point to point (Fellinda, 2006). This is largely due to the fact that inland water transport (IWT) offers the most economical, energy efficient and environmental friendly means of transporting all types of cargo from place to place (Ojile, 2006).

The development and efficient functioning of IWT is very essential highly congested cities to cushion the high demand and over stressed other means of transportation such as land. Example is a megacity like Lagos state, which has a high demand on urban transport, especially road mode whereby six million passengers hustle daily between Lagos mainland

Akinbamijo, O.; Ipingbemi, O. & Bayode, T. (2016). In-Land Water Based Transport in Lagos State: Challenges and Remedies. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 825-831

and island. In Lagos State over 98% of movement is done by road, and cities of this size cannot survive on one mode of transportation (Frontier Market Intelligence, 2014).

It is unfortunate that Lagos, a coastal city with abundant navigable waterways has its waterways minimally exploited. If optimized, it could help in eliminating congestion, pollution, and provide a low cost alternative to long haul passages. Despite these many rewards, In-water based transportation system encounters a number of challenges which if managed; it will effectively complement and reduce the pressure on road transport in Lagos State. Obed (2013) lamented that there has been a considerable decline in the use of IWT in Nigeria. This was attributed to several physical constraints impending growth and performance in the IWT sector in Nigeria. This creates an urgent need for innovative actions and strategies to radically improve the sector for it to continue as the bedrock in facilitating trade, industrial and economic growth. Therefore, this study examines the challenges militating the effective usage of In-water based transportation system with the view of finding solutions to managing the challenges encountered by this mode of transportation.

Few researches have been done on challenges of waterways in Nigeria. Among the few researches, Ezenwaji (2012) in his study on the constraints on effective water transportation in some riverine communities of old Anambra local government area identified some challenges confronting IWT with the hope that the elimination of such constraints would serve as a catalyst to economic development of such areas. The result of the analysis showed that there are four prominent constraints namely environmental, economic, craft and market.

Environmental constraint is the most important underlying factor militating against effective water transportation. The length of the river covered by water hyacinth seems to pose a great problem as it is difficult for boats to ply where there are large numbers of the water weeds. Rangaraj and Raghuram (2007) emphasized that unless the waterways are cleared of water weeds no meaningful transportation can take place. In Anambra River and its tributaries, water weeds at times cover over 75% of the width of the river for a continuous stretch of upwards of 3kms accounting for the high risk of boat capsizing. The absence of budgetary provision for water transportation over the years is a big constraint to effective water transportation. For a long-time now, Anambra State Government has made no budgetary provision for this sector and as a result no funds have been released to the sector by the government. Absence of markets or attraction between origin and destination of places linked with waterways often times affect the level of patronage of the transport mode. This results in low business profit for the operators. Based on the findings, Ezenwaji (2012) recommended prompt and adequate intervention of State Governments to the mode, through inclusion of the sector in the budget; very low water transportation fares and high cost of boat maintenance should be addressed both by the State government and boat operators through their transport union.

Some other inherent challenges facing the sector noted by UN-ESCAP reviewer (2003) include: Safety - Safety is often compromised because IWT tends to be ignored by existing government transport regulations and environmental safety standards. Certain environmental problems and risks associated with IWT include canalization and dredging (reactivation of polluted sediments into surface waters); shipping operations (pollution through oil spills; noise pollution; risks of accidents with dangerous cargoes); and import of invasive species: (bacteria and other microbes, small invertebrates and the eggs, cysts and larvae of various species) (Gascho *et al*., 2006).

Study Area

The study area is Lagos state with a particular focus of waterways where water based transportation operates. Lagos State is the smallest state in geographical terms in the Nigerian

Federation, it occupies an area of 357,700 hectares (3,475.1km^2), which is just 0.4% of the total land area of Nigeria (Adejare *et al*., 2011), of which 22% of the total land mass consists of lagoons and creeks. Lagos State lies between longitudes $2^0$42' East and 3^0 42' East and Latitude 6^0 22' North and 6^0 52' North, in the southwestern area of Nigeria and shares boundaries with Ogun State both in the north and east, by the Republic of Benin in the west and the Atlantic Ocean, stretching for almost 180 kilometres of coastline, in the south (Olayiwola *et al*., 2006).

Lagos state is a mega city with an estimated population of about 9 million inhabitants which is about 6.5% of the total population of Nigeria (Census, 2006). However, according to Michael (2012), the city of Lagos is expected to hit the 24.5 million population mark and thus be among the ten most populous cities by the year 2015. Twelve (12) out of the twenty (20) Local Governments of Lagos state are drained by rivers, which are: Badagry, Ojo, Amowo - Odofin, Apapa, Lagos Island, Eti - Osa, Kosofe, Somolu, Lagos Mainland, Ikorodu, Epe and Ibeju Lekki. However, Lagos state is running water transport on 12 routes under the supervision of Lagos State Water Authority (LASWA). The routes are Ikorodu-Marina/CMS; Marina-Mile 2; Ikorodu-Addax/Falomo; Ikorodu-Ebute Ero; Marina-Ijegun Egba-Ebute-Ojo; Mile 2-Marina/CMS-Mekwen-Falomo; Badore-Ijede; Badore-Five Cowries; Marina-Oworonshonki; Ebute Ojo-Ijegun Egba; Oworonshonki-Five Cowries; and Baiyeku-Langbasa. The metropolitan area accounted for the seventeen out of the twenty local government areas in Lagos State as shown in Figure 1.

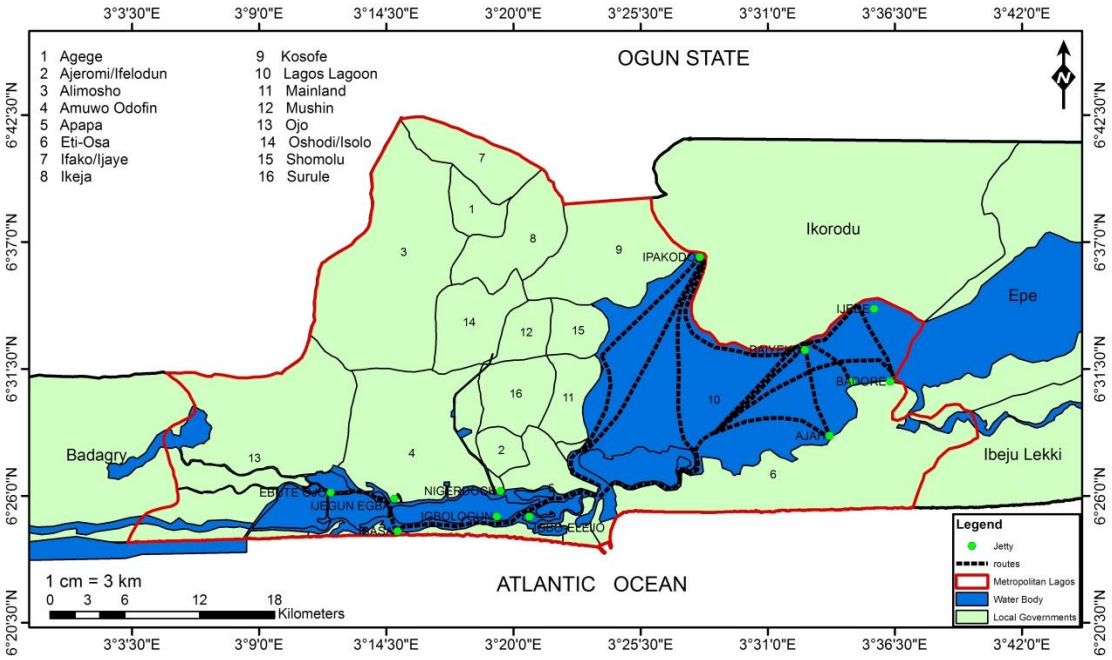

Figure 1: Lagos Inland Waterways Routes
Source: LASWA, 2014 and Author's Work, 2014

METHODOLOGY

This is a non-experimental study, cross-sectional and descriptive in approach. The study employs the use of both secondary and primary data. The secondary data were sourced from libraries, journal publications, internet, institutions and archives. Secondary data consisting of statistics on water transport services, number of users and operators etc. were obtained from Lagos State Waterways Authority (LASWA). Techniques used for primary data collection include structured questionnaires, open ended individual conversation and field observations. Having gotten the patronage data between January to September, 2014 of the various jetty according to their local government of operations from LASWA as shown in Table 1, the

jetty with the highest patronage were purposively sampled, and they are Majidun in Ikorodu Local Government; Liverpool in Island and Ijegun Egba in Badagry/Ojo Local Government as shown in Table 2. A total of 228 questionnaires (0.05%) were administered to Inland water based transportation users using accidental sampling technique. The study hypothesized that Inland Waterways users does not vary significantly between the Local Government Areas; Analysis of variance (ANOVA) was used to test the variation in the number of users in the local government areas. Statistical Package for Social Sciences (SPSS) was used to obtain frequencies for the descriptive statistics.

Table 1: Population of Study

Ikorodu Local Government			Island Local Government			Badagry/Ojo Local Government		
Names of Jetties	Number of passenger from Jan-Sep., 2014	Average Number of passengers from Jan-Sep., 2014	Names of Jetties	Number of passenger from Jan-Sep, 2014	Average Number of passengers from Jan-Sep., 2014	Names of Jetties	Number of passenger from Jan-Sep., 2014	Average Number of passengers from Jan-Sep., 2014
Metro Ferry	644,645	71,627	Coconut	925,722	102,858	Iya Afin	195,120	21,680
Majidun	1,337,128	148,570	Liverpool	1,455,993	161,777	Slave Route	148,046	16,450
Ijora	217,692	24,121	Alex	565,248	62,805	Ebute-Ojo		
Badore	747,798	83,089	Sagbokoji	879,062	97,674	Ijegun Egba	1,317,018	146,335
Langbasa	568,130	63,126	CMS	535,253	59,473	Tin Can	1,223,896	135,988
Oke Ira Nla	470,649	52,294	Takwa Bay	501,191	55,688			
Bayeku	1,274,830	141,648	Falomo	235,655	26,184			
Epe	137,925	15,325	Elegbeta	311218	34,580			
Agboyi Ketu	502,417	55,824	Addax	551,530	61,281			
Ibeshe	48,032	5337						
Total	5,949,246	660,961		5,960,872	662,320		2,884,080	320,453

Source: Lagos State Waterways Authority, 2014

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Table 2: Sample Frame and Sample Size of IWT users for the study

S/N	Local Government/District	Sampled Jetty	Sample Frame	Sample Size (0.05%)
1	Ikorodu	Majidun	148,570	74
2	Island	Liverpool	161,777	81
3	Badagry/Ojo	Ijegun Egba	146,335	73
	Total		**456,682**	**228**

Source: Lagos State Waterways Authority, 2014 and Field Survey, 2014

FINDINGS AND DISCUSSION

Obstacles hindering water transportation

According to Table 3, 5.3% of the respondents responded that the river course is shallow thereby hindering navigation in some part of the waterways. 34.6% of the respondents complained of the presence of water hyacinth. The water hyacinth appears August and remains till February of the following year if not cleared. Water hyacinth has been a threat to operators on waterways because it damages the boat engine propeller. 44.3% of the respondents complained of poor safety measures. The life jacket giving to passengers were of poor quality and sub-standard. 15.8% of the respondents complained of other reasons which are lack of funding and investment from government and private body respectively, poor quality of vehicle, poor maintenance, facilities and waterways transportation management. Plate 1, 2 and 3 shows the presence of water hyacinth on the waterways, poor facility of Liverpool and CMS jetty respectively.

Table 3: Obstacles hindering water transportation

Obstacles hindering use of waterway transportation	Number of respondents	Percentage
Shallow river	12	5.3
Water hyacinth	79	34.6
Poor safety measures	101	44.3
Others (poor quality of vehicle, poor maintenance and waterways transportation management).	36	15.8
Total	**228**	**100.0**

Plate 1: Water hyacinth on the waterways

Plate 2: Poor facility of Jetty (Liverpool) in Lagos Island

Plate 3: Poor facility of Jetty (CMS) in Lagos Island
Source: Author's Work, 2014

Ways of overcoming challenges facing water transportation

Table 4 presents ways of overcoming challenges facing water transportation. In a bid to find a remedy to the obstacles encountered, the users also gave their opinion. 26.8% of the respondents suggested clearing of the water hyacinth. 25.0% of the respondents suggested

that the obstacles can be resolved through adequate funding and investment on Inland Waterways Transportation such as access to business loans and attracting investors to water transportation sector. These funding and investment can also be inform of provision of vehicles and facilities etc. 6.6% of the respondents noted that the operators (captain) lacks competent skills, they therefore suggested it is paramount they go for regular training on inland waterways transportation. 35.5% of the respondents of the also suggested that ensuring stringent safety measure is necessary to curb the poor safety measures practices such as non-compliance to laws governing IWT as directed by LASWA, non-use or misuse of life jackets, refusal to purchase fire extinguisher and life ring for their vehicles etc. 6.1% of the respondents did not give any suggestion.

Table 4: Ways of overcoming water transportation obstacles

Ways of overcoming waterways transportation obstacles	**Number of respondents**	**Percentage**
Clearing the water hyacinth	61	26.8
Funding and Investment	57	25.0
Personnel training	15	6.6
Stringent safety regulations	81	35.5
No response	14	6.1
Total	**228**	**100.0**

To test statistically the null hypothesis which stated that Inland waterways users does not vary significantly between the local government areas, Analysis of Variance (ANOVA) was used to compare the variation in the numbers of users between the local government areas in the study area. The result of the analysis presented in Table 5 shows that, there is significant difference between the numbers of users in the study area. The ANOVA is statistically significant at 95% level of confidence at the p value of 0.000. Since the p value is less than 0.05 ($P<0.05$), the null hypothesis is therefore rejected.

Table 5: ANOVA-Variation in Inland Waterways users between the local governments

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	168875991169.389	1	168875991169.389	550.801	.000[b]
Residual	7665016249.278	25	306600649.971		
Total	176541007418.667	26			

a. Dependent Variable: no of passengers-
b. Predictors: (Constant), local government

CONCLUSION AND RECOMMENDATIONS

This study explored the challenges encountered by In-land water based transportation system in the coastal areas of Lagos state with a view to finding a visible remedy to those challenges. Consequently, the study revealed that water hyacinth is a threat on the water channels. This highly invasive aquatic weed surfaces on the waterways in August till February every year, it blocks the routes by forming a mat on the waterways which makes movement difficult on the waterways. The government should ensure that agency responsible, be it government agency, should respond to this challenge appropriately. This study recommends an integrated control method which is biological and mechanical removal. Mechanical removal of the bulk of material followed by a multiple herbicide treatments of remaining plants can be used to control severe water hyacinth infestations, while minimizing water quality impacts.

Provision of security and safety measures like use of standard life jacket should be provided by the government. Also, the operators lack formal waterways transportation education. Consequently, their lack of formal education in this sector has affected their operations. Therefore, the government or agency responsible for IWT should ensure the operators upgrade their knowledge of IWT by going for workshops, training and obtaining relevant certification. Consequently, this will also reduce accident rate and improve customer (users)

management on the waterways. Lastly, government should dredge the shallow river course to aid navigation on the waterways.

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Social Tenure Domain Model for Informal Land Title Registration in Akure, Nigeria.

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ABSTRACT

Social Tenure Domain Model (STDM) is developed to support pro-poor land management; and to address the technical gaps that is associated with unregistered land, the upgrading of slums, urban and rural land management. In developing countries less than 30% of the land has cadastral overage. The implication here is that about 70% of the land is outside the formal land registration. This caused problems for billions of people living in slums without proper water, sanitation, community facilities, and security of tenure. This model was developed to accommodate a continuum of land rights; which include rights that are documented and undocumented; STDM provide a flexible and unconventional land administration system. It accommodates different types of spatial data with varying degree of accuracy in an integrated manner to generate a social tenure relationship and then integrate the data with formal land administration system (LAS). STDM main objective is to make every right on land to count and device a means of recording all spectrums of land rights; in order to open up new markets to the land industry. The methodology here include application of STDM in capturing unregistered land rights in pilot study and such land rights are integrated into formal land administration framework thereby creating new market opportunities. It is an unconventional method of gathering spatial data on property rights. The model is expected to be used for spatial data collection of land rights in informal settlements; the data so generated can then be integrated with formal land administration system. This model is recommended as a relevant documentation that is flexible, user- friendly and capable of being scaled up to address a wide range of land tenure issues with the aim of empowering the poor. STDM has the capacity to broaden the scope of land administration by providing land information management framework which can integrate formal, informal and customary land system.

Keywords: Land rights, Informal settlements, Social Tenure Domain Model, Registration, Administration

INTRODUCTION

The process of land administration includes an institutional arrangement for implementing land policies and land management strategies. It further include a legal framework, process, land information, management of information systems and technologies needed to support land market development, control of land use and sustainable development of interest and rights in land.

The infrastructures needed to carry out most of these functions are not readily available in many developing nations and where it exists, it is not at national coverage (Lemmen, 2010). The conventional Land Administration System (LAS) has its short comings; judging from the fact that LAS could not adequately take care of informal and customary tenures processes.

Several land tenure policy specialist working in Africa, Asia and South America since 1998 had identified technical gap in convectional land administration which was found to be unfit for some tenures due to what they attributed to their ranges of social tenures which conventional Land registration system could not accommodate. (UNECA, 1998, Migot-Adholla, Hazell, Blare and Place, 1991; Bruce and Migot-Adholla, 1993).

A number of people working on land administration field noted that conventional land administration systems were not appropriate for lands held under customary; pastoralist and slum areas. (Barry and Fourie, 2002; Fourie, Vander Molen and Groot, 2002). Augustinus,

Ojo, B. (2016). Social Tenure Domain Model for Informal Land Title Registration in Akure, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 832-840

Lemmen and Van Oosterom (2006) also emphasize the inability of conventional land administration system to handle customary and informal tenures. It was noted that conventional land titling had failed to deliver expected results due to its inappropriateness and inflexible process of providing tenure security. Observation revealed that this process had limited implementation; lacks coordination and partnership among stakeholders. Unfortunately, most developing nations lack the tools, systematic strategies to address the challenges of delivering secure land and property rights for all spectra of her society.

The concept of Social Tenure Domain Model (STDM) was developed to bridge this gap by providing a prototype for representing the relationship that exists between people and land. In tackling the technical gaps associated with unregistered land, upgrading of slums both in rural and urban centres; the social tenure domain model (STDM) was developed. (Augustinus, et al, 2006) (Global Land Tool Network (GLTN)).

STDM accommodates a continuum of land rights that ranges from documented to undocumented, legal and illegal land rights (GLTN). STDM is able to accommodate spatial data with varying degree of accuracy and the spatial data can still be integrated to generate a social Tenure relationship (Augustinus, 2010).

LITERATURE REVIEW

Challenges in Urban Land Management

Land dealings in most developing nations Nigeria inclusive are generally lacking in transparency. About 70 percent of the land areas are outside the land registry of many developing countries. The situation is directly linked with the chaotic and unsustainable cities development, conflicts and proliferation of slums (UM-HABITAT, 2008; Mabogunje, 2005)

Urban growth rate was estimated by the United Nation to be growing faster in developing nations. Several of the cities have slum formation and informal settlement. About 90% of the new urban settlements are in slum formation. A slum household as defined by UN-HABITAT, (2008) “are group of individuals living under same roof lacking one or more of the following: access to improved water; access to improve sanitation facilities; sufficient living area; structural quality and durability of dwellings, and security of tenure.

In Nigeria context and Akure in particular, it is still very difficult to establish the genuiness of land claim. The problems of “Omo-Onile” -the indigenous land owners – still persist; this is not unconnected with the fact that majority of the land owners in most cases cannot boast of formal title to their land holding. There are lacks of adequate databases for recording land holding unlike what operates in developed World.

The Land Use Act of 1978 is the major law that regulates land administration in Nigeria. This law notwithstanding; the confirmation of claims (rights) through the registration of title document or the statutory Certificate of Occupancy (C of O) in the land registries are very difficult to come by due to lack of efficient data capture and safeguarding of the integrity of information recorded. Application of new technological advances in the use of Aerial photography, Satellite imageries, Global Positioning Systems (GPS), Geographical Information System (GIS), Computerization, as well as, provision of land information software to manage information generated on land are still in infancy stage. (Nwilo and Osanwuta, 2004)

Lack of well developed modern land registries equipped with adequate infrastructure and information technology system to deliver information on land has been a critical challenge to effective urban land management. Majority of the thirty six (36) states in Nigeria lack properly developed land registries. Oboli and Nwilo, (2005) pointed out that out of the one

hundred and twenty (120) urban centres and seven hundred and seventy-four (774) local government headquarters in Nigeria, only twenty (20) cities and thirty local government headquarters in Nigeria have up-to-date land maps that can aid Land administration and land registration.

The existence of bureaucratic establishment that are involved in land matters even makes the procedures very difficult. The bureaucratic manage the urban land in a non-transparent manner. Corrupt practices are instituted that gives no room for accountability. The land managers are noted for perpetrating long, tedious and frustrating procedures for land title, perfection (Bisiriyu, 2008). The cost of title perfection is equally beyond the reach of common man.

In overcoming most of these problems there are needs for looking for alternative approach to bridge the gap technically created by conventional land administration system (LAS). This approach or tool must be pro-poor, affordable, gender sensitive, sustainable and capable of systematic scalability.

The Social Tenure Domain Model (STDM): Why STDM?

The Social Tenure Domain Model (STDM) was designed as a complimentary approach in land administration. The concept is to bridge the gap that exist in conventional land administration, by providing a prototype for representing the relationship that exist between people and land with a varying degree of technical accuracy. The STDM concept view rights to land lying on a continuum.

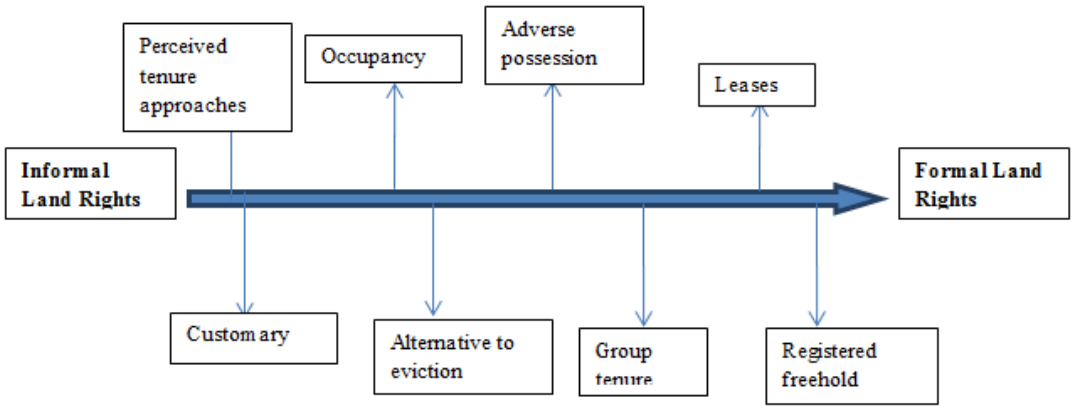

Figure 1: The Continuum of Land Rights (Adapted from GLTNs Continuum of Land Rights, Lemmen, 2010)

At the formal end of the Continuum are informal rights: a group of individuals such as clan, customary rights, traditional rights, pastoralist rights etc. these are sets of right to a piece of land that emerge from traditional rights. The boundaries of the land may not be clearly marked on the ground or presented in a map. There may not be an official paperwork certifying who owns such rights but they exist and are commonly recognized.

At another extreme are formal land rights, where owners of such rights are individual who hold a set of registered rights to a parcel of land that are enshrined in law: the parcel is delineated on a map; held in a record office. The owner has the right to occupy, transfer and prevent other people from using it.

However between these two extremes are a wide range of rights as simply illustrated in Figure 1 above. These rights sometimes overlap with one another. The registered freehold requires a complicated and costly administrative system with a reliable survey of the land parcels and good land governance. Unfortunately, the costs of formalization of land rights are far beyond the reach of the majority. The continuum of tenure types is a range of possible

forms of tenure. It provides different sets of right and degree of security and responsibility. Each of these rights requires different degree of enforcement.

STDM as sponsored by UN-HABITAT/ GLTN came up with land tool to capture the gaps that was identified with conventional land administration approach. Observation showed that conventional land administration is not suited for continuum of land rights and may not deliver security of tenure on large scale. The LAS only benefits the elites at the expense of the poor majority. In bridging this gap Social Tenure Domain Model (STDM) was developed.

STDM Conceptual Model

The STDM conceptual Model is presented in Figure 2 below:

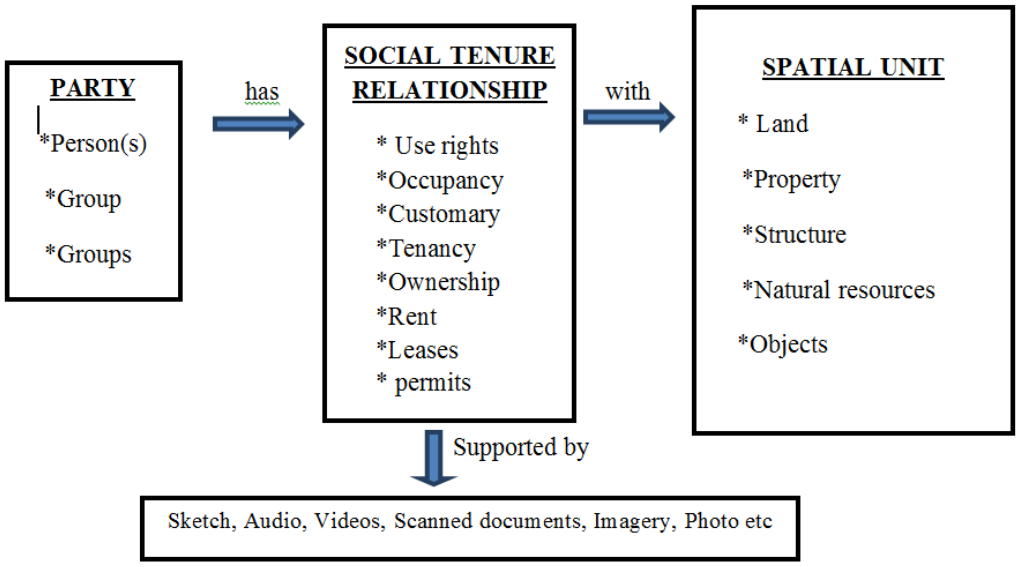

Figure 2: STDM Conceptual Model (Adopted from GLTN, FIG, UN-HABITAT, 2010)

STDM is an information tool for improved and efficient land recording. The STDM catch on the use of ICT tools that are now readily available and are becoming more efficient in recent time. STDM was born out of the urgent need to have a land information system that works differently and in addition to the conventional land information system.

Land tenure types that are not based on formal cadastral parcels and not registered require a new form of land administrative system. In most cases, the official land administration structures deny the poor legal access to land. In such situation, people opt for informal and customary arrangement to access land in areas that would otherwise be unaffordable or not available for them (UN-HABITAT, 2008). As can be seen in figure 2, Social Tenure Domain Model (STDM) is about people. It is about "People-land" relationship. People depend on land for living. Every human relationship with land must be accommodated in a spectrum.

The STDM is specifically designed for developing countries to support pro-poor land administration. Developing countries like Nigeria are characterized by very little cadastral coverage in urban areas with slums or in rural customary areas. The focus of this model is on the relationship between people and land, which is independent from level of formalization or legality of this relationship. Land rights in this model may constitute formal ownership, apartment right, usufruct, freehold, leasehold or state land. It can equally be a Social Tenure relationship like occupation, tenancy, non-formal and informal rights, customary rights of various forms, indigenous right and possession. Sometimes, these rights are with over lapping claims which lead to disagreement and conflicts (Lemmen, 2010)

The spatial units in this model are area of lands where these rights and Social tenure relationship are exercised. It may concern the identification of the spatial units on a photograph, an image or a topographic map. it may be on a locally produce sketch map or the photograph of the sketch map may be taken as evidence. STDM make the process of a land rights identification to be flexible by recognizing the fact that parties spatial units and social tenure relationship may be presented in many format depending on local tradition, culture, religion and general behaviour of the people. Recording spatial unit under STDM may not be based on formal registration but may be based on observation in real situation resulting in recordation of informal land use rights.

Simple Approach and Non-Conventional Land Recording Tools

The land rights are recorded in several ways in land administration system. Such land rights are recorded in cadastral maps, land registers and other records. Having land rights recorded this way confer benefits of greater tenure security, increase willingness to invest on such land or use such land as collateral in financial institutions.

However, the formal land administration has some limitations. It tends to marginalize many people most especially the poor, women and the weak in the society. Their relationships to land are not always included in the formal land administration system. In sub-Saharan African, the beneficiaries of the formal land recording are the rich and highly connected in the society. Most attempts made at expanding formal land registration systems usually benefit elite and very many poor people end up with less access and security to land.

Land administration system sound simple. It described who has what relationship to which resource and where. The system also collect, store and update these information. However, most conventional systems introduce hoops to jump through before the final information can be entered or updated. The ways and manner the detailed information on land are to be recorded are complex with the use of many gate keepers such as notaries or conveyancers to handle legal aspects, land surveyors to handle the maps, planners to deal with changes in land use and valuers to determine the worth of the land.

The costs of these services are beyond the reach of the poor and middle class are excluded from formal land administration system. Unfortunately they have relationship with land too. In relation to government agencies, clients are often made to pay “facilitation fees” or other forms of informal payments to have access to the conventional land administration system. Expanding the formal land-recording is not only slow but equally expensive to the poor and women. Conventional land administration is not suited to cater for continuum of rights. It is too cumbersome for this process.

There is now the need for innovative, cheaper and simpler ways of recording land rights that is affordable to the poor and the majority. There are now new technologies using computers, Satellite Images and Geographical Positioning System to the rescue.

GLTN has come up with various land tools to improve tenure security. These tools are:

i. The Social Tenure Domain Model - a pro-poor system land information management;
ii. Participatory enumerations through community-led data collection;
iii. Building of local record of land transactions; and
iv. Use of non-conventional approaches in collecting land data.

METHODOLOGY

Collections of data on customary rights with different form of tenures require a broad approach to data collection in the field:

Information at household level may be collected by representative of the community using pre-determined and tested questionnaires ; for example, information about name of owners, witnesses, family members, gender, age, social tenure relationship and a link to specific spatial unit.

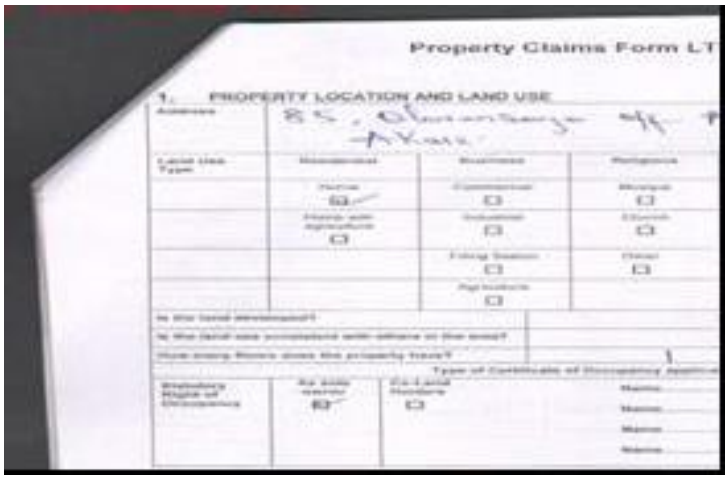

Figure 3: Sample of scanned questionnaire
Source: Ondo State Land Records Bureau Pilot Study, 2014

Information on spatial unit can be hand-draw on paper, marked on an existing map on aerial photo or satellite image. The position may be surveyed with hand-held global positioning system equipment with traditional or modern surveying equipment or digitalized form a pre-existing map.

Figure 4: Showing Satellite Image of central mosque area of Akure, along Adesida road.
Source: Prepared From Orthorectified Satellite Imagery of 50cm Resolution Dated: January 2013 and Using GeoxH 6000 GPS.

An enlarged satellite image or aerial photo is now common and well recognized by local people. People can identify almost immediate the roads and spatial units on the images. High resolution image can be enlarged and printed and used as a basis for data collection. As can be seen from satellite image of central mosque area of Akure along the popular Adesida road in figure 4; the major Adesida road, the pedestrian bridge, the central mosque, the democracy park, Oja-Oba market and the adjoining properties can be easily identified from the satellite image. The boundaries on the images can be identified by the people and traced on the image. Accuracy of this data may not be exact, but it is useful for identification. Later the correctness of these identified drawing can be certified by surveyors through accurate land mapping which is somehow expensive. Recordation in STDM need not be based on formal registration but on observation in reality.

The information is collected form occupants in the presence of their neighbors who act as witness and validates the information.

The information collected is publicly displayed in the local area for correction and validation.

The collected information is loaded into social tenure domain model software. This software allows the data to be updated. Its design is simple to allow it been run by local people. The local people are trained with the help of mobile team on how to manage and periodically update the records

Applicability of the Model in Akure, Nigeria

Akure is the State Capital of Ondo State, Nigeria. Akure is a traditional Nigerian city and like other traditional Yoruba towns in the country, it exists before the advent of the British Colonial rule in the country. Akure, the capital city of Ondo state is located in South Western part of Nigeria and one of the 36 states of Nigeria. It lies approximately on latitude 70171 North of the Equator and longitudes 50141 East of Greenwich Merdian. The population of the city according to the last population census conducted by the National Population Commission in 2006 put the population at 353,211 (NPC, 2006). The population of Akure is made up of civil servants, professionals, artisans, traders', farmers and students. Being a state capital, Akure is the hub of economic, social and political activities. The figures 5 show the geographic location of Akure city.

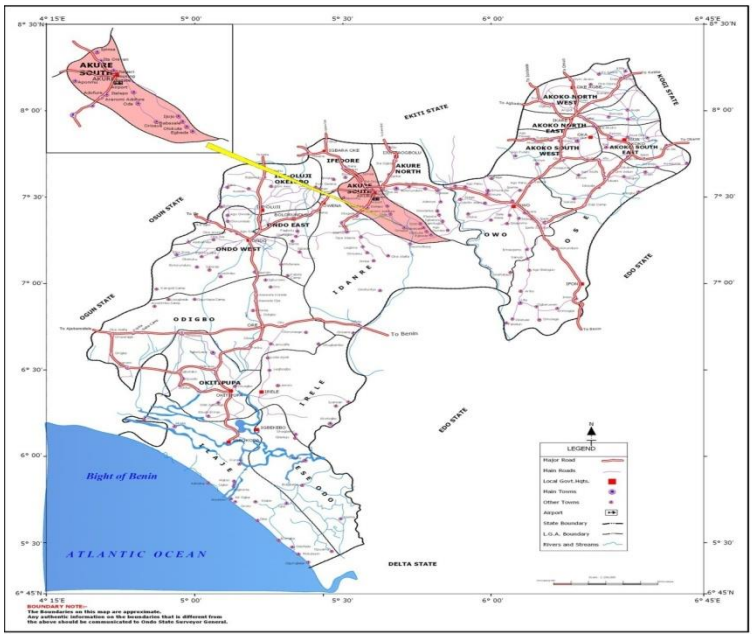

Fig. 5: Map of Ondo State Showing Position of Akure
Source: Abuja Geographic Information System, Maitama, Abuja.(2006)

There are issues with family lands in Akure and the conventional land administration system is not able to cover all land in Akure. In fact, there are numerous informal settlements development in Akure city alongside few formal estates owned by government and organized private sectors. Family land is a form of communal tenure and it is common in the study area. It is equally problematic to administer and in most cases lead to conflicts and litigations primarily because of lack of information on such lands. Land data on these lands are not captured and are not readily available to government in their formal registry.

There must be a way of recording these extra-legal but legitimate rights in an inexpensive way to boast land administration and security of tenure on such land. Social Tenure Domain Model was developed as a logical and structured standard format for describing the land - human relationship. Its design can cope with land administration components that do not fit

into more conventional land administration system. (Griffith-Charkes, 2011). Social tenure domain is a tool developed by Global Land Tool Network (GLTN) and facilitated by UNHABITAT. Its design is to cope with area where there are poor data on land most especially in Sub-Saharan Africa. STDM help in filling the data gap experienced in most developing countries.

In our local context, the process involved in the application of STDM to spatial data collection in Akure includes the followings:

Pilot test of STDM
Careful selections of some information/slum settlement are made within Akure city as a pilot study.

Participatory enumeration
The residents of the selected settlement would choose leaders and residents among them to be trained on participatory enumeration. The data gathering proceed must be jointly designed and conducted by the people who are being surveyed. The training would be on how to record details of the settlements i.e. who lives there, how long, reasons for living there, types of houses built etc.

The software package
it has two components namely a satellite imagery map, which shows the existing structure, roads and settlements and a database where the details of each household, pictures; photocopies of document and finger prints can be stored. The process must not be too restrictive so that the process does not bring us back to the trap of the conventional system - too inflexible, too formal and too expensive. There must be a balance.
Validation of information: the resident would be made to validate all information collected in the presence of their neighbours. The data and plans will be presented to the local or national authority via city citizen's forum for further integration with existing formal land administration. If the exercise is successful, the project can be scaled up for city wide coverage.

CONCLUSION

STDM among other things stand to benefit the professionals in land matters by bridging the gap that exists between conventional land management and customary land tenure system in one hand; and informal settlements and slum by providing systematic recordation that is flexible and does not follow conventional procedures. It will improve security of tenure at scale to many poor that rely on informal / customary land rights which are not often administered conventionally and are not systematically documented. STDM is designed as a pro-poor land information management system. There would be in existence a form of documentation that is affordable to the poor and relevant to their situation and social tenures in support of their land rights. STDM could be used to document land rights claims and over-lapping rights prior to conventional adjudication, surveying and registration, which in most cases is expensive and beyond the reach of the poor in the society.

For slum upgrade, the current trend is community focus project because of lack of city wide land information and management. However, STDM can make a city wide land management possible by linking the STDM information with the conventional cadastral information management system. STDM provide information on land at macro level and information is power. The poor are made to understand simple land information management and this will improve transparency about land allocation, acquisition, inheritance and transfers. The totality of this improves land governance. Women are highly affected by poverty and this has been linked to their lack of access to land. Fewer women have rights over land than men. STDM

contributes to overcoming gender disparity as it can also hold the record of women land rights.

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Factors Affecting Construction Project Handover and Feedback Mechanism

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ABSTRACT

Handing over and feedback is the last stage of construction. While handover is the transfer of constructed project and necessary information from design team to the project owner, users or facility manager, feedback gives the overview of the project and the lesson (s) for future engagements to the constructed project participants. With the ever increasing demand for quality service from project teams by clients, it therefore follows that poor handover and feedback mechanism can have a huge impact on clients' satisfaction. It is based on this premise that this research was carried out to assess the factors affecting construction project handover and feedback mechanism and their effect on project success with the view of providing overall effective project and client satisfaction. A questionnaire survey was used and 36 professionals in the construction industry in Ondo state were sampled. Data collected were analyzed using descriptive statistics: mean and percentile. Findings revealed that handover and feedback mechanism are not new to construction professionals but most times some vital process and documents are left out. Also factors affecting effective handover and feedback amongst others are: project failure/abandonment (a failed project cannot be handed over); project variation; inability of the client to pay the contractor and; insolvency in the course of the construction. This study therefore recommends that handover and feedback mechanism should be taken as a crucial stage with all necessary information properly communicated and measures taken to guide against the limiting factors in order to achieve a successful project.

Keywords: Feedback, Handover, Construction project, Project success, Nigeria

INTRODUCTION

The Construction Industry has been a large and ever growing industry with a lot of professionals working towards a common goal of a said project. The work of construction companies is project-oriented according to Zwikael (2009) and it is also one of the largest job creators in developing countries (Hari, Jeevarathnam & Thulani, 2012). Project Management Institute (1999) defined project as a series of tasks, arranged in a defined sequence or relationship that produces pre-defined output or effect. Several phases abound in the course of carrying out a project, and this includes: conception phase; planning phase; production; handover; utilisation and; close down. Munns and Bjeirmi (1996) observed that handover is the fourth stage of the six phases in construction that allows the transition from project delivery to occupation and operations. The strategic objectives of the handover stage are to ensure the building is free from identified defects, fully functional and operational, and to prevent disruption to operations during the handover transition.

On the other hand, customer/client feedback system enables organizations to monitor customer perceptions of their service and to improve their service performance (Sami, Juha & Jouko, 2014). The chartered institute of building (CIOB) (2002) stated that project feedback reflects the lessons learnt at various stages of the project and also includes recommendations to the client for future projects. Thus it is important to note how this twin issue (handover and feedback) affect the success of a project in other to give optimum satisfaction to the client.

Several research works conducted on project success has given recommendations on issues that are needed to be resolved in order to have successful project. Every day, clients are

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increasingly looking for high quality service from their teams. This high quality service must be experienced from initial contact, throughout the phases of a project, through completion and hand-over and beyond (Preece & Tarawneh, 1997).

It is imperative to note that no matter how good the beginning is when the end is bad then all the process is bad. Poor handover have a strong impact on overall client satisfaction (Sami *et. al*., 2014), also the importance of reflecting the lessons learnt and suggestion for future projects called feedback, cannot be over emphasized. Australian Government (1998) stated that the completion of a project should not signal the end of any further actions. This research therefore assess the factors affecting construction project handover and feedback mechanism and their effect on project success with the view of providing overall effective project and client satisfaction. In achieving this, the problems associated with project handover and feedback, the factors affecting project handover and feedback mechanism in building construction and their effect on project success were assessed.

LITERATURE REVIEW

Handover Stage of Building Project

Queensland Department of Public Works (QDPW) (2010) opined that handover is a major milestone in the construction work management process that occurs as the transition between project completion and commencement of building operations. In its opinion at this stage, all construction issues are resolved and the building is deemed ready for use and also the strategic objectives of the handover stage are to ensure the building is totally free from any identified defects, it is fully functional and operational, and to prevent disruption to operations during the handover transition. Jennifer, Carmel and Nurain (2012), suggested that handover procedures and training should begin before the key delivery professionals leave, that this will enable facilities and asset managers to discuss operations with designers before they are disengaged.

The CIOB (2002) viewed project completion or commissioning and handover as an interlinked final stage of work executed by the contractors and consultants prior to acceptance of the facility by the client. It went further to explain the stages involved or things that must be done to achieve an effective handover. Necessities like, certificate of completion, sectional completion (stage construction), final account, health and safety file, as-built and install drawings and specifications and maintenance manual.

In similar view handing over building to the occupants is one of the key milestones of a building's life. Initial commissioning will have proved that the building's systems work, although they may need continual fine-tuning during the first year as loads change. This fine-tuning is much more effective with the involvement of maintenance staff or training the client on the usage of the facilities in the building (Carbon Trust, 2012). This indicates that this stage of construction is necessary in determining the success of a project.

The Activities Involved in Handover

Summarising the opinions of QDPW (2010), Carbon Trust (2012), Guide to Building Handover (GBH) (2012), The CIOB (2002), handover activities may vary in accordance with the specific project and contractual arrangements. The handover may be progressively staged (during project delivery), with each stage following the completion of an agreed level of partial building works as specified in the contract.

Handover activities can be grouped into the following stages: Pre-handover activities (including commissioning); Practical completion; Post-handover activities; Final completion; Project close activities.

Pre-Handover Activities

Commissioning

Commissioning is the process of verifying that building systems are performing in a way that meets client's requirements. Commissioning prior to handover is necessary to ensure that it is functioning, operational and ready for use. This can lead to a fully optimised building, using less energy and keeping occupants comfortable and productive. Commissioning is often thought of as a single point in a construction project, carried out before handover (QDPW, 2010; Carbon Trust, 2012; GBH, 2012; T CIOB, 2002)

The commissioning team should be formed early in the process and involve the following people: client representative, commissioning specialist, design representatives, cost management representative, construction specialist, facilities or premises manager (where appointed). This team should define, prepare and control commissioning activities. The facilities manager or another member of the client team needs to take responsibility for checking the commissioning plan. They will also need to make sure the commissioning records are complete and comply with the contract.

Receipt of building documentation

Prior to handover, it is expedient that the contractors and consultants transfer all building documentation to the project manager. Copies of this documentation should then be transferred by the project manager to the building owners/users and the maintenance provider (s) (QDPW, 2010; CIOB, 2002).

As built and as installed drawing

This according to GBH (2012) is a reference drawings needed to troubleshoot or resolve building issues. As installed drawings also specially shows concealed or underground cable and piping routes, been concealed by backfilling of excavation or concreting of floor slab or installation of non-removable ceiling. It also provides critical dimensions and access points (Property Services, 2011).

Operating and maintenance manual

Operating and maintenance manual contains user-friendly instructions that effectively guide the Owner/Operator in the proper operation and maintenance of building systems, materials, finishes, components and equipment (GBH, 2012). According to The Ontario Association of Architects and General Contractors (OAAGC) (2007) this documentation provides information with regards to the regular maintenance and cleaning instruction of materials, necessary instructions in order to operate systems and equipment. This instructions shows the upkeep required for finishes and various components of equipment and systems, it specifies the cleaning methods and materials or regularly scheduled maintenance of equipment.

The Health and Safety file

The Health & Safety File is a document which is prepared by the project manager, with assistance from the design team, main contractor and the subcontractor. This file contains all relevant information to allow the Client to effectively occupy, utilise, manage and maintain the building safety. The Client is also responsible on receipt to update the file regularly, in case of changes made to the building (Advance procurement for university and colleges, 2009).The CIOB (2002) opined that health and safety file is produced right from the onset of the project construction that is been updated at completion of the project and handed over to the client, the concise updated health and safety file of the built product highlights any potential risks to the end user.

Other documents according to QDPW (2010), Carbon Trust, (2012) and GBH (2012) includes: plant, equipment, services and system information/schedules, as well as

recommendations related to lifecycle costing; service maintenance requirements, certificates, warranties and guarantees, occupational instructions and any training packages.

Practical Completion

The practical completion marks the end of the construction stage and the time when the building is handed over to the building owners/users. Practical completion is achieved when project requirements have been delivered, in accordance with the project brief, approved design and intent, contractual obligations and statutory requirements.

Confirmation of practical completion usually occurs at the conclusion of Commissioning/Pre-handover activities. It is at this time that the maintenance provider (s) should be advised of all maintenance-related design and construction issues. At practical completion the above named significant documents are handed over by the contractor to the project manager, subsequently the project manager hands over to the client. The project manager needs would have ensured on behalf of the client, that these documents are available and that they are to the necessary quality (QDPW, 2010; GBH, 2012, CIOB, 2002).

Post-Handover Activities

Defects liability period

Sdn Bhd, Burns and Ong Sdn Bhd (2007) defines defects liability period as a period when the contractor is obliged and liable to rectify defects that appear as from the time the Certificate of Practical Completion is issued and its expiry time. Most building contracts defects liability period spans for twelve to six months (base on the contract agreement) from the practical completion milestone. Alejo (2013) argues that defects liability period practice in Nigeria building industry should be extended more than six month, as it is done in other developed countries in the world.

During this period, the contractor (or their nominee) is responsible for: addressing minor omissions and defects outstanding at handover; and rectifying building defects identified during the defects liability period. Thus, maintenance activities should be monitored and maintenance records should be continually updated to reflect any new defects and/or rectification works. These records should be incorporated into a defects report, which includes details of maintenance activities undertaken, defects identified and/or rectified and other building issues requiring attention. These records should also be retained in the maintenance manuals for easy access to information on the condition of assets. By the end of the defects liability period, the building should be fully operational and all identified defects and omissions should have been addressed (Public Works, 2010; GBH, 2012; CIOB, 2002).

Final completion and Project close out activities

The completion stage is achieved after the finalisation of construction and when the facility is handed over to the client (Australian Government, 1998). Hence, final completion marks the conclusion of the building project. The certificate of final completion (issued following satisfactory final completion inspection) confirms that all contractual requirements have been met, including the rectification or acceptance of all outstanding defects and attendance to all omissions (Zarabizan, Syuhaida & Aminah, 2012).

Final account which is the sum agreed to be paid at the end of the contract by the owner to the contractor, comes in at this stage. This according to Zarabizan *et. al,* (2012) is sometimes delayed and disputed. In fact, the bottlenecks in settlement of final account have existed for decades and undue prolonged inaction to curtail it has made settlement of final account more difficult and frequently gives rise to dispute unnecessarily (Kwok, 2009). This stage allows the Project manager closes auditable project files, releases final payment to Contractor and close financial accounts.

Feedback in Building Construction

CIOB (2002) emphasized the necessity project feedback as a way of reflecting the lessons learnt at various stages of the project, including recommendations to the client for future projects. Its opinion shows that feedback should be obtained from all of the participants in the project team at various stages and also that feedback can be obtained at the end of a key decision-making stage. In addition to this, project feedback form should include: brief description of the project, outline of the project team, form of contract and value, feedback on contract (suitability, administration, incentives, etc.), technical design, construction methodology, comments on the technical solution chosen, any technical lessons to be learnt, form of consultant appointments, comments on consultant appointments, project schedule, comments on project schedule, cost plan, comments on cost control, change management system, values of changes, major source (s) of changes/variations, overall risk management performance, overall financial performance, communication issues, organisational issues, comments on client's role/decision-making process, comments on overall project management including any specific issues, other comments and finally close-out report.

Project Audit

Project audit give the brief description of the objective of the project, summary of any amendments to the original project requirements and their reasons, brief comment on project form of contract and other contractual or agreement provisions. It reviews project milestones and key activities highlighting planned versus actual achievements, unusual developments and difficulties encountered and their solutions, and also brief summary of any strengths, weaknesses and lessons learnt (CIOB2002).

Measure of Project Success

The construction industry is dynamic in nature (Behm, 2008). The concept of project success has remained vaguely defined in the construction industry. The measure for project success varies among professionals and stakeholders in the built environment. While some consider time, cost and quality as the predominant targets, others suggest that success is something more complex (Chan, 2001). Cheung, Suen and Cheung (2004) opined that project performance can be measured and evaluated using a large number of performance indicators that could be related to various groups such as time, cost, quality, client satisfaction, client changes, business performance, health and safety. Chan (2001) reviewed eight leading journals on project success and revealed that cost, time and quality are the three basic and most important performance indicators in construction projects. He went further to mention other measures, such as safety, functionality and satisfaction, among others that are attracting increasing attention.

METHODOLOGY

The aim of this paper is to assess the factors affecting construction project handover and feedback mechanism and their effect on project success with the view of providing overall effective project and client satisfaction. In achieving this, a survey design was used. This involved the use of questionnaires administered to Quantity surveyor, Architects, Civil Engineers and Builders in Ondo state ministry of works, Federal ministry and the selected contracting firms within Ondo state, Nigeria. Using convenient sampling, 65 questionnaires were distributed with 36 returned which represents a response rate of 55.4%. Mean Item Score (MIS) was used to analyze data gathered and this was employed for two purposes which are: ranking and determination of significance of different factors of the collected data. The premise of decision for the ranking is that the factor with the highest MIS is ranked 1st and others in such subsequent descending order. Since a Likert of 5-point scale was employed for the collection of data, the formula for MIS is written as:

$$MIS = \frac{5n^5 + 4n^4 + 3n^3 + 2n^2 + 1n^1}{n^5 + n^4 + n^3 + n^2 + n^1}$$

Where n is the frequency of each of the rankings

FINDINGS AND DISCUSSIONS

Findings of Research

Background Information of Respondents

The respondents sampled include 41.7% Quantity surveyors, 25% Architect and Civil engineers each, and 8.3% builders. 38.9% of the respondents have between 1 to 5years of working experience while 33.3% have between 6 to 10 years experience. 8.30% of the professionals have 11-15years, 2.8% have between 16 to 20years while 13.90% have above 20years of experience in building construction. It therefore follows that the data gathered from the respondents can be relied upon since 61.1% of the respondents have above 5years working experience, hence information would have been given based on their vast wealth of experience. Also 36.11% of respondent have been involved in 1 to 5 construction projects, 19.44% were involved in 11 to 15 projects, and 13.89% were involved in 6 to 15 projects, while 25% in above 20 projects and 5.56% did not respond to the question asked.

Problems Associated With Project Handover in Building Construction

Table 1 shows the result of polled professionals' opinion about the problems associated with building project handover, they are asked to assess the occurrence of the problems as they arise in building project handing over process. From the table taking only problems with 3.0 mean score and above, it can be deduced that according to occurrence in descending other is as follows: Disputed final account comes first, next is the certificate of completion not issued, then absence of as built and as installed drawing, then non availability of overall financial performance, next is change management system not well documented, then absence of operating and maintenance manual, avoidance of project audit, the last of the list of eight (8) problems that scaled through the bench mark mean score of 3.0 is, absence of health and safety file.

Similarly for problems associated with feedback process, taking only problems with 3.0 mean score and above, it can be deduced that according to their ranking of occurrence in descending other is as follows: Non availability of overall financial performance , absence of as built and as installed drawing, disputed final account, change management system not well documented, certificate of completion not issued, omission of certificate of practical completion, avoidance of project audit, Close-out report not presented, no concern for comments from parties involved, absence of health and safety file, absence of operating and maintenance manual, and Non availability of brief description of the project.

This same constituent study for handover where only eight (8) were respondents choice, was used for feedback and all the constituents were selected as any omission will cause problem in feedback

Factors Affecting Construction Project Handover and Feedback Mechanism in Building Construction

Result shows that out of the 13 identified factors affecting project handover and feedback mechanism, project failure/abandonment topped the list with a mean score of 3.74 (a failed project cannot be handed over). Next is project variation with a mean score of 3.69, followed by the inability of the client to pay the contractor which ranked 3rd with a mean score of 3.67. Result shows that if 3.0 is set as the minimum mean score for a factor to be considered

relevant, then all the 13 factors have reasonable effect on project handover and feedback except ignorance as indicated in table 2.

Table 1: Problems Associated with Project Handover and Feedback

Problems of Handover and Feedback	Mean for Handing over	Ranking	Mean for Feedback	Ranking
Disputed Final Account	3.49	1	3.48	3
Certificate of Completion not Issued	3.29	2	3.36	4
Absence of As Built and As Installed Drawing	3.29	2	3.50	2
Non Availability of Overall Financial Performance	3.24	4	3.64	1
Change Management System not Well Documented	3.15	5	3.36	4
Absence of Operating and Maintenance Manual	3.15	5	3.09	11
Avoidance of Project Audit	3.03	7	3.28	7
Absence of Health Safety File	3.00	8	3.12	10
Omission of Certificate of Practical Completion	2.97	9	3.30	6
No Concern for Comments from Parties Involved	2.91	10	3.18	9
Close-Out Report not Presented	2.85	11	3.22	8
Non Availability of Brief Description of The Project	2.76	12	3.03	12

Table 2: Factors affecting construction project handover and feedback

Constituent of Handover and feedback	Mean Score	Ranking
Project failure/abandonment	3.74	1
Project variation	3.69	2
Inability of the Client to Pay the Contractor	3.67	3
Insolvency in the Course of the Construction (Contractor)	3.64	4
New government policies	3.61	5
Insolvency in the Course of The Construction (Client)	3.47	6
Client desire	3.44	7
Inability of the client to pay the consultants	3.42	8
Contractor's shoddy job	3.40	9
Conflicts	3.39	10
Architect instruction	3.23	11
Statutory obligation	3.14	12
Ignorance	2.94	13

Effect of Project Handover and Feedback mechanism on Overall Project Success

Table and short explanation was used to present findings from respondents on the effect of six (6) project handover and feedback constituents on three measures used to measure construction project success.

i. Completion of the project to cost

Result in table 3 shows the opinions of respondents on handover to completion of the project to cost. It was revealed that out of the constituents of handover, final account top the table and next to it is; certificate of completion and certificate of practical completion respectively, even though other factors are beyond the average level, the first three was considered. Final account, certificate of completion and certificate of practical completion deals directly with cost at the final stage of a project in view of this affects the cost of construction project, this has been shown in the below result.

Result shows out of the constituents of feedback, considering the first 3, Project audit was ranked 1st, next to it is Overall financial performance, while Brief description of the project

was the third, even though other factors are beyond the average level, the first three was considered.

ii. Completion of Project To Quality

Table 3 indicate the result of the opinions of respondents on handover to completion of project to quality, out of the constituents of handover; as built and as installed drawing was ranked most, then to certificate of practical completion and certificate of completion.

Table 4 also explained the result of the opinions of respondents on effect of feedback on completion of project to quality. Project audit and overall financial performance was ranked most, Brief description of the project was ranked third.

iii. Completion of Project To Time

Table 3 indicate the result of the opinions of respondents on handover to completion of project to time, out of the constituents of handover; certificate of completion was ranked most then as built and as installed drawing and certificate of practical completion came behind respectively.

Table 4 shows the result of the opinions of respondents on effect of feedback on completion of project to time. Overall financial performance report of the project was ranked most, then project audit and taking and recording comments from parties involved respectively.

Table 3: Effects of Handover on Construction Project Success

Effect of Handover	**Completion of Project to Cost**		**Completion of Project to Quality**		**Completion of Project to Time**	
	Mean	Rank	Mean	Rank	Mean	Rank
Certificate of practical completion	3.66	3	3.94	2	3.62	3
Final account	4.00	1	3.76	4	3.47	4
Health safety file	3.13	6	3.16	6	3.41	5
As built and as installed drawing	3.64	4	3.97	1	3.76	2
Operating and maintenance manual	3.26	5	3.52	5	3.26	6
Certificate of completion	3.84	2	3.79	3	3.78	1

Table 4: Effects of Feedback on Construction Project Success

Effect of Feedback	**Completion of Project to Cost**		**Completion of Project to Quality**		**Completion of Project to Time**	
	Mean	Rank	Mean	Rank	Mean	Rank
Brief description of the project	3.77	3	3.61	3	3.35	4
Project audit	3.88	1	3.70	1	3.42	2
Change management system	3.21	6	3.48	4	3.35	4
Overall financial performance	3.81	2	3.70	1	3.69	1
Comments from parties involved	3.48	5	3.42	5	3.41	3
Close-out report	3.55	4	3.39	6	3.19	6

Discussion of Findings

Problems Associated With Project Handover and Feedback

Based on empirical evidence from the research conducted it was discovered that; disputed final account, certificate of completion not issued, absence of as built and as installed drawing, non-availability of overall financial performance, change management system not well documented, absence of operating and maintenance manual, avoidance of project audit and absence of health safety file was rated above average of the twelve problems associated with construction project handover and feedback. This agrees with the opinions of QDPW (2010), Carbon Trust (2012), GBH (2012), CIOB (2002) that the above named eight constituents are important to have a hitch free handover and feedback. In fact Zarabizan et. al., (2012) ascertained that disputed final account causes bottleneck in handover and feedback.

Factors Affecting Construction Project Handover and Feedback Mechanism
Findings revealed that; project failure/abandonment, project variation, inability of the client to pay the contractor, contractors insolvency in the course of the construction, new government policies, clients insolvency in the course of the construction, client desire, inability of the client to pay the consultants, contractor's shoddy job, conflicts, architect instruction and statutory obligation had proven themselves as factors affecting construction project handover and feedback.

Kandeil, Hassan and Nady (2010) agrees with some of the factor listed above as affecting handover, factor like; Project variation and contractor's poor job (quality). Kandeil et. al (2010) also observed that insolvency in the course of the construction (client), inability of the client to pay the consultants, inability of the client to pay the contractor, insolvency in the course of the construction (contractor) in form of lack of cash flow as factor affecting handover.

Effect of Project Handover and Feedback on Overall Project Success
When a construction project is successful at completion and the transfer and information are not managed well, the end stage can sour the whole earlier process. In view of this, the findings in this research have shown that project handover and feedback will affect project success in terms of cost, time and quality. This agrees with the combination of Queensland department of Public Works (2010), Guide to Building Handover (2012), The Chartered Institute of Building (2002) presented guide for effective handover and feedback and that of Hari et. al (2012), measure of construction project success.

CONCLUSION

This research has been able to assess the effect of construction project handover and feedback mechanism on project success. The following are the conclusions of the research:

i. Construction project handover and feedback is the final and transition stage of construction where proper information must be communicated.
ii. It is not a ceremony but a crucial stage of construction to determine the final success of a construction project in the sense that any omitted document of constituents of this stage will affect construction project success.
iii. Problems associated with this stage are: Disputed final account, Certificate of completion not issued, absence of as built and as installed Drawing, non-availability of overall financial Performance, change management system not well Documented, absence of operating and maintenance Manual. Avoidance of project audit and Absence of health safety file.
iv. Ignorance is not a factor affecting effective handover and feedback but; project failure/abandonment, project variation, inability of the client to pay the Contractor, insolvency in the course of the Construction (contractor), new government policies, insolvency in the course of the Construction (client), client desire, inability of the client to pay the Consultants, Contractor's shoddy job, Conflicts, Architect instruction and Statutory obligation.

RECOMMENDATIONS

The following were recommended based on the findings of the research:

i. This stage of construction should not be taken as a ceremony stage but as a crucial stage, as it connects the client, the design team, contractors and the users or facility managers together to bring about the completion and post completion of the project.
ii. All necessary information should be communicated in order to achieve a successful project.

iii. The identified mostly omitted constituents of handover and feedback must be enforced at this stage to enhance its success.
iv. Measures should be taken to guide against identified limiting factors affecting this stage of construction

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The application of HSE in building construction – A case study of Moroto Regional Referral Hospital in Northern Uganda

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ABSTRACT

The Health, Safety and Environment are the fundamental pre-requisites of the construction industry, to be applied by the builders/ and contractors. The requirements of clients, contractors, donors, local regulations or laws may stipulate higher and/or additional requirements in certain cases. In that situation, higher standards have to be followed. This paper discusses about a large general hospital site "Moroto Regional Referral Hospital", located in Northern Uganda where construction and repairing works were carried out. The project was funded by the World Bank, therefore, stringent HSE procedures were followed in conformity with local laws and regulations. In this regard, construction staff, comprised mainly of skilled and unskilled labour, was given early morning briefing before the start of work. Every worker had to wear the necessary gear including special construction clothes, gloves, shoes/gumboots and helmets. The staff was always given proper rest by ensuring strict compliance of working times. The construction material was also provided proper care as stuff like sand was always kept covered, excavated pits were given fencing to avoid falling and electrical installations were fully protected. The project was of 18 months duration, and it was successfully completed within the contract time period and handed over to the client in September, 2015. Although the site was located in a remote place where availability of necessary facilities, materials and skilled labour was a challenge, however, HSE guidelines were strictly followed resulting in timely completion of the project without incurring any health or safety issue, verified through preliminary medical check-up of the staff.

Keywords: Health Safety and Environment, Construction, Hospital, Project

INTRODUCTION

HSE, which stands for Health Safety and Environment, has the main aim of protecting environment, general public, workers, and to follow the set laws and safeguard the reputation of the organization (Duijm et al. 2008). In some organizations, HSE departments have the responsibility of protecting the occupational health, environment, and the safety of workers and materials, when various operations are carried out at the site/workplace.

In the perspective of health & safety, it includes preparation of well-organized and well-managed methods and applications for determining the hazards of a workplace and diminishing sudden accidents and vulnerability to the harmful materials and circumstances. According to Ligard & Holmes (2001), it also involves the training of workers in the usage of Personal Protective Equipment (PPE), responding to the sudden accidents, its prevention, and emergency alertness.

Whereas, from the environmental perspective, it includes the preparation of an organized and well-thought approach to follow the set rules and regulations of environment, such as handling the air pollutants and waste materials in a way to assist in reducing the carbon footprint of the workplace.

Sohag, I. A. & Sohag, M. A. (2016). The application of HSE in building construction – A case study of Moroto Regional Referral Hospital in Northern Uganda. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 851-854

Importance of HSE in building construction

HSE deals with the health and safety of both the employees/workers and surrounding environment of a particular workplace where construction activity is taking place, and is therefore an essential component of the organization which has to be given due importance (Shamsuddin et al. 2015).

Mohamed (2002) explained that in order to monitor the health & safety of employees and the workplace environment, most of the reputable organizations usually appoint HSE officer on the construction/building site and is provided an office to work in.

The HSE officer guides his/her workers about their safety through a daily/weekly meeting called Toolbox Talk in which he/she informs the workers about their daily construction activities and its related PPE and further explains on how to remain safe on site by wearing PPE equipment whenever they are working on the site. In case of any unfortunate mishap takes place and the worker gets an injury, he/she has to report to HSE officer, who then treats the worker in emergency room present on the site. However, if the injury is serious, the HSE officer takes the worker to a nearby hospital.

Proper signage is also an integral part of HSE which plays a great role in keeping the working environment, workers and visitors safe and sound. It increases the vigilance of both the workers and visitors on the site. It is also the responsibility of HSE officer to do the proper signage on the site every time a construction activity takes place or construction material is stored/placed on the site.

Figure 1 - Signage of high flammable area where fuel was stored

Description of site activities

In lines of the standard HSE rules and regulations, the construction activities of Moroto Regional Referral Hospital used to start in the morning with a Toolbox talk, which used to take place on every Monday, Wednesday and Friday at 07.00 am before the commencement of works and continued till 05.30 pm, while on Sundays it was limited up to afternoon.

During the last days of handing over of the project site, the contractor worked tirelessly day and night in order to hand over the project on time. The need of working day and night aroused due to the extended works and variation orders of the work, provided by the stakeholders. Around 200 people worked every day which included mason, plumber, painter, electrician, helper, etc.

Proper health, safety and environment measures were adopted on the project site. During the night hours, tower lights had been used in order to ensure that the workers do not face any challenge in work and remain safe. During the work, site workers had to wear personal protective equipment (PPE) which included gloves, overall, helmet, gum boots, goggles and face mask.

During the rainy season, polythene cover used to be placed over the sand in order to keep its moisture content stable. Similarly, in case, if concrete has been casted or plastering of the structure has been done and the rain starts, polythene cover used to be placed over the structure.

Figure 2 - Polythene cover was placed after placing mortar between kerbstone and paver block

Figure 3 - Planted grass protected with the help of warning tape

As shown in the photo above, the ground on which grass was planted can be seen protected with help of a warning tape. Similarly, the deep excavation works which were carried out on the site were given proper signage and the warning tape was placed around the excavated area for the safety of workers and visitors on the site.

Observations

During the course of construction work, the HSE regulations were strictly followed on the construction site and no serious incident ever took place during the whole project. Moreover, the construction process carried out smoothly and the hospital was successfully handed over to the client on the due date after execution of repairing/construction works. The workers did not suffer any serious injury or health issue during the course of works, which shows that implementation of HSE regulations keep the workers in good health. This ultimately helps the employers by non-interruption of works or placement of new workers. This also provide a healthy and conducive environment where workers try to deliver efficiently with commitment as being practiced in the developed countries where even in laboratories HSE is strictly

applied (Ishaq & Riaz, 2015). As such, a good working environment helps in better delivery as observed by the timely completion of the project. The regular briefing also helps in the refreshing of the HSE rules for the workers.

CONCLUSION

HSE applications greatly enhance the health and safety of workers and visitors present on the construction site. Sudden accidents and mishaps which can damage the health of people present on construction site, jeopardize the whole construction process and environment, can be avoided with the help of proper application and management of HSE regulations.

It was a World Bank funded project, therefore, HSE rules and regulations were followed religiously, which had a good impact on the execution of the project, conservation of environment, health of the workers and developing conducive working environment. It is urged that HSE implementation on civil projects should not be limited to the donors funded projects. Infact it should be strictly followed in all the civil, whether in private or public sector. In this regard, government agencies need to devise a holistic strategy whereby all the stakeholders are involved in the implementation of HSE in civil works.

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Stakeholders Management for Public Private Partnerships in Niger-Delta Region of Nigeria

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ABSTRACT

One of the barriers that have been identified during the implementation of Public Private Partnership (PPP) globally which have led to project failure is stakeholder opposition. This paper focused on the key concepts underlying stakeholder involvement and the criteria to measure their satisfaction level with the PPP infrastructure projects in Niger-Delta region of Nigeria. Both qualitative and quantitative approaches were employed in generating preliminary data for field testing. This involved 41 respondents selected from concession companies and 19 end users in the region using stratified sampling technique. The study revealed that The State PPP directorates considered satisfaction in terms of the project meeting the quality specification; function as intended; completed as schedule; and benefiting the end users. The promoters/ investors considered satisfaction in terms of the project being self-financing; users demand for the services; return on capital Invested; and minimum operation/ maintenance cost. The end users viewed the satisfaction in terms of involvement of the host community from inception till operation; improve standard of living of the host community; serve as means of employment; and a source of relief but not to add to their stress. The study recommended that confident-building measure through establishment of forum between the private and public sectors and end users' to discuss economic impact and social value of the infrastructure projects for growth, determination of the priority of the infrastructure projects and the challenges be put in place to eradicate future conflict.

Keywords: Stakeholders' Involvement, Satisfaction, Public private partnership, Infrastructure, Nigeria

INTRODUCTION

Series of PPP initiatives around the world have encountered various problems that eventually led to the PPP infrastructure project failure. One of the most important factors identified is the Public opposition due to various reasons such as: unaware of the concept of PPP; not sufficiently educated about PPP; and denied access to detailed information contained in the consortium's PPP proposals. For instance, the failure of major PPP transportation initiatives in the United States and unsuccessful initiative to privatise sewer system in Malaysia were due to public opposition.

The Stakeholder involvement (SI) in infrastructure projects plays a significant role in the success of PPP infrastructure projects. Stakeholder involvement in PPP infrastructure projects has replaced the more limited term of Public involvement in the context of infrastructure development. According to El-Gohary, Osman, and El-Diraby (3006) described a stakeholder as any person or organization that has a legitimate interest in a project. PMI (2000) affirmed that each project typically involves a unique combination of stakeholders: persons or organisations that are actively involved in the project, or whose interest may be positively or negatively affected by the project. Olander (2003) argued that stakeholder analysis is used to identify stakeholders, assess their claims on the project and each stakeholder's interest and power to influence project decisions, in order to form and choose appropriate strategies. The stakeholder analytical tool is used to determining the strengths and weaknesses of project stakeholders influence in PPP infrastructure projects.

To capture stakeholder input, a thorough stakeholder involvement programme has become an integral part of infrastructure projects. The programme can be administered by the project

Lashinde, A. T.; Ogunsemi, D. R. & Awodele, O. A. (2016). Stakeholders Management for Public Private Partnerships in Niger-Delta Region of Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 855-863

owner, designer or contractor depending on project specific requirements. (El-Gohary *et al.*, 2006). In terms of the stage in which stakeholder is involve in PPP infrastructure projects. Accordingly, the Involvement of the beneficiary community should be from the implementation to the delivery of infrastructure projects. I.e. Stakeholder involvement is from planning, designing, construction and operation. Interns of stakeholder in planning and design, Stanford (2000) opined that in order to ensure a true stakeholder involvement programme in planning and design phases, the public has to be taken in full confidence that their involvement will influence the decision making process. Levy (1996) affirmed that during this phase of infrastructure project development all stakeholders are involved, but the way of involvement is different. Local and regional stakeholders are concerned with the influence of construction activities on their daily routine activities and life style. Attention has also been drawn to the importance of involving stakeholders in the design process of construction projects for identifying and understanding the values of the stakeholders in a project (Thompson *et al*., 2003). For construction-related projects, it is typically the responsibility of the project management team to identify the stakeholders, determine what their needs and expectations are, and then manage and influence those expectations to ensure a successful project (PMI, 2000). This entails establishing interfaces between the stakeholders, obtaining feedback as appropriate throughout the project, resolving conflicts between the stakeholder needs, and paying adequate attention to changing stakeholder needs, including new stakeholders, throughout the project (Gardiner, 2005). In order to achieve best value for money, there should be alignment between the stakeholders of the PPP project. Best value for money, on the other hand, represents the optimum combination of whole-of-life costs and quality (or fitness for purpose) of the goods or services to meet the user's requirement (HM Treasury 1998). .

LITERATURE REVIEW

Identification and Value of PPP Stakeholders

Olander (2003) developed a model for evaluating stakeholder influence on the project process as illustrated in figure 2.1. The model focuses on the impact of each stakeholder on project decisions and the consequences of the outcome. According to Olander (2007), evaluating the total impact of stakeholders in relation to a project requires more than identifying the impact level and probability of impact, but also requires the project managers assessing the stakeholder attributes and classes. Project participants include the granting authority, usually a government agency; the project sponsor; and usually one or more financial institutions.

The granting authority identifies project requirements, establishes the concession period, solicits tenders, and awards the contract. The project sponsor typically is a consortium or a joint venture of engineering, construction, and venture capital firms. Investment capital may come from commercial banks, insurance companies, or the sale of bonds (John & Isr, 2003). For the purpose of this study, the stakeholder of PPP can be classified in to three: government agency as the granting authority; project Investors involves the consortium and Investment capital and the end users were the beneficiaries of the services. The expectation of the government from the investors are financial capability, Technical capability, Managerial capability, Ability to accommodate adjustment in risk allocation, Health and safety performance and Strong private consortium. While the Investor's Expectation from the host country are political stability, creating a favourable social, legal, economic, and financial environment for PPP, clear division of responsibilities/objective, attractive incentive packages and tourism and welcome attitude of host community. The end users' requirements from both the government and investors are project benefiting the host community, Involvement of the host community, project being means of employment or source of relief and function as

intended. Three of the major challenges facing a prospective sponsor are estimation of project costs, projection of revenues during the concession period, and selection of an appropriate financing strategy.

Values are the deep-rooted beliefs about what is right or wrong, and what is important and unimportant. When thinking about value, it is helpful to consider the interaction between societal, organisational, group/team and individual levels of values as for instance: the values of a society influence organisations; and an organisation's values can influence the values of teams and individuals within it (Martin & Henderson, 2004). National Audit Office NAO (2004) described value as the function of the relationship between the 'satisfaction of needs' (in terms of business benefits and requirements) and the resources needed to deliver them. Dallas (2006) argued that one way of describing the critical factors required for the delivery of value through the useful life of a facility is through the use of value drivers, which he described "*as the various components of value, which together contribute to the overall benefits of the completed project to its stakeholders*". A good understanding of the stakeholders' values has been argued to play a vital role towards successful project outcomes (Kamara *et al.*, 2000; & Thompson *et al.*, 2003).

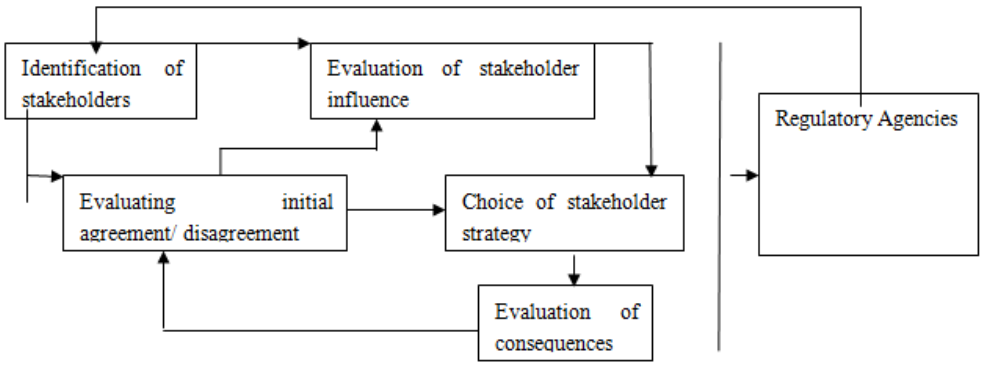

Figure: 2.1 Model for Evaluating Stakeholders Influence on Project Process
Source: OLander (2003)

Previous researchers were investigated on stakeholders' involvement in PPP: Bingham (1994) what does the public really think; Dunn et al. (2000) a systematic approach to community relation for the next millennium; Ernzen and Woods (2001) Contractor-led public relations on a design-build highway project; Hansen & Jackson (2001) redefines community engagement. Transport Res Record; Howard/Stein-Hudson Associates, Inc. (2003) Public involvement program for Northern Sub-Area Study & GA 400 Corridor Analysis; Plank et al. (1997) Public involvement helps supply project succeed; Sherman (2001) Effective use of public involvement to achieve aesthetic quality in bridge design; and Sinclair et al. (2003) Public involvement flood management in the Red River basin.

PPP Stakeholders' Satisfaction

In order to investigate on the PPP Stakeholders' Satisfaction, case studies of 12 PPP infrastructure projects in Niger-Delta region of Nigeria. The 12 notable PPP infrastructure projects identified in Niger Delta region are 2 airports, 3 power plants, 2 hotels, a hospital, a science park, a resort, a farm and a modern motor park and transit. These projects were located within the 3 sectional areas of the region. They were grouped into six categories: Agriculture, Energy and Power plants, Hospital and health care, Hotels and resort, Technology and Transportation.

What stakeholders considered as the criteria to measure the satisfaction level varies from one stakeholder to another. Consequently, their level of satisfaction varies per project. . The

granting authority, usually a government agency considered satisfaction in terms of the project met the quality specification; function as intended; completed as schedule; and benefiting the end users. The promoters / investors considered satisfaction in terms of the project finance itself; high level of users demand for the services; return on capital Invested; and minimum operation/ maintenance cost. The end users view the satisfaction in terms of involvement of the host community from inception till operation; improve standard of living of the host community; serve as means of employment; and a source of relief but not to add to their stress.

METHODOLOGY

Qualitative approach based on interview was adopted in this paper the reason is to have direct contact with the group of stakeholders of the 12 case studies PPP projects in the region. The semi-structured interview was conducted through vis-à-vis with 5 interviewees per identified PPP infrastructure project given a total of 60 interviewees on the completed identified 12 PPP infrastructure projects in the region. Among these 60 interviewees, 41 were directly affiliated with the identified infrastructure projects while 19 had indirect involvement in any of the infrastructure projects but are users of one facility or another. The information obtained during the interview sessions were analysed and evaluated following the principles of Content analysis.

FINDINGS AND DISCUSSIONS

Characteristics of the Interviewees

Table 1 shows the characteristics of the interviewees in terms of their, status, organization and designation. The respondents interviewed cut across all the stakeholders of the identified infrastructure projects. 15 interviewees were from the public sector (9 from State PPP Directorates and 6 from NDPHCN); 26 were from private sectors (investors); and 19 were end users (2 were clan heads, 3 were ex-militants, 6 were market women and 8 were youth). The interviewees from public sectors and private organizations had a range of different professional backgrounds: Project Management; Quantity Surveying; Architecture; Civil / Structural Engineering; Electrical Engineering; Mechanical Engineering; Building Construction; Business Administration; and Facility Management. The users interviewed were Clan Heads; Traders; Students in schools; and Students out of school.

The interviewees revealed that the level of satisfaction of the stakeholders varies and what each stakeholder considered as the criteria to measure the satisfaction level also varies. The government officials (state PPP directorates) considered satisfaction in terms of the project met the quality specification; function as intended; completed as schedule; and benefiting the end users. The promoters / investors considered satisfaction in terms of the project finance itself; level of users demand for the services; return on capital Invested; and minimum operation/ maintenance cost. The end users view the satisfaction in terms of involvement of the host community from inception till operation; improve standard of living of the host community; the project serve as means of employment; and a source of relief but not to add to their stress. The 12 notable PPP infrastructure projects were: 2 Airports; 1 Agriculture; 2 Hotels: 1 Business Resort; 1 Hospital & Healthcare Facility; 3 Power Plants; 1 Science and Technology Park; and 1 Modern Motor Park & Transit. The characteristics of the interviewees in terms of their, status, organization and designation is shown in table 1 above. The respondents interviewed cut across all the stakeholders of the identified infrastructure projects. Fifteen interviewees were from the public sector (9 from State PPP Directorates and 6 from defund NDPHCN); twenty-six were from private sectors (investors); and 19 were end users (2 were clan heads, 3 were ex-militants, six were market women and 8 were youth)

Table 1: Background Information of the Interviewees

S/No	Respondents	Rank	Background/ profession	Organization	Qty
1	Public Sector	Project Directors	Architect	State PPP Directorates	3
			Electrical Engineering	NDPHCN	2
			Mechanical Engineering	NDPHCN	2
			Civil Engineering	State PPP Directorates	3
		Senior Quantity Surveyors	Quantity Surveying	State PPP Directorates	3
		Administrative officers	Business Administration	NDPHCN	2
2	Promoters	Project manager	Civil Engineering	Private sector	8
			Mechanical / Electrical Engineering	Private sector	2
		Managing Partner	Architect	Private sector	4
			Civil Engineering	Private sector	2
			Quantity Surveying	Private sector Private	2
		Managers	Facility Management	sector	1
			Farm manager	Private sector	1
			Poultry technician	Private sector	2
			Veterinary doctors	Private sector	1
			Building Technology	Private sector	1
			M& E Engineering	Private sector	2
3	Clan Heads	Clan Head Uyo	Traditional ruler	Traditional ruler	2
		Clan Head Okon town	Traditional ruler		
4	Ex-militants	Member MEND	Ex-militants	Ex-militant	3
		Member JRC	Ex-militant		
5	Market Women	Trader s	Business Women	Traders	6
6	Youths	Youths	Student- in-School	University/ polytechnics	5
			Student- Out-Of-School	Drop out students	3
	Total				**60**

Ogwashi-Uku poultry farm Asaba; the interviewees involve one government official from the state PPP directorate, three private sectors (investors) and one user. The government official comments that he was highly satisfied with the poultry farm project based on its functionality. He comments that the poultry farm is function as intended while in terms of whether or not benefiting the end users, He said that it really benefiting the users. The investors were highly satisfied with the poultry farm in terms of its functionality and users' demands. They comments that the poultry farm is producing 1,000 crates of eggs daily and the farm feed mill is producing 25 tonnes of feed daily. While In terms of the user's demand, they said that the user's demands are highly encouraging, the distributors evacuate daily products of the farm very day. They agreed that the projects would be self sustaining as it could generate about N20 million monthly. The end user was highly satisfied with the farm products. He said that the farm had boosted economic activity in the community, provides a daily means of income to young people in the area and reduce the crime rate in the community to the beeriest minimum. Therefore, it can be concluded that the stakeholders were highly satisfy with Ogwashi-Uku poultry farm.

Ibom power plant Ikot Abasi; the interviewees comprises two government officials from the defund Niger Delta Power Holding Company (NDPHC) a division of Power Holding Company in charge of power distribution and importation of equipments for Niger Delta region of Nigeria, two investors and one user. The government officials comment that they were highly satisfied with Ibom power plant. In terms of the functionality of the plant, they comments that the Ibom power plant is function as intended. In terms of whether or not benefiting the end users, they agreed that it is really benefiting the users. The investors were highly satisfied with the power plant in terms of its location, source of the gas for the generating of the electricity and functionality of the plant. They agreed that the plants met the quality specification and function as intended. It was reveal that the gas turbans installed at

Ibom power plant were all good and working to the capacity. The end user was highly satisfied with the power plant. He said that there is slightly improvement in electricity supply in the state. Although, the power generated is integrated on to the national grid, He said that the power plant has creates employment to the people of the state and some people from other parts of the country. It can be inferred that the stakeholders were highly satisfy with Ibom power plant.

Omothoso power plant Ore; the interviewees consist of two government officials from the defund NDPHC, two investors and one user. The government officials agreed that they were highly satisfied with the power plant. In terms of the functionality of the plant, they comments that the plant is function as intended and benefiting the end users. The investors were highly satisfied with the power plant in terms of its location, source of the gas for the generating of the electricity and functionality of the plant. They agreed that the plants met the quality specification and function as intended. It was reveal that the gas turbans installed at the power plant are not working to the capacity due to the fact that only 2 of the 5 installed turbans are good the remaining 3 are scrap. They blame the NDPHC for the importation of such turbans. The 3 turbans need total overhauling. The end user was satisfied with the power plant. He said that there is slightly improvement in electricity supply in the state due to the fact that the power generated is integrated on to the national grid. He said that the power plant has creates employment to some people. It can be inferred that the stakeholders were satisfy with Omothoso power plant.

Sapele phase II power plant (Ogorode Generating Company); the interviewees involve two government officials from defund NDPHC, two investors and one user. The government officials comment that they were highly satisfied with Sapele power plant. In terms of the functionality of the plant, they comments that the power plant is function as intended while in terms of whether or not benefiting the end users, they agreed that it is really benefiting the users. The investors were highly satisfied with the power plant in terms of its location, source of the gas for the generating of the electricity and functionality of the plant. They agreed that the plants met the quality specification and function as intended. It was reveal that the gas turbans installed at Sapele power plant were all good and working to the capacity. The end user was highly satisfied with the power plant. He said that there is slightly improvement in electricity supply in the state. Although, the power generated is integrated on to the national grid, He said that the power plant has creates employment to the people in the state. It can be inferred that the stakeholders were highly satisfy with Sapele power plant.

The interviewees on Calabar hospital and healthcare facility consist of one government official from state PPP directorate, two investors and two users. The government official comments that she was somehow satisfied with the Calabar hospital and healthcare facility. In terms of the functionality of the hospital and healthcare program, she comments that the hospital and healthcare program is function as intended while in terms of whether or not benefiting the end users, she said that it extremely benefiting to the people of Cross River state and people from other parts of the country comes for medical assistance especially on eyes cataracts since treatment is free, the patient pays for the drugs at a reasonably subsidized price. The investors were somehow satisfied with the healthcare program because the government could not really fulfill her part of the agreement. Although the market demand is high and the patient are willing to pay for the drugs at subsidized price. The patients/users agreed that they were satisfied with the quality of treatment and services provided at the hospital. Although, its takes a whole day to see consultant doctor due to very high numbers of patients patronizing the hospital. It can be inferred that the stakeholders were somehow satisfy with Calabar hospital and health care facility project.

Ibom Le Meridien hotel Uyo; the interviewees involve one government official from the state PPP directorate, two investors and two users. The government official comments that she was highly satisfied with the hotel and the international standard golf course makes the hotel a very unique one in Nigeria. In terms of the functionality of the hotel, she comments that it is function as intended while in terms of whether or not benefiting the end users, she said that the hotel is really benefiting the users. The investors were highly satisfied with the whole concept of the hotel and golf course. They agreed that the hotel is function as intended and the market demand for reservation is highly encouraging. People come from various part of the country for reservation and holds conferences / annual general meetings of various professional bodies. They unanimously agreed that the projects would be self sustaining. The end users were highly satisfied with the Ibom Le Meridien hotel. They agreed that the hotel has creates employment to the people of the state. The market women leader at Uyo main market comments on the Le meridien hotel Uyo as being highly attractive but not for market women or middle class set of people. Although she stated that she had attended some government functions at the pavilion of the hotel. Therefore, it can be concluded that the stakeholders were highly satisfy with the Ibom Le Meridien hotel.

The interviewees on Le Meridien Ogeyi palace hotel Port Harcourt comprise one government official from the state PPP directorate, two investors and two users. The government official comments that he was highly satisfied with the hotel based on its functionality and meeting international standard. In terms benefiting the end users, he said that the hotel is really benefiting the users. The investors were highly satisfied with the level of users' demands for the hotel. They agreed that the hotel is function as intended and the market demand for reservation is highly encouraging. People come from various part of the country for reservation and holding of conferences. The end users were highly satisfied with the hotel. They agreed that the hotel has creates employment to the people of the state. Therefore, it can be inferred that the stakeholders were highly satisfy with the Le Meridien Ogeyi palace hotel Port Harcourt.

Tinapa business resort Calabar; the interviewees involve one government official from the state PPP directorate, two investors and two users. The government official comments that she was highly satisfied concept of the business resort and the beauty the resort is adding to the state. At the same time he was not satisfy with the current situation of the business resort in terms of its functionality and whether benefiting the users. He comments that currently the resort is neither not function as intended nor benefiting the end users. He added that the resort benefiting no one presently because no business activity is going on there. The investors were not satisfied with the current situation of the resort. Although, it was successfully completed and highly attractive but making no returns because there is no business activity there. They agreed that the resort is not function as intended and the market demand is zero. The end users were dissatisfied with the Tinapa business resort. They agreed that no business is taking place in the business resort currently. A market women comment bitterly that the resort is like ghost area. She called on both the federal to assist the state government to resuscitate the resort Therefore, it can be concluded that the stakeholders were dissatisfy with the tinapa business resort.

The interviewees on Uyo science and technology park involve one government official from the state PPP directorate, two investors and two users. A top government official comments that she was not satisfied with the current situation of the science and technology park because it neither functions as intended nor benefiting the end users. She further comments that the concept the science and technology park was good and would have boosted the standard of living of the people in the state if not due to game of politics. The investors were not satisfied with the current situation of the science and technology park. Although, the

phase one was successfully completed and fully equipped and commissioned. But doe to game of politics or political reason the nothing takes place and the whole place is under lock. The end users were dissatisfied with the science and technology park. They agreed that no business is taking place and place is under lock. Therefore, it can be deduced that the stakeholders were dissatisfy with the science and technology park.

The interviewees on Akwa Ibom international airport involve one government official from the state PPP directorate, two investors and two end users. The government official from the state PPP directorate was highly satisfied with Akwa-Ibom airport projects. He based his comment on the whole concept of the airport in terms of meeting the international standard, contain both training and maintenance sections that turns Akwa Ibom into a regional hub for aviation. In terms of the functionality of the airport, his comment was that the airport project functions as intended. In terms of whether or not benefiting the end users, he lamented that it is really benefiting the users. The investors were highly satisfied with the airport in terms of its functionality and user's demands. They agreed that the airport is function as intended and the user's demands are highly encouraging because on daily bases airlines connecting Uyo - Lagos and Uyo - Abuja and vice versa at the airport. The end users were highly satisfied with the airport projects. They agreed that they were relieved from going to Calabar to board airplane. They further agreed that the airport has creates employment to the people of the state and some people from other parts of the country. The airport has being a great source of relief and means of employment. They appeal to the state government to complete the remaining aspect of the second phase in order to connect directly from Akwa-Ibom state to UK and the rest of the world to fulfill being a real international airport. It can be deduced that the level of satisfaction of the stakeholders with Akwa-Ibom International Airport is high as they were indicated in their comments.

The Asaba International airport; the interviewees involve one government official from the state PPP directorate, two investors and two users. The government official comments that he was highly satisfied with airport projects. In terms of the functionality of the airport, he comments that the airport project is function as intended while in terms of whether or not benefiting the end users, he said that the airport is really benefiting the users. The investors were highly satisfied with the airport in terms of its functionality. They comments that the airport is function as intended while In terms of the user's demand, they said that the user's demands are highly encouraging and that on daily bases airlines connecting Asaba - Lagos and Asaba - Abuja and vice versa at the airport. The end users were highly satisfied with the airport projects. They agreed that they were relieved from going to Owerri to board airplane. Furthermore, they also agreed that the airport has creates employment to the people of the state and some people from other parts of the country. Therefore, it can be concluded that the stakeholders were highly satisfy with Asaba airport.

The interviewees on Itam motor park and transit involve one government official from the state PPP directorate, two investors and two users. The government official comments that he was highly satisfied with the Itam park and transit based on its functionality and concept of modern motor park and transit. The Itam park is divided into three segments: AKTC, Lagos and local park In terms of whether or not benefiting the end users, he said that it is really benefiting the users. The investors were highly satisfied with the level of users' demands in terms of patronages. They agreed that the Itam park and transit is function as intended and the users' demands are highly encouraging. About 50 buses of 14 passengers travel from AKTC section of Itam motor park to various parts of the country. The end users were highly satisfied with the facilities at Itam motor park and transit. They agreed that the fare is fairer at AKTC park than the other segment of the park called Lagos park. Therefore, it can be inferred that the stakeholders were highly satisfy with the Itam motor park and transit.

CONCLUSIONS

It is a known fact that Nigeria main source of economy is crude oil, located within the Niger-Delta region. Despite this relative oil wealth, it is evidence that the region is peculiar with fewer infrastructural facilities and those that were available are in bad condition especially in the oil exploration areas within the region. Therefore, mush infrastructure is needed in the region and the government alone cannot provide the entire needed infrastructure. The government needs collaboration with the private investors in order to give the region uplifted phase value. The results of this research will provide a useful tool for rapidly understanding between the three stakeholders of PPP infrastructure project. Hence, for stall cordial relationship and satisfactory security needed for investment. Finally, The Involvement of the beneficiary community in the implementation and delivery of infrastructure projects is recommended. In order to let the end-users know the benefits and challenges of investment in PPP infrastructure projects in the region as well as having sense of belonging in the projects. This increased confidence and capacity of individuals or groups and also build mutually supportive networks that hold communities together. Collaboration involves an attempt to work with the other person to find a win-win solution to the problem in hand - the one that most satisfies the concerns of both parties. The win-win approach sees conflict resolution as an opportunity to come to a mutually beneficial result and forestall satisfactory security needs for investment in the region.

Confident-building measure through establishment of forum between the private and public sectors and end users' to discuss economic impact and social value of the infrastructure projects for growth, determination of the priority of the infrastructure projects and the challenges. The decisions are taken immediately in order to make effective resolution. This kind of partnership between the government, private sector and end users' will improve the investment climate in Niger-Delta region or any other conflict zone.

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An Appraisal of Performance Measurement Practice of Construction Firms in Nigeria

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ABSTRACT

Performance measurement (PM) is crucial to the construction industry (CI) in order to improve the performance of the industry and most importantly as a tool for continuous improvement. Unfortunately, unlike several CI in the West, especially in the UK, US, Chile and Brazil, most firms in Nigerian CI are still holding on to the traditional approach to PM which has been widely criticised. The study appraised the PM practice of construction firms in Nigeria. A questionnaire survey was conducted on randomly selected small and medium sized construction firms in Abuja, Nigeria. A total of 50 questionnaires were distributed and 23 were returned and used for analysis. Data were analysed using the descriptive statistics method including tabulation, percentages and charts. The results of the study revealed that most construction firms are interested in how they perform and do measure their performance. The study also shows that most of the construction firms still rely on financial measures (which has been highly criticised). Findings from the study also indicate a low awareness/implementation of PM and PM concepts. The most adopted PM framework was found to be the Balanced Scorecard. It is recommended that proper documentation and efficient information system of construction firms' overall function be encouraged within the Nigerian Construction Industry.

Keywords: Performance measurement, Continuous improvement, Performance measurement frameworks

INTRODUCTION

The construction industry (CI) is a fundamental economic sector that permeates most of the other sectors as it transforms various resources into physical, economic and social infrastructure necessary for socio-economic development (Ministry of Works, 2003). In Nigeria, the industry occupies an important position in the economy and has great potentials of becoming one of the biggest construction markets yet; it contributes less than other industries (Aibinu and Jagboro, 2002; Construction Overview, 2011). The Nigerian Construction Industry (NCI) contributes only 3.2% to the Gross Domestic Product (GDP) which is very low (Dantata, 2008; Construction Overview, 2011).

The performance of the CI has considerable impact on the economy (Bon-Gang and Fan, 2010). The industry, globally, has been under tremendous pressure to improve its performance and several calls have been made in this regard (Kulatunga et al., 2005). In Nigeria, the NCI is faced with problems such as construction delays, time and cost overruns, abandonment of projects at various stages of completion, lack of skilled local labour, power shortage, unavailability of materials, corruption, unethical practices and lack of capacity to deliver (Aibinu and Jagboro, 2002; Dantata, 2008; Kolo and Ibrahim, 2010; Ayodele et al., 2011; Oyewobi et al., 2011). The industry suffers the problems of inefficient policies and practices, weak institutions and adverse business environment, alongside complex social and cultural practices (Aniekwu and Audu, 2010). The performance of the industry has been a concern to its stakeholders who have called for improvement in its performance (Okuwoga, 1998; Aibinu and Jagboro, 2002; Kolo and Ibrahim, 2010).

One of the key areas identified for the improvement of the construction industry's performance is the area of performance measurement (PM) (Latham, 1994; Egan, 1998;

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Bassioni et al., 2004). According to Mbugua et al (1999), Baldwin et al (2001), Wegelius-Lehtonen (2001) and Martinez (2005), PM is vital for continuous and progressive improvement in most businesses and organisations. PM is defined as 'the quantification of efficiency and effectiveness of past actions by means of data acquiring, collection, sorting, analysing, interpreting and disseminating (Neely et al., 1998).

The call for improvement in the construction industry and interest in PM led to its adoption by several countries. The UK construction industry adopted PM in its agenda leading to the implementation of PM by several construction firms (Lattifi et al., 2001; Bassioni et al., 2004). In Nigeria, the Public Procurement Act of 2007 was formulated to improve the performance of the NCI. Performance measurement has evolved through the years (Wilcox and Bourne, 2003). PM in its early phase involved the use of financial measures such as profit, return on investment and productivity (also known as traditional measures) and was heavily criticised for been misleading, difficult, confusing and also hindering continuous improvement (Ghalayini and Noble, 1996).

Over the last few decades, there was a paradigm shift since it was apparent that the use of financial measures alone was not enough to manage modern organisations (Wilcox and Bourne 2003; Khan and Shan, 2011). Several frameworks containing non-traditional measures were developed to counter the limitations of the traditional measures. They include European Foundation for Quality Management (EFQM), Balance Scorecard and Performance Prism.

Construction firms within the construction industry benefit a lot from PM practice when they evaluate their current performance and then identify strategies to maintain good performance in the future. PM also helps organisations achieve their goals and objectives, be more competitive and successful (Backinsell, 2001; Bassioni et al., 2004). Although construction firms derive several benefits from measuring their performance, PM has not been widely implemented and information on the performance of the construction industry is scarce (Costa et al., 2004). Another setback for PM practice is that most construction firms still depend on traditional measures that focuses on profitability, efficiency and return on capital which has been criticised severally (Kagioglou, 2001; Bassioni et al., 2004).

RESEARCH METHOD

The study appraised the PM practice of construction firms in Nigeria. The scope of the study was limited to construction firms in the Federal Capital Territory of Nigeria, Abuja. The quantitative approach using questionnaire survey was used for this study to allow for respondent's convenience and high response rate (Statistics Canada, 2010). The sample survey approach for data collection was adopted and used to collect data on PM from a sample of construction firms in Abuja.

The data were collected through a well-structured questionnaire. The questionnaire was first piloted before it was finally administered to the construction firms. The population for the study is construction firms (mainly small-size and medium-size as outlined by Odediran et al., 2010) in Abuja. Abuja was selected due to the on-going development and unprecedented growth that has led to massive construction work and influx of people from all over Nigeria in the last 36 years (Jubril and Garba, 2012).

Questionnaire was administered to 50 construction firms through random sampling technique based on the list of registered construction firms in Abuja. 23 copies were retrieved representing a response rate of 46% as shown in Table 1. The response rate of 46% is acceptable and is a little above what is obtainable based on the opinions of Chinyio et al

(1999); Akintoye (2000); Dulami et al (2003) and Takim et al (2004). They all reported that in the construction industry, the response rate of 20-30% is what is usually obtainable for questionnaire survey (Akadiri, 2011)

The data collected were analysed using the descriptive statistics method. The descriptive statistics method is the simplest method of analysis that provides a general overview of the results and also gives an idea of what is happening and analyses survey percentages, actual numbers (totals), averages and proportions (Naoum, 2007; Statistics Canada, 2010).

Table 1 Questionnaire rate of response

Respondents	Questionnaires issued	Responses	% Response
Construction firms	***50***	**23**	**46%**

RESULTS AND DISCUSSIONS

Construction Firms' interest in Performance

22 construction firms representing 96% responded that they are interested in measuring their performance; while 1 construction firm representing 4% responded that they are not interested in measuring their performance. When further probed, the respondent responded by saying 'the organisation is only interested in profit and nothing else'. Profit (a financial measure) is a performance measure; meaning, that organisation relies on only financial measure.

The construction firms further responded that they are interested in measuring performance due to various reasons as shown in Table 2. Responses show that construction firms measure their performance due to two major factors; to improve future performance (26.6%) and to sustain competitiveness (20.3%) as shown in the table below.

Table 2 Reasons for organisations' interest in performance

Reasons for interest in performance	Frequency	Percentage
In order to survive	*7*	*10.9%*
Improved future performance	*17*	*26.6%*
Attract future investment	*8*	*12.5%*
Increase share value	*8*	*12.5%*
Attract higher calibre of employees	*3*	*4.7%*
Sustain competitiveness	*13*	*20.3%*
Survive in national and international markets	*8*	*12.5%*

Performance measurement (PM) practice

91% of construction firms admitted that they do measure their performance while 9% responded that they do not measure their performance. However, out of the two organisations that do not measure their performance; one of the organisations responded they are only interested in profit. It is possible that those firms who responded 'no' do measure their performance (since profit is a performance measure) but rely mainly on financial measures such as profit, quality and specification. When construction firms were asked if their organisation have PM in their policy or mission statements, 78% of respondents say they do even though this cannot be proven by this researcher based on the research instrument used.

Globally, several factors led the construction industry to begin to measure its performance. In this research, one of the major factor that led construction companies to measuring their performance is 'increasing global competition' (31.25%) as shown in Table 3. Other notable ones are; changing nature of work (18.75%) and power of information technology (18.75%).

Performance Measures and adoption

Several researchers have identified PM and have been adopted by several construction industries. In this research, construction firms responded that they adopted PM such as quality

(13.24%), turnover (11.03%), delivery (11.03%), profit margin (7.35%), cash flow (7.35%) and very few non-financial measures like client satisfaction (10.29%). The result is summarised in Table 4 below.

Table 3 Factors responsible for measuring performance

Factors	Frequency	Percentages	Rank
Changing nature of work	*9*	*18.75%*	*1*
Increasing global competition	*15*	*31.25%*	*2*
Changing organisational roles	*8*	*16.67%*	*3*
Changing external demands	*7*	*14.58%*	*4*
Power of Information Technology	*9*	*18.75%*	*1*

Table 4 Performance measures used by construction companies

Performance measures	Frequency	Percentages	Rank
Quality	*18*	*13.24%*	*1*
Cash flow	*10*	*7.35%*	*4*
Employee satisfaction	*7*	*5.15%*	*6*
Specification	*7*	*5.15%*	*6*
Leadership	*3*	*2.21%*	*8*
Capabilities (Technology, Infrastructure)	*4*	*2.94%*	*7*
Cost	*9*	*6.62%*	*5*
Turnover	*15*	*11.03%*	*2*
Market share	*4*	*2.94%*	*7*
Innovation	*7*	*5.15%*	*6*
Customer satisfaction	*14*	*10.29%*	*3*
Profit margin	*10*	*7.35%*	*4*
Customer loyalty	*7*	*5.15%*	*6*
Number of customer complaint	*3*	*2.21%*	*8*
Stakeholder satisfaction	*3*	*2.21%*	*8*
Delivery	*15*	*11.03%*	*2*

Construction firms responded that 52.4% get their measures from existing PM frameworks, 23.8%get theirs from strategy and policy and 23.8% also get theirs from both frameworks and strategy/policy as shown in Table 5 below.

Table 5 Sources of Construction Firms' Measures

Sources of Performance Measure	Frequency	Percentages
From the organisation's strategy/policy	*5*	*23.8%*
From existing performance frameworks	*11*	*52.4%*
From both organisation's strategy/policy and existing frameworks	*5*	23.8%

In order to consider a performance measure adoptable by a construction firm, it must possess certain attributes. The two most common attributes a performance measure based on the response from this study are; reliability (22.8%) and credibility (21.5%) as shown in the Table 6 below.

Table 6 Attributes of Performance Measures

Attributes of Performance Measures	Frequency	Percentage	Rank
Validity	*12*	*15.2%*	*4*
Responsiveness	*9*	*11.4%*	*5*
Abuse-proof	*4*	*5.0%*	*7*
Reliability	*18*	*22.8%*	*1*
Credibility	*17*	*21.5%*	*2*
Functionality	*13*	16.5%	*3*
Availability	*6*	7.6%	*6*

Construction firms were asked if their performance measures adopted. 81% of organisations responded they do undergo periodic review while 19% do not at all.

The time frame for this periodic review is quarterly (47.1%), yearly (29.4%) and the least is monthly (23.5%).

Benefits of measuring performance

The major benefits of measuring performance according to respondents are in accountability (14%), control (14%) and improvement in productivity (15%).

Table 7 Benefits of measuring Performance

Benefits of measuring Performance	Frequency	Percentage	Rank
Accountability	*13*	*14%*	*2*
Profitability	*12*	*13%*	*3*
Achievement of objectives and strategy	*10*	*11%*	*4*
Control	*13*	*14%*	*2*
Track progress	*12*	*13%*	*3*
Strategy formulation	*9*	10%	*5*
Long term competitive advantage	*9*	10%	*5*
Improvement in productivity	*14*	15%	*1*

PM Frameworks

The awareness of existing PM frameworks is important in order to select the most appropriate ones to use. 71% of construction firms responded that they are aware of existing PM frameworks (even though awareness may not imply usage of same) while 29% lacked awareness.

Respondents were asked to tick the frameworks they know and mention other ones not listed in the questionnaire. The three most popular frameworks used by construction companies are performance measurement matrix, balanced scorecard and the performance pyramid as shown in Table 8.

Table 8 Known existing PM framework

Existing framework	Frequency	Percentage	Rank
Performance measurement matrix	*10*	*35.7%*	*1*
Balanced scorecard	*8*	*28.6%*	*2*
Performance pyramid	*8*	*28.6%*	*2*
Performance prism	*0*	*0%*	*4*
European Foundation for Quality Management Model (EFQM)	*2*	*7.1%*	*3*

In terms of the adoption of these existing PM frameworks, 79% construction firms responded that they've been able to adopt them while 21% are yet to adopt them.

The most adopted PM framework by construction firms is the balanced scorecard representing 40%. Next to the balanced scorecard is the PM matrix with 35% representation.

Table 9 PM frameworks adopted

Adopted PM Framework	Frequency	Percentage	Rank
Performance measurement matrix	*7*	*35%*	*2*
Balanced scorecard	*8*	*40%*	*1*
Performance pyramid	*5*	*25%*	*3*
Performance prism	*0*	*0%*	*4*
European Foundation for Quality Management Model (EFQM)	*0*	*0%*	*4*

Challenges associated with PM implementation

When asked to outline the challenges associated with PM implementation in their organisation, some of the construction firms outlined the below as some of the challenges associated with PM implementation as summarised in the table below. Some of the firms did not outline any challenge.

DISCUSSION

The study appraised the PM practice of construction firms in Nigeria. The result of the research shows that most construction firms are interested in their performance and the most common reason for this interest is to improve future performance. This result agrees with Love and Holt (2000) and Backinsell (2001) who pointed out there is so much interest in performance especially within the construction industry.

On whether the construction firms measure their performance or not, 91% of them do measure their performance and the major reason for measuring performance is due to increasing global competition. This also agrees with some of the reasons for PM outlined by Lee et al (2000). The study also established that most of the construction firms still relied on traditional or financial performance measures as earlier established by Kagioglou (2001) and Bassioni et al (2004).

Table 10 Challenges associated with PM implementation

Challenges associated with PM implementation
Inconsistent profit margin
customer disloyalty
Lack of adequate cash flow
Employee dissatisfaction
Type of organisation's leadership
Difficulty in data collection for evaluation,
Time involved in evaluating performance,
Lack of skilled personal who can measure performance
Lack of reliable structure in place
Inability to deliver
Uniqueness of clients/clients' needs and
Lack of technical know-how among personnel
Lack of proper documentation and malpractices
Client's demands and meeting up with global trend
Data collection
Diversity in customers/clients need
High competition
Inefficient information system
Collection of data needed for excellent evaluation
Difficulty in collection of data
Lack of interest in measuring performance
Lack of proper sourcing of data
Improper recording of information
Communication problem

The most common measures adopted are; quality and delivery. The study also shows that the two most common attributes a performance measure must possess is reliability and credibility and one of the benefit of measuring performance is improved productivity. In the area of awareness of existing PM frameworks, about 71% of construction firms are aware of them and the most known framework is the PM matrix while the most used or adopted framework is the Balanced Scorecard.

This result agrees with what Kulatunga et al (2006) and Khan and Shah (2011) stated in their works that the Balanced Scorecard is the most popular PM framework in terms of adoption. Some of the challenges construction firms face in the implementation of PM are; difficulty in data collection, lack of reliable structure in place, lack of proper documentation, communication problem and uniqueness of clients' need. Some of these challenges agree with Costa et al (2004) assertion in the area of scarcity of information.

The study concluded that a lot still needs to be done in the area of PM practice among construction firms in Nigeria.

SUMMARY

In summary, the study appraised the PM practice of construction firms in Nigeria and the following as major findings:

i. Majority of the construction companies are interested in how they perform and actually measure their performance.
ii. Only a few of the construction firms have understanding on PM concepts.
iii. The most used performance measures are the traditional measures (which has been highly criticised) with few adopting the non-traditional measures.
iv. The most popular and most used framework is the Balanced Scorecard.
v. Most construction firms are faced with certain challenges when implementing PM. Some of these challenges are; lack of proper documentation, lack of reliable structure in place and lack of technical know-how among personnel.

CONCLUSION

In conclusion, the study shows that construction firms have high interest in their performance and do actually measure their performance. However, the awareness of PM and its concepts are still low with no structure on ground to guide. The lack of proper and adequate data documentation and also reliance on financial measures in most construction firms is evident in the course of the research. Finally, the most adopted PM framework is the Balance Scorecard.

RECOMMENDATIONS

i. Construction firms should be trained on ways of properly documenting their data and subsequent access to these data.
ii. There need to be more awareness of PM and its concepts among construction firms.

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Project Risk Factors Effects on Civil Construction Cost in the Niger Delta Region Contractors' and Consultants' Perspectives

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ABSTRACT

Risk is associated with every human endeavour. Project risk has been viewed from different perspectives which can determine the outcome of a successful project apart from other variables which include cost, time and quality. This study aims at evaluating the effects of project risk factors on civil construction cost accuracy from contractors' and consultants' perspectives with the view to achieving the overall project success in terms of cost performance. In order to achieve this aim, the objectives of the study are to identify and evaluate the effects of project risk factors responsible for inaccurate prediction of civil construction cost in the Niger Delta Region of Nigeria. Extensive literature review was carried out to assess the risk factors affecting civil construction cost. Based on the comprehensive assessment of the risks, twenty-five (25) factors were identified. A purposive survey of 36 valid responses comprising 18 contractors and 18 consultants was carried out with structured questionnaire. Data obtained were analysed using Percentile and Relative Importance Index (RII).The results revealed that ten factors have very high significant effect on the cost of civil construction projects. This study also revealed that there is high agreement between contractors` and consultants' perceptions of the effect of the risk factors on civil construction cost. This study therefore recommends that contractors and consultants should focus on risks related to cost, resource management, elements of construction sustainability, construction environment as an effective management and control tools to bringing risks on civil construction projects to the barest minimum and enhance the possibility of attaining good success on the overall construction cost delivery.

Keywords: Construction Cost, Consultants, Contractors, Cost Delivery, Risk Management

INTRODUCTION

Civil construction projects involve large capital outlay, complex contractual arrangement, unbalanced cash flow and inflation. This is majorly due to changes in economic, financial, political and environmental activities resulting in regulatory policies. All these bring with them some element of risks. The way and manner these risks are managed is very important as the success and failure of any project depend on it.

Risk management forms one of the nine management areas in the project management body of knowledge by the Project Management Institute (PMI, 2008). This is key as every human endeavour is associated with one form of risk or the other and construction activity is not excluded especially civil construction projects. Risks play a significant role in decision making and may affect the project performance in construction projects.

According to Oyegeko and Phen, (2006), construction projects are always unique and element of risk emanate from different sources, dynamic and complex and gives room for multiple processes in terms of feedback (Uher, 2006).

There are major variables that play vital roles in the successful completion of any construction activity. These include cost, time and quality. Most times, these factors are influenced by some elements of risk especially cost. Cost is the bedrock of any development

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project as it is inevitable to achieve any project without an element of cost. It becomes imperative to ensure that cost is well understood at the planning stage before implementation.

Cost is risky when there is no total consideration. Cost of risk is a concept that has not been considered by many construction industries despite the fact that it is the factor that is most expensive (Cavignac, 2009). Different project stakeholders have different skills and expertise that are determinants to the outcome (Dey, 2004). It then means that, risk management will help project stakeholders (client, contractor, consultant, supplier and beneficiaries) meet their set goals and bring to the barest minimum the negative impacts on construction success in term of cost, time and quality.

A lot of researchers have highlighted the causes of risks factors in construction projects, life cycle, environmental factors but little research has probed effects of risks from the contractor's and consultant's perspectives to enable evaluate these factors and minimise or eliminate them from the feasibility study stage of the project.

This study seeks to evaluate the effects of risk factors viewed from the contractors' and consultants' on cost of civil construction projects in the Niger Delta Region of Nigeria with the administration of questionnaires. The region was well chosen as it is always characterized with a lot of construction activity per time. The factors so highlighted from the two perspectives will give a holistic view of how to tackle risk at every point in the projects life cycle.

LITERATURE REVIEW

Civil Construction Industry

The construction industry is a complex, heterogeneous and dynamic one with infrastructural development in the build environment fraught with risks and uncertainties. The problem multiply in size due to the nature of construction project (Dey, 2011, Dey and Ogulana, 2002)

These include buildings, civil, mechanical and electrical installations. Civil construction projects include; high-rise buildings, overpasses, bridges, tunnels, dams, reservoirs, rail tracks, swimming pools, hydro power etc. The success parameter for these developments is enshrined in cost, time and quality but these can be truncated along the project life cycle owing to some inclination of risk factors.

Impacts of risks on project strategies with respect to cost was the focus of Chen *et al.,* (2004), while Shen, 1997 looked at time while Tam et al 2004 related risk to safety. Other researchers viewed risk factors management for construction projects at the life cycle of the project. Project conceptual and feasibility phases were viewed by Uher and Toakley (1999), and design phase by Chaoman, 2001 and construction phase by Abdou, 1996

Risk Defined

The word 'risk' has been used differently by different researchers. Risk is defined as a combination of the probability, severity and exposure of all hazards of an activity (Jannadi and Almishari, 2003), hazards or uncertainty (Al-Bahar and Crandall, 1990), likelihood of occurrence and the degree of impact of a negative event adversely affecting an activity (Chapman, 2001), a threat to project success, where the final impact upon the success of the project is uncertain. According to Chitkara, (2011), risk is an abstract term, uncertain event, situation or condition which may occur. It may have a positive or negative effect on project objectives. Therefore, risk can be viewed as the potential for unwanted or negative impacts of an activity.

It can be generally recoginised among those within the construction industry as the phenomenon of continually facing a variety of situations involving many unknowns,

unexpected, frequently undesirable and often unpredictable. A newer definition defined risk as the chance of something happening that will have an impact on objectives positive or negative (Australia Standards, 2004). From all these definitions, authors have viewed risk as negative but some risks are beneficial. With these understandings, risk is bound to emanate from different sources.

Sources of risk in civil construction projects

According to Fidan et al., (2011), source of risk is defined as any factor that has a potential to cause harm to a project either owing to an adverse change from initial project conditions or expected situation. Construction projects risks is crucial in decision making and if not dealt with properly, can cause cost overrun, project time slip, fluctuation and loss/expense claims.. Project risks differ and different strategies should be used to minimise cost and time overruns.

Project's performance and success is being influenced by some variables as indicated earlier which has to do with time, cost and quality in beneficial or detrimental ways. According to Akinlola et al., (1997), these sources could be grouped as environmental, construction, operation, physical, political, legal, financial, design, logistic risks. Risk was also grouped as external and internal. Internal risks involve, design, contractual, financial, construction, personal and operational risks while the external risks has to do with environmental, economic, political, social, public, legal and logistic risks (Nguyen and Ogulana, 2007). Internal risks can be controlled by project managers while the reverse is the case for external risks.

Many methods exist on how to classify risk associated with construction projects. The PMI (2008) grouped as internal and external. The internal risks include; technical risks (government regulations, force majeure, labour stoppage, cash flow, and safety issue), non-technical risks (technology changes, state-of-the art changes, issues of operation, maintenance issues) and legal risks (licenses, patent rights, lawsuits, subcontractors' performance and contractual failures). External risks include; costs, borrowing and interest rates and availability of raw materials. These distinctions became necessary to enable manage or curb risks when they occur. As the saying goes, 'problem known is half solved'.

Cost – Related Risk

A lot of risks occur in the project life cycle and others by some factors in the cause of project execution. However risks occur, it is important to envisage before their occurrence. The table below suggests the different risk factors affecting cost of construction projects according to (Wiguna and Scott, 2005).

Table 1 shows that high inflation and increased price, design change by owner, defective design, weather condition and delayed payment of contractors were the first 5 factors that affected cost of construction projects.

Impact of risk

Australia Standards, (2004) has earlier defined risk as either positive or negative which can be seen as an event. Risk event therefore, can be best described as variations (increase or decrease) in quality and quantity of work, performance, productivity, project schedules in time, progress payment in terms of cost. The outcome of an event definitely has an impact or variance on the projects' objectives and delivery. The effects of risk factors were viewed by Al-Bahar and Crandall, 1990 and Zhang, 2007 with respect to projects' objectives such as cost, time, quality and safety.

Difference Between Risk and Uncertainty

Risk can be classified as beneficial or detrimental. Beneficial risk can enhance the achievements of the objectives of the project. Beneficial risks are called opportunities.

Detrimental risk: This may pose a challenge or adverse exposure to the achievement of the objectives of the project. Detrimental risks are called threats. Risks increase with hazards but can be decrease with safeguards.
Risk is quantitative while uncertainty is qualitative. Flanagan et al., 2006 and Mills, 2001 opined that risk and uncertainty can potentially have damaging effects for construction projects.

Table 1: Risk factors causing cost of construction projects

External and site condition	Mean of risk factor	Ranking	Economic and financial	Mean of risk factor	Ranking	Technical and contractual	Mean risk factor	Ranking	Managerial	Mean of risk factor	Ranking
Unforeseen site ground condition	0.4191	7	High inflation and increased price	1.4552	1	Defective design	1.1932	3	Defective construction work	0.3649	11
Weather condition	0.6979	4	Delayed payment on contract	0.5509	5	Design change by owner	1.2147	2	Low labour and equipment productivity	0.3288	12
Difficulty in obtaining permits and ordinances	0.0918	15	High interest rate	0.2142	14	Inadequatel y compensated variation order	0.3060	13	Inadequate project programme	0.3781	9
Changes in govt policies	0.0627	16	Poor cost control	0.3774	10	Delay in providing detailed drawing	0.4138	8	Problem with availability of labour, material and equipment	0.5266	6

Source: (Wiguna and Scott, 2005)

Risk Management

Management of risk in civil construction sense is a systematic way of identifying, analyzing, and dealing with risks associated with project with the singular aim of achieving the project objectives. Risk management is one of the nine knowledge areas by the Project Management Institute (PMI). The PMBOK Guide recognizes nine knowledge areas typical of almost all the project. These include:

i. Project integration management
ii. Project scope management
iii. Project time management
iv. Project cost management
v. Project quality management
vi. Project human resource management
vii. Project communications management
viii. Project risks management
ix. Project procurement management

PMI defined management of risk as the processes concerned with conducting risk management, planning, identification, analysis, responses, monitoring and control on a project.

In all the key areas, there are inherent characteristics, e.g. risk management has the following according to (PMI, 2008)

i. risk management and response planning
ii. risk identification, monitoring and control

iii. Qualitative and quantitative risk analysis

Risk identification

Several risk identification and assessment methods have been proposed to facilitate project risk management. The first step to risks management is risk identification.in which potential risks associated with construction projects are identified, (Akinci and Fischer, 1998, Zou et al., 2007) Several risk identification and assessment methods have been identified to facilitate project risk management. The proposed methods include risks checklists and risk breakdown structures are used to identify potential risks of projects.

Azhar et al., (2008) was able to identify 42 cost overrun factors and arranged them in three categories which include macro economies, management and business and regulatory environment. In this regard, Enhassi et al., (2009) identified 110 delay factors and causes which were classified into 12 groups which include time and cost overruns in Gaza construction projects.

Risks associated with projects also emanated from construction stakeholders which include Client, quantity surveyor, architect, structural engineer, services engineer, contractor and subcontractor, suppliers and external factors that caused project delays,(Aibinu and Odeyinka, 2006) Other risk factors can be project, client, contractor, design team related, material, labour, plant and equipment and external factors as asserted Kumaraswamy, 1996 in Hong kong. The author identified 83 factors and classified them into 8 categories. Others classified risk factors as it relates to finance, owner, contractor, consultant, project attributes, co-ordination and environmental problems, in Vietnam,(Long et al., 2004). Some were also grouped as an act of God, physical, financial, economical, design and job site related risks according to (Mustafa and Al-Baha, 1991). Frimpong et al., (2003) also identified some factors that caused delays and cost overruns.

Risk is associated with every human endeavour but effective risk management method can help understand not the kind of risks the project faces but how to manage these risk at all project phases.

It is a necessity in most industries and a set of techniques have been developed to control its effects (Baker and Reid, 2005 and Schuyler, 2001). Irrespective of the root causes of construction projects risks factors, there is need to assess these risks as it relates to the contractor and consultants as major stakeholders to enable project managers tackle risks factors that may affect the project from its outset.

Construction projects cannot be predicted and risk management is very important in the process in order to achieve the objectives of the project in terms of cost, time and quality.

Project risk management is an iterative process which may be beneficial when it is implemented in a systematic manner from feasibility to hand over in the life cycle of the project

The systematic risk management process has been divided into:

i. Risk classification
ii. Risk identification
iii. Risk analysis
iv. Risk response

According to Berkeley el al., (1991) and Flanagan and Norman, (1993). Risk response includes retention, reduction, transfer and avoidance. If these risks responses can be controlled, then risk can be managed.

Risk management in the construction project management context is an holistic way of identifying, analyzing and responding to risk to achieve the objectives of the project (ICE/RAMP 2005 and PMI 2007) When risks are identified and analysed with construction projects management improvement and use of resources ,effective risk management becomes beneficial. Management of risks is consciously proffering solutions to risks –prone areas. The management tool is geared towards identifying sources of risk and uncertainty, determining their impacts and developing appropriate management responses (Uher, 2003)

Risk Management Technique

Risk analysis and management techniques have been tackled by researchers which include (Ahmed and Kayis, 2007, Cretu et al., 2011, Chapman and Ward, 2003, Klemetti, 2006 and Smith et al, 2006) but risk management techniques were identified to include the following key steps, (Wysocki, 2009)

i. Risk identification
ii. Risk assessment
iii. Risk mitigation
iv. Risk monitoring

Risk Mitigation and Allocation

Risk mitigation measures to aim at minimizing the loss, damage or disruption in a project due to unforeseen event (Chitkara, 2011). The author went further to document the measures of risk mitigation and allocation. These include; risk transfer, risk deferred, risk reduction, risk acceptance, risk avoidance and risk sharing. These factors are to be considered when risk has already occurred.

Role of the Project Manager in Risk Management

Civil construction projects are always exposed to risks that affect the projects' objectives. This could be economical, financial, environmental, stakeholders, statutory, political etc. and also in the project's life cycle. The performance of project managers impact on the project either way (successfully or unsuccessfully).

METHODOLOGY

The research methodology chosen to evaluate the effects of risk factors on cost of civil construction projects comprised a comprehensive literature review, structured questionnaires to the stakeholders in the industry and a statistical analysis tool.

The questionnaire had 2 sections. The first section had to do with the demography of the respondents while the second part dealt with risk factors that affected civil construction cost. .The study identified twenty-five (25) risk factors affecting project cost through a comprehensive literature and administration of questionnaire. Other risk factors include; management, economic and finance, contractual and technical, external and site condition, environment and safety related risks but only the cost related risks shall be dealt with in this study.

Prior to the distribution of the structured questionnaire, a pilot study was conducted with an academia and contractor to test whether the questions were unambiguous. The feedback so obtained was satisfactory and a total of 60 questionnaires were distributed to construction stakeholders (contractors and consultants) in the six (6) core Niger Delta states of Nigeria. The survey data concentrated on projects executed and completed between 2005- 2009.

Feedback was received from 36 participates and 24 invalid responses due to incomplete answers. This represents a valid response of 60%, which is adequate according to Moser and Kalton (1971) assertion. The respondents who are industry's practitioners were asked to

assess the likelihood that the risk factors accessed would occur on their project and impact of occurrence on the cost of the project using a 5-point likert scale of 1-5 using a Relative Importance Index (RII) spanning from strongly agree(5), agree(4), neutral(3), disagree(2) and strongly disagree (1). A total of 12 civil construction projects were chosen from the six (6) core Niger Delta Regions and 18 of each of the contractors and consultants were also accessed for homogeneity from government companies constructed and completed between2005– 2009. Most of the contract sum ranged from 5Million – 5Billion as at the time of the construction. The government projects were chosen because civil construction projects are capital intensive.

DATA PRESENTATION AND ANALYSIS

A total of 60 questionnaires were distributed in the region. A response rate of 60% was achieved and variety of years of experience groups between 5 -30 years old and education level were included in the study.

Table 2: Distribution of respondents' years of experience and level of education

Year of Experience	Frequency	Percentage
‹ 10	14	38.89
› 10	22	61.11
Total	36	100.00

Table 3: Level of Education of Respondents

Level of Education	Frequency	Percentage
Doctor	10.00	27.78
Master	11.37	31.58
Bachelor	14.63	40.64
Total	36.00	100.00

Table 2 highlighted the years of experience of the contractors and consultants. From the table, it is obvious that greater percentage had years of experience over 10years while table 3 listed their education level. They are all read, that means, they understand fully well the research area.

There are several risk factors that affected the cost of civil construction projects but in the Niger Delta Region, the cost-related risk factors will be holistically viewed from literature. In appendix 1, all the projects that cut across the Niger Delta Region had a cost overburden between N300, 000.00 to N1, 800,000,000.00. This is not healthy for a developing economy like Nigeria where there is a dare need of infrastructure development for economic prowess. Table 5 shows the effects of project risk factors on the cost of civil construction projects in the region. This was further represented in a pie chart as shown in figure 1.

Table 5: Effect of project risk factors on the cost of civil construction projects

SN	Effect of risk factor	Frequency of Respondent	Percentage (%)
1	Delay of completion dates of the project	7.20	20
2	Cost variation in form of cost overrun	10.80	30
3	Conflict	3.60	10
4	Claims	1.80	5
5	Disputes	3.60	10
6	Risk	9.00	25
	Total	36.00	100

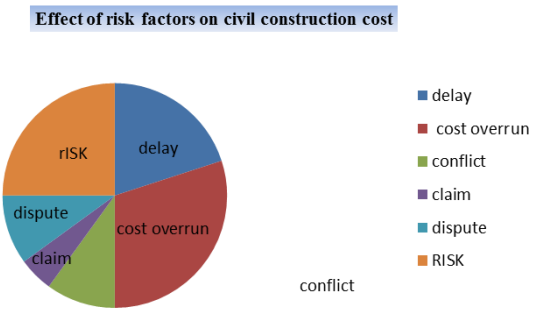

Figure 1: Effect of risk factors on civil construction cost

DISCUSSION OF FINDINGS

As earlier discussed in literature, all researches have dealt with factors that affected construction cost but its effects on are yet to be viewed from the contractors' and consultants' perspectives. This section shall mirror the risk factors and its ranking as viewed by contractors and consultants. The effects of these risk factors on cost highlighted and a control measure to check and curb these factors.

Key risks versus Contractor

The research assessed 25 key factors and the first five (5) most significant factors include; Change order by client with an RII of 0.97, ranking the 1st . This was closely followed by high inflation of exchange and interest rate with an RII of 0.95. Variation by client was ranked 3rd as perceived by contractors it an RII of 0.90. Design variation ranked 4th with an RII of 0.89 and incomplete or inaccurate cost estimate had an RII of 0.86 and was ranked 5th. This is shown on appendix 2.

Key risks versus Consultant

The research equally assessed 25 key factors and the first five (5) most significant factors include; Change order by client with an RII of 0.98, ranking the 1st. This was closely followed by Variation by client was ranked 2nd as perceived by consultants it had an RII of 0.97. High inflation of exchange and interest rate with an RII of 0.95. Design variation ranked 4th with an RII of 0.93 and incomplete or inaccurate cost estimate had an RII of 0.92 and was ranked 5th. Appendix 2 clearly shows the statistics.

Summary of the key factors viewed from the contractors' and consultants' perspectives

From the result, it could be seen that both contractors and consultants ranked change order by client as the most critical factor that affected cost of civil construction projects. They also jointly agreed that design variation and incomplete or inaccurate cost estimate were also significant factors that affect cost of the project though with different RII values. The effects of these risk factors include, cost overrun, risk, delay of completion date, dispute, conflict and claims. These effects so far listed as perceived by respondents have the potentials of ultimate project failure. It is important to view these risks by using the project life cycle and all potential stakeholders.

CONCLUSION

Effective management of risk factors will help the construction industry to identify and quantity the risk factors and consider risk mitigation measures. When risks are efficiently and effectively managed, cost saving is inevitable, great success rate and economic advancement.
The Niger Delta Region of Nigeria is a complex and volatile region because of its natural endowment and therefore calls for a well-articulated plan before execution. It is worthy to note that, change order by client and design variation, variation order, high inflation of exchange/interest rate and inaccurate cost estimate were top on the list of the risk factors.

Most of these factors can be controlled by the projects' team if there is a programmed understanding. The system needs to encourage all project stakeholders' participation as the need arises in the projects' life cycle. The industry needs to include risk as an integral part in the management process of the project. Risk must be planned for in any construction project.

RECOMMENDATION

i. Price escalation and fluctuation: This study has revealed that price escalation and fluctuation are the most prominent causes of cost slip of construction projects caused by risk factors. There is therefore an urgent need to improve the current trend in the Nigerian economy. During the period under the study, the prices of construction resources have always been on the increase.

ii. Delay in progress payment by client has been identified as a very significant cost slip factor, government should as a short-term measure consider the financial assessment before embarking on all construction projects in the country as this is capital intensive. This should be tied to the procurement of significant materials and plant items that will be needed during project execution

iii. Stakeholders' early participation: Both clients initiated and necessary variations have been identified as major factors leading to poor cost performance. The most effective way to reduce this is a thorough, complete and clearly presented project brief from the clients. Contractors and Consultants should be given reasonable time for detailed design and documentation.

iv. Currently in Nigeria, cost planning which is a most viable tool during the design process is almost neglected even in major construction works. All professional bodies in the construction industry should as a matter of urgency sensitise other consultants of the dare need for the design team to put cost planning into effective use in Nigeria.

v. Change order by client: Change order should be eliminated. Clients must be certain of what they want at the feasibility stage before embarking on the project

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APPENDIX

Appendix: 1

Different civil construction projects across the Niger Delta Region and their cost estimate

State	Type of Project	Client	Initial cost	Final Cost	Cost slip	Time of execution	Reason for cost slip
Akwa Ibom	Electrical	Public	181,414,248.75	185,400,500.0	3,986,251.25	2006-2009	Inaccurate cost estimate
Akwa Ibom	Road/bridges/drains	Public	211,321,800.48	215,400,300.00	4,078,499.52	2006-2009	Variation by client
Bayelsa	Electrical	Public	23,169,550.75	23,700,000.25	530,449.50	2008-2009	Design variation
Bayelsa	Sand filling/shore protection	Public	4,200,000,000.00	5,500.414,960.00	1,300,414,960.00	2005-2006	Difficulty to obtain permit
Cross River	Road/bridges/drains	Public	32,120,480.00	34,000,000.00	1,879,520.00	2007-2009	Client change order
Cross River	Road/bridges/drains	Public	44,300,361.00	46,000,000.00	1,699,639.00	2007-2009	Poor communication
Delta	Road/bridges	Public	300,000,000.00	402,300,250.00	102,300,250.00	2007-2009	High inflation of exchange rate
Delta	Sand filling	Public	3,250,000,000.93	3,450,000,000.07	199,999,999.07	2005-2009	Poor cost control
Edo	Road/bridges	Public	161,203,000.47	164,500,000.00	3,296,999.53	2006-2009	Incomplete drawing
Edo	Heavy Engrg	Public	150,120,000.00	155,000,000.00	4,880,000.00	2006-2008	Govt policy change
Rivers	Landing jetty	Public	10,414,000.00	12,181,133.00	1,767,133,000.00	2005-2008	Delay in contract payment
Rivers	Road, Bridge/drain	Public	88,786,425.00	95,117,295.00	6,330,870.00	2007-2009	Lack of stakeholders' coordination

Appendix: 2 Major risk factors affecting civil construction cost and their ranking using RII

S/N	Risk Factor	RII Contractor	Ranking	RII Consultant	Ranking
	COST -RELATED				
1	Tight project schedule	0.67	16	0.76	12
2	Design variation	0.89	4	0.93	4
3	Unsuitable construction programme planning	0.66	17	0.72	15
4	Occurrence of dispute	0.45	25	0.80	11
5	Price inflation of construction materials	0.70	14	0.66	17
6	Excessive and incomplete approval process in govt	0.69	15	073	14
7	Incomplete or inaccurate cost estimate	0.86	5	0.92	5
8	Inadequate programme scheduling	0.52	22	0.70	16
9	Variation by client	0.90	3	0.97	2
10	Difficulty in obtaining permit/ordinances	0.85	6	0.74	13
11	Unforeseen ground condition	0.51	23	0.55	23
12	High inflation of exchange and interest rate	0.95	2	0.95	3
13	Defective design	0,73	13	0.90	6
14	Delayed contract payment	0.82	7	0.64	18
15	Poor cost control	0.81	8	0.63	19
16	Low labour and equipment productivity	0.60	20	0.61	20
17	Inadequate labour, material and plant availability	0.63	19	0.60	21
18	Change order by client	0.97	1	0.98	1
10	Changes in govt policies	0.80	9	0.89	7
20	Defective construction work	0.65	18	0.58	22
21	Force majeure	0.49	24	0.52	24
22	Delay in the provision of complete drawings	0.77	11	0.82	10
23	Lack of coordination amongst stakeholders	0.78	10	0.85	9
24	Poor communication structure	0.74	12	0.86	8
25	General safety regulation	0.55	21	0.50	25

Budgetary Reliability of Design Stage Elemental Cost Plan in Building Procurement

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ABSTRACT

Accurate prediction of final tender sums (contract sums) of building projects depends on reliable projections of baseline cost plans developed at the design development stage. However, no matter how much care and effort is put into the preparation of design stage elemental cost plans, deviations are usually observed between these cost plans and the final tender sum. This makes accurate predictions challenging for construction practitioners in New Zealand. The major attributable factors for the observed variability are inherent risks in the design stage elemental cost plan development. Whilst this is recognized, this study evaluates the reliability of elemental cost plans in traditional building procurement. The study seeks to answer the question: is elemental cost plan a reliable budgetary tool for construction projects? The study was undertaken based on twenty completed building projects from which secondary data were collected within the New Zealand construction industry. Data analysis was carried out using document analysis and percentage deviation of final tender sums from the cost plans. Further analyses were carried out using root mean square and relative mean absolute deviation methods of analyses. The results showed that the budgetary reliability of elemental cost plans varied depending on project types. Whilst a deviation of -3.67% and +3.95% was obtained on the residential projects analysed, the deviation on educational projects was between -3.98% and +12.15%. Commercial projects attracted -14.22% and +16.33% while in the case of refurbishment projects, a deviation of -10.07% and +30.14% was obtained. These findings suggest that the larger or more complex a project is, the less reliable it is to use elemental cost plans to guarantee a reliable final tender sum prediction.

Keywords: Elemental cost plan, final tender sum, New Zealand, reliability, traditional building procurement

INTRODUCTION

The main concerns of construction clients in New Zealand are projects delivered within budget, on time, to the expected quality and with no surprises (Alan et al., 2008). Potts (2008) suggested that most clients work within tight pre-defined budgets or cost plans prepared by the consultant Quantity Surveyor at the design development stage. This is normally not expected to be exceeded; otherwise the whole scheme may fail. According to Odeyinka (2010) risks in traditional procurement are covered through the allocation of contingencies to cover both foreseen and unforeseen circumstances in design stage elemental cost plans. This is expected to ensure the completion of a project within the budget or cost plan. However, there are evidences in construction management literature indicating that it is difficult to find a project in which the final tender sum is the same as the design cost estimate/cost plan estimate (Akintoye, 2000; Aibinu & Pasco, 2008; Odusami & Onukwube, 2008; Enshassi et al., 2013).

Related studies conducted in the UK, Middle East, Asia and Africa concluded that in procurement methods where cost plans are used, deviations between the cost plan sums and final tender sums are common. Such deviations in the region of +1% to +12% are mentioned in: Morrison (1984), Cheong (1991), Oladokun et al. (2011), and Enshassi et al. (2013).

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According to Zou et al. (2007) the major attributable factors for these deviations are risk elements that are inherent in construction project developments.

Whilst these risk factors are recognised, the study determines the reliability of design stage elemental cost plan in building project procurement. This study provides information on cost plan and final tender sums of selected case study projects in New Zealand. This represents a benchmark for measuring cost planning accuracy or reliability. Although the usefulness of design stage elemental cost plan and final tender sum as pre- and post-contract cost control tools in traditional procurement has been documented, to the best of the knowledge of the researchers, there is no recent documentary evidence of an investigation into the budgetary reliability of design stage elemental cost plan in traditional building procurement in New Zealand construction. As such, the study finds its significance.

LITERATURE REVIEW

An Overview of Elemental Cost Planning

An earlier study by Dent (1978) defined cost planning as a system for monitoring cost at building design stage such that: tenders do not exceed preliminary estimates; and costs are developed in a way that gives project owners the best value for money. According to Seeley (1996) cost planning is a systematic application of cost criteria to a building design process to maintain in the first place, a sensible and economic relation between project parameters (cost, time, quality and functionality) and in the second place, provide overall control of proposed expenditure as circumstances might dictate. Several contemporary authors: Ashworth (2004), Ashworth and Hogg (2007), Kirkham (2007), Smith and Jaggar (2007), and Ashworth (2008) have expressed that cost planning is not only a pre-tender estimating method but also seeks to offer a control mechanism during the design stage.

Building cost planning was originally developed within the framework of the traditional procurement arrangement using conventional documentation, tendering and administration processes. With the advent of alternative forms of procurement and with more fluid approaches to design stage processes and documentation, the need for sound cost planning has not diminished (Smith et al., 2004). Thus, as a process established on solid theoretical foundations, Smith et al. suggested that cost planning should be robust enough to adapt and flourish in a variety of procurement environments.

In view of the above expressions and within the context of the current study, cost planning is simply a term that describes any system of bringing cost advice to bear upon a design process. In the same vein, design stage elemental cost plan is a pre-contract or specifically, a design stage cost control strategy based on elemental cost analysis which is prepared during the design development to give construction clients value for money. This bears in mind the need to meet specific requirements and ensure that available funds for a project are rationally distributed among the elements of the building. In this context, measuring the reliability of an elemental cost plan (a budget) means assessing the quality of the cost plan in terms of the expected accuracy range. Consequently, the reliability of a cost plan is determined by whether the expected accuracy range matches the required accuracy range. Meanwhile, the accuracy of a cost plan can be defined as the difference between final tender sum (contract sum) and elemental cost plan sum; this can be measured by the error rate calculated from Equation (1) (An et al., 2011):

$$[1] Error\ rate\ (\%) = (|\ Final\ Tender\ Sum - Elemental\ Cost\ Plan\ Sum|/\ Final\ Tender\ Sum) \times 100.$$

Similar view was illustrated in Ashworth (2004) whereby a range of -4% to +15% was recommended as an acceptable parameter for measuring estimating accuracy.

Previous Studies

Substantive research has been carried out in the field of pre-tender estimating for construction projects, a significant outcome of which is the identification of numerous risks that influence budgetary performance (Zou et al., 2007). Also some studies have investigated the accuracy of design stage elemental cost plans and their respective measure of influences, which is similar to the focus of the current study. Several researches (Akintoye, 2000; Enshassi et al., 2005; Aibinu & Pasco, 2008; Odusami & Onukwube, 2008; Onukwube et al., 2009; Oladokun et al., 2011; Jafarzadeh, 2012) have indicated that pre-tender estimating accuracies are significantly affected by the level of risk information available to estimators. These are recognised by this study as fundamental evidence of risk factors causing variability between elemental cost plans and final tender sums (Choy & Sidwell, 1991; Ling & Boo, 2001; Baloi & Price, 2003; Hlaing et al., 2008; Tsai & Yang, 2010).

The disparity between design stage elemental cost plans and final tender sums received in competition for a project would provide further evidence to the issues relating to the accuracy of pre-tender cost estimates in this study. For example, Morrison (1984) investigated this disparity in the United Kingdom by collecting and analysing data from seven separate quantity surveying firms. Morrison found that a mean deviation of 12% was obtained by the quantity surveyors. Also Ogunlana (1991) reported significant deviations of design cost estimates from accepted tenders using information held by seven design offices in the United Kingdom.

Cheong (1991) found that the disparity between cost plan estimates and contract sums is generally between 5% and 10%. Cheong's study had collected opinions across a wide range of Quantity Surveyors in Singapore. Significantly, Cheong's analysis of 88 projects from one quantity surveying consultancy in Singapore found that variability values between cost plan estimates and contract sums ranged from 33.79% (over-estimates) to 31.30% (under-estimates).

Similarly in Nigeria, Odeyinka and Yusif (2003) using cost data on preliminary cost estimates and lowest tenders that were supplied by 24 quantity surveying firms, found the following: 17 of 40 building projects (42.5%) had their lowest tender sums lower than the Quantity Surveyors' estimates and this ranged between 1% and 47%. 23 of the projects (57.5%) had their lowest tender sums higher than the Quantity Surveyors' estimates and this ranged between 1% and 174%. An analysis of pre-tender cost estimating performance of a Nigerian consulting quantity surveying firm by Oladokun et al. (2011) found that on 81 building projects there was an estimate bias reflecting underestimates of about 34%.

Odeyinka (2010) asserted that no matter how much care and effort is put into the preparation of design stage elemental cost plans, deviations observed between them and the final tender sums are usually significant. According to Zou et al. (2007) the major reason for this is inherent risks in both design and construction. The traditional way of dealing with these risks is merely to allow a percentage as contingency allowance. Thus, the essence of having an elemental cost plan as a budgetary tool for building projects is defeated if these risk elements are not captured or properly evaluated. Overall project objectives regarding cost, time and quality targets become threatened.

Risk and Cost Predictability

Risk could have different meanings to different people (Baloi & Price, 2003). The concept of risk can vary according to individual's perceptions, attitudes and experiences. For instance; architects, engineers and contractors are more likely to view risk from a technological perspective while lenders and developers tend to view it from an economic and / or financial point of view. Baloi and Price therefore concluded that risk is generally seen as an abstract concept that is difficult to measure. Rezakhani (2012) defined risk as a potential for complications around project completion, achievement of project objectives and an uncertain future event or condition whereby the occurrence rate is greater than 0% but lesser than 100%. Risk generates an effect on at least one of the main project objectives in terms of cost, time and quality targets. Earlier study by Akintoye and MacLeod (1997) explained that risk has been significant owing to the occurrence of budget/cost and schedule/time overruns associated with construction project developments. Joshua and Jagboro (2007) submitted that risk is inevitable and exposes project activities to adverse consequences of future events. The effect of risk on a project can be positive or negative. To align with the common usage of the word risk, this research embraces the view that benefits or positive impacts of risks on project objectives could be achieved by minimising risk occurrence and its detrimental impacts.

Potts (2008) explained that the budgeted cost established by the consultant Quantity Surveyor at the pre-contract stage forms the basis for the assessment of the tender sums submitted by bidding contractors. The successful tender therefore becomes the final tender sum (contract sum) for the project. Potts suggested that most clients work within tight pre-defined budgets/ cost plans which are usually part of a larger overall scheme. If a budget or cost plan is exceeded, the whole scheme may fail. Pre-contract estimating produces the original budget or cost plan and this forecasts the likely expenditure for the client. The budget or cost plan should be used positively to make sure that the design stays within the scope of the original scheme. Thus, many budget overruns are due to circumstances observed as risk factors and an important issue is the ability to predict such factors and the impact they have on the project. The smaller the level of information available at the early stages of a construction project, the higher is the level of uncertainties and hence risks. This view was shared by Zou et al. (2007) and Taroun et al. (2011). Therefore, as project information increases, risk is expected to decrease.

There has been lesser attention paid to the disparity between design stage elemental cost plan and final tender sums in New Zealand. Recently, Adafin et al. (2014) undertook a preliminary exploration of the theoretical concepts and methods for assessing risk impacts on the variability between design stage elemental cost plan and tender sums in New Zealand. It is apparent that there is a dearth of literature on this subject matter, which is being addressed by this study.

METHODOLOGY

This study was carried out primarily through the use of secondary data. The research approach collated data on elemental cost plan and final tender sums from completed building projects located in Auckland (AKL), Christchurch (ChC) and Wellington (WLT), New Zealand. Access was obtained to project records held by three quantity surveying firms based in Auckland. Project records and documents produced by professionals and organizations were explored as the main data analysis for the study (Gibson & Brown, 2009). A thorough examination of their project files within the limitations of the Privacy Act was undertaken. Apart from this project information, five senior partners within the three firms who had worked closely with the projects were interviewed. Project data were collected from four different types of building projects.

Tables 1-5 present the project information obtained for residential, educational, commercial and maintenance projects. These project details were analysed to achieve the research objective, which was to evaluate the budgetary reliability of design stage elemental cost plans in each of the four project types. For the purpose of anonymity, the projects are coded P01 - P20. In this study, the use of document analysis helped to justify the theoretical conclusions generated from the review, regarding cost predictability. Simple descriptive analysis was used to express the percentage difference between cost plan and final tender sums (Nworgu, 2006). Two further analyses were carried out using root mean square (RMS) deviation, and relative mean absolute (Rel. MAD) deviation methods of analyses as adopted by (Odeyinka et al., 2009). The *RMS* is expressed mathematically as follows:

$$[2]\ RMS = \sqrt{\left\{\frac{1}{n}\sum_{i=1}^{n}(c_i - o_i)^2\right\}}$$

Where *RMS* is the root mean square deviation measure; n is the number of projects investigated, c_i is the cost plan sum for individual project and o_i is the final tender sum for the individual project.
The *Rel. MAD* is expressed mathematically as follows:

$$[3]\ \text{Rel.}\,MAD = \frac{1}{n}\sum_{i=1}^{n}\frac{|(c_i - o_i)|}{c_i}$$

Where *Rel. MAD* is the relative mean absolute deviation measure; n is the number of projects investigated, c_i is the cost plan sum for the individual project and o_i is the final tender sum for the individual project.

FINDINGS AND DISCUSSIONS

Demographic information obtained from participants included their designation, academic and professional qualifications and work experience. Generally, all of the respondents hold tertiary education at HNC/HND/Bachelor's degree levels in quantity surveying, while one of them holds an MBA. They are senior partners in their individual firms and are professionally qualified (three full members and two fellows) with the New Zealand Institute of Quantity Surveyors (NZIQS). The participants have an average of 28 years of work experience in their consultancies. This demographic information indicates that the participants have been involved with running of projects and therefore have some knowledge of issues relating to project cost planning. This also enhances validity of survey data. Therefore, the secondary data provided by them could be relied upon for this study.

Table 1 presents elemental cost plan sums and final tender sums for five residential building projects studied. An analysis of the percentage difference between the cost plan sum and final tender sum gives an indication of the budgetary reliability of the elemental cost plan. It is evident from the Table that the percentage difference between the cost plan and final tender sums ranges between -3.67% and +3.95%. This falls within the ±5% range adopted by Morrison (1984) as the acceptable accuracy range between the Quantity Surveyor's estimate and the accepted or final tender sum. Similarly, a range of -4% to +15% was recommended by Ashworth (2004) as an acceptable standard for measuring estimating accuracy.

Though, traditional contracting systems in New Zealand require contractors to prepare their own quantities in a lump sum competitive contract. The schedules of quantities prepared by contractors are usually in a trade format while cost plans are produced in an elemental format by the consultant Quantity Surveyors during design development stage. Hence, this does not

allow a compatible platform for comparison. It is noteworthy that the budget or cost plan established by the consultant Quantity Surveyor during the design development stage forms the basis for the assessment of tender sums submitted by bidding contractors. The successful tender therefore becomes the final tender sum (contract sum) for the project. A thorough examination of the cost plan and final tender summary for each of the five projects studied showed a minimal difference between the cost plan sums and final tender sums. This then suggests that in traditional procurement where elemental cost plan based on New Zealand Institute of Quantity Surveyors (NZIQS) Elemental Analysis of Costs of Building Projects is used, the cost plan tends to be a reliable budgetary tool. This is not unsurprising because residential building projects are usually well defined in terms of design and specification at their pre-construction phases. This view was shared by Ling and Boo (2001) explaining that the risk of variation and change in scope is usually very low during the construction phase for this category of projects.

Table 1: Budgetary reliability measures for residential building projects

Project Code	Elemental Cost Plan Sum (NZ$)	Final Tender Sum (NZ$)	Cost Difference (NZ$)	Percentage Difference (%)	Year	Project Location	Procurement System Adopted
P01	7,210,250.80	6,859,266.32	-260,984.48	-3.67	2013	AKL	Traditional
P02	794,456.98	815,257.68	20,800.70	2.62	‘12-13	ChC	Traditional
P03	905,500.00	924,680.00	19,180.00	2.12	’12-13	ChC	Traditional
P04	1,914,848.40	1,878,417.15	-36,431.25	-1.90	2013	AKL	Traditional
P05	1,034,360.00	1,075,210.00	40,850.00	3.95	’12-13	ChC	Traditional

Table 2 presents the cost plan data and final tender sums for five educational building projects. An analysis of the percentage difference between the cost plan and final tender sums gives an indication of the budgetary reliability of the cost plan. Data on the Table show that the percentage difference between the cost plan and final tender sums range between -3.98% and +12.15%. This range is significant. The high disparity observed, may suggest that the cost plan is not a very reliable budgetary tool in educational building projects. As evident from the cost plan and final tender summary, high variability was observed in some cases which suggested the occurrences of risk factors such as client’s change, incomplete design information and site investigation information among others. This finding justifies Potts’ (2008) suggestion that failure to keep within the provisions of pre-defined budgets or cost plan is one risk that impacts on a project’s budgetary performance and consequently the client’s cash flow position.

Table 2: Budgetary Reliability Measures for Educational Building Projects

Project Code	Elemental Cost Plan Sum (NZ$)	Final Tender Sum (NZ$)	Cost Difference (NZ$)	Percentage Difference (%)	Year	Project Location	Procurement System Adopted
P06	994,678.00	1,084,000.00	89,322.00	8.98	2013	AKL	Traditional
P07	2,403,619.00	2,477,000.00	73,381.00	3.05	2013	AKL	Traditional
P08	944,000.00	906,409.00	-37,591.00	-3.98	2013	AKL	Traditional
P09	34,922,850.00	38,628,000.00	3,705,150.00	10.61	2012	ChC	Traditional
P10	48,833,750.00	54,768,250.65	5,934,500.65	12.15	2012	ChC	Traditional

Table 3 presents the cost plan data and final tender figures for five simple and complex commercial building projects. An analysis of the percentage difference between the cost plan and final tender sums shows a range between -14.22% and +16.33%. This is a very significant deviation. Further scrutiny of the percentage difference for each of the five projects indicates that the larger the scope of the commercial building, the higher the level of disparity between the cost plan sum and final tender sum. A thorough examination of the cost plan and final tender summary for each of the five projects showed a high disparity between

the cost plan sums and final tender sums. The observed high variability therefore suggests that the elemental cost plan is not so much a reliable budgetary tool for commercial projects, especially where the project is large in scope and of a complex nature. This further suggests that there is uncertainty in a lot of project information available where large and complex projects are involved. Hence, it is noteworthy that the more uncertain the project information is at the pre-construction stage when elemental cost plan is prepared, the more risky it is for cost certainty to be guaranteed to the client at the end of the tendering process.

Table 3: Budgetary Reliability Measures for Commercial Building Projects

Project Code	Elemental Cost Plan Sum (NZ$)	Final Tender Sum (NZ$)	Cost Difference (NZ$)	Percentage Difference (%)	Year	Project Location	Procurement System Adopted
P11	1,985,000.00	2,085,369.83	100,369.83	5.06	'12-13	AKL	Traditional
P12	31,000,000.00	26,593,185.00	-4,406,815.00	-14.22	2012	ChC	Traditional
P13	33,225,000.00	38,650,125.00	5,425,125.00	16.33	'11-12	ChC	Traditional
P14	2,850,000.00	3,058,252.85	208,252.85	7.31	'12-13	AKL	Traditional
P15	28,245,000.00	31,285,225.00	3,040,225.00	10.76	2010	AKL	Traditional

Table 4 presents the cost plan data and final tender figures for five refurbishment projects. An analysis of the percentage difference between the cost plan and final tender sums shows a range between -10.07% and +30.14%. This presents a highly significant deviation. It is important to note that the highest positive variability emanated from a small maintenance project and the Table does not reflect a clear-cut pattern of percentage variability. A thorough examination of the cost plan and final tender summary for each of the five projects showed a high disparity between the cost plan sums and final tender sums. The observed significant variability suggests that the elemental cost plan is less reliable as a budgetary tool in refurbishment projects. This is not a surprise as refurbishment projects harbour loaded estimates and assumptions that cater for higher risks due to unknown items involved in terms of scope and complexity at project inception, hence unpredictability regarding cost certainty.

Table 4: Budgetary Reliability Measures for Refurbishment Projects

Project Code	Elemental Cost Plan Sum (NZ$)	Final Tender Sum (NZ$)	Cost Difference (NZ$)	Percentage Difference (%)	Year	Project Location	Procurement System Adopted
P16	2,266,000.00	2,522,725.36	256,725.36	11.33	2011	WLT	Traditional
P17	380,341.12	342,045.24	-38,295.88	-10.07	2010	AKL	Traditional
P18	666,000.00	866,725.36	200,725.36	30.14	2011	WLT	Traditional
P19	805,134.60	736,687.56	-68,447.04	-8.50	2010	AKL	Traditional
P20	2,023,490.94	2,233,773.04	210,282.10	10.39	2011	WLT	Traditional

Further analyses were carried out to determine the budgetary reliability of the elemental cost plan for procuring the different types of buildings previously analysed. *RMS* deviation measure was expressed mathematically in Equation 2. This was converted to a percentage measure through normalization adjustment in order to make it comparable to other measures. In Table 5, this is regarded as the adjusted RMS measure. Odeyinka et al. (2009) justified the relevance of the normalization process as the RMS values obtained in their study are more of the function of tender and final account figures. This is applicable to the current study regarding the comparison between elemental cost plan and final tender sum. Moreover, the adjusted values are relative values that are more comparable.

The fourth analysis is the *Rel. MAD* measure that was expressed mathematically in Equation 3. The results of these analyses are presented in Table 5. As shown in the Table, the normalized / adjusted *RMS* measure and *Rel. MAD* measure are moderately close. This indicates that the two measures are reliable for measuring the budgetary performance of the

design stage elemental cost plan under study. From the Table, the reliability ranking based on the normalized *RMS* and *Rel. MAD* measures shows that the elemental cost plan is most reliable as a budgetary tool for procuring residential building projects (Ranked1). This is followed by educational, commercial and refurbishment projects respectively (Ranked 2, 3 and 4). The reliability ranking showed that the elemental cost plan is least reliable as a budgetary tool for procuring maintenance or refurbishment projects. Meanwhile, it is important to note that this result reveals the level of threats involved in relying considerably on elemental cost plan as a budgetary tool. Besides the residential building projects with a budgetary reliability of ± 2.85% that is quite reliable and acceptable, the deviation margins for other project types are quite significant. Hence, Quantity Surveyors need to attach some level of confidence limits to the estimate they give to project owners if interested in cost certainty. This is very important because the deviations observed are as a result of inherent risks in the design stage elemental cost plan development.

Table 5: Elemental Cost Plan (ECP) Budgetary Reliability Measures of Different Building Types

Building Type	RMS Measure (NZ $)	Adjusted RMS Measure (%)	Rel. MAD Measure (%)	Reliability Ranking
Residential	119,924.48	3.00	2.85	1
Educational	3,129,255.85	9.15	7.75	2
Commercial	3,410,231.99	12.96	10.74	3
Refurbishment	176,956.90	17.16	14.09	4

Results and findings could be presented either in tables or figures for illustration purposes. These presentation modes could be adopted in the earlier and latter sections (2, 3, 4 and/or 5) when deemed necessary. The table caption should be numbered and positioned before the table as shown in Table 1.

CONCLUSION AND FURTHER RESEARCH

The aim of the study was to investigate the budgetary reliability of design stage elemental cost plan in procuring building projects using secondary data from completed building projects. This study therefore concludes within the limitations of the data set confined to New Zealand, that in traditional procurement where elemental cost plans are used, there are deviations between elemental cost plan sums and final tender sums. The percentage deviation ranges between -3.67% and +3.95% for residential building projects. It ranges between -3.98% and +12.15% in the case of educational buildings. Commercial buildings attract a range of -14.22% and +16.33%, while it ranges between -10.07% and +30.14% for refurbishment projects. This suggests that besides the residential projects with little and acceptable deviation, the deviations observed in other projects are very significant.

The study concludes further that the elemental cost plan was most reliable (Rel. MAD of 2.85%) as a budgetary tool in procuring residential projects. This was followed by educational projects (Rel. MAD of 7.75%) and commercial projects (Rel. MAD of 10.74%) respectively. The design stage elemental cost plan was found to be least reliable as a budgetary tool in procuring refurbishment projects (Rel. MAD of 14.09%). An awareness of the possibility of deviations in different project types in quantitative terms offered by this study makes the design stage elemental cost plan a relevant tool for risk management to avoid budget overrun. Further, given construction projects procured using the elemental cost plan in traditional procurement, inherent risks could be subjected to quantitative assessment and management. Hence, the observed deviation measures could offer a relevant background towards the application of risk management techniques in budgetary and cost control in order to avoid budget/cost overrun in construction project developments.

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Methodological Approaches to Risk Assessments during Cost Plan Production

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ABSTRACT

Reliable prediction of final tender sums of building projects from the cost plan is of great importance to construction clients and practitioners to prevent unpleasant consequences of cost overrun, disputes and project abandonment. Researchers over the last two decades have employed forecasting methodologies which utilize various elements of price forecast equation. However, in spite of these research efforts, a model that could improve the accuracy of final tender sum predictions is yet to be developed for New Zealand. Different countries may require specific empirical studies to investigate budget / cost overruns, but a similar methodology could be used and findings compared. The research reports part of an on-going research concerned with assessing the impacts of risks during pre-tender cost estimating. It attempts to review the need for project information during cost planning, with a view to providing a case study background to confirm cost planning inaccuracies. A review and conceptual classification of tender price forecasting methodologies is undertaken towards developing a conceptual framework for risk assessments in traditionally procured commercial projects. The framework described, allows improved assessment of the impacts of risks on the variability between design stage elemental cost plan and final tender sum. Overall, it suggests an economical predictive-model for the New Zealand construction industry.

Keywords: Commercial projects, elemental cost plan, final tender sum, New Zealand, traditional building procurement

INTRODUCTION

One aspect of client expenditure management that requires attention is the accuracy in tender price prediction (Skitmore & Picken, 2000). Several researches indicated that pre-tender estimating accuracies are significantly affected by the level of risk information available to estimators (Akintoye, 2000; Aibinu & Pasco, 2008; Odusami & Onukwube, 2008; Enshassi et al., 2013). Proper risk analysis could offer at least a partial solution by reducing the variances between design stage elemental cost plan and final tender sums (contract sums) of construction projects (Adafin et al., 2015). Clients need to be informed in advance of their likely financial commitments specifically the cost implications as designs evolve, hence reasonably accurate predictions of final tender price cannot be overemphasised. This requires the preparation of more accurate cost plans based on the analysis of cost data generated from previous similar design / projects.

Various approaches have been adopted in tender price forecasting, ranging from statistical/mathematical to the use of artificial intelligence techniques. Most of these approaches employed the individual elements of tender price equation to model their forecasts. In the same vein, many researchers have attempted to model risk in construction projects using various methodologies such as multivariate discriminant and regression analyses, fuzzy and artificial neural network based on the United Kingdom, Australian, Asian and African construction industries (Ng et al., 2004; Sonmez, 2004; Lowe et al., 2006; Odeyinka et al., 2006; Odeyinka, 2007; Aibinu & Pasco, 2008; Aibinu et al., 2011; Larkin et al., 2012; Odeyinka et al., 2012). Similar research in New Zealand (NZ) is thin and no attempt has been made to develop a model that could assist NZ construction industry practitioners to have a better and reliable prediction of final tender sums from cost plans.

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Furthermore, there is a gap in research regarding the impact of risks on variabilities observed between design stage elemental cost plans and final tender sums. Knowledge in this area is therefore fragmentary and this is the focus of the current study.

LITERATURE REVIEW

Project Information during Cost Planning

The traditional view of cost planning is that it moves through stages of increasing accuracy starting with fairly low accuracy at the inception stage of a development process. According to Smith and Jaggar (2007) the level of accuracy depends on the level of project information available in the preparation of design stage elemental cost plan. Thus risk is inherent in construction project developments from inception to completion stages of projects' lives. As less information is available at the inception of construction projects, the level of uncertainties and hence risks becomes higher. Winch (2002) and Odeyinka et al. (2010) suggested that accuracy of cost estimates at the design development is impacted by risks linked to level of project information.

Cost planning by the clients' quantity surveyors essentially relies on information from three principal sources (Seeley, 1996; Ferry et al., 1999): information supplied by clients, members of the design team, and those acquired directly by the quantity surveying office e.g. historical cost information. Kirkham (2007) and Ashworth (2008) explained that information required at the final sketch plans/scheme design stage to enable full cost plan preparations include: sketch drawings, outline specification, and contractual information e.g. selected method of tendering, selected type of contract, cost plan date, proposed tender date, contract period, and (4) a comparable cost analysis from a previous similar project. In agreement, Smith and Jaggar (2007) further specified that details of project information are developed in form of more detailed plans at the final sketch plans stage (scheme design stage) of development process. Hence, full cost plan is prepared on the basis of the amount of information that may be available namely: project brief, architectural sketches, structural sketches, site layout, outline cost plan, preliminary schedule of finishes, specification notes, and outline development control approval from the planning authority.

In the current study, project information/risk assessment during cost planning would provide further evidence on issues relating to accuracy of pre-tender cost estimates which have been discussed in construction management literature over the decades (Akintoye, 2000; Ng et al., 2004; Sonmez, 2004; Soutos & Lowe, 2005). For example, Morrison (1984) had investigated this disparity in the United Kingdom by collecting and analysing data from seven separate quantity surveying firms. Morrison found that a mean deviation of 12% was obtained by the quantity surveyors. Ogunlana (1991) reported significant deviations of design cost estimates from accepted tenders using information held by seven design offices in the United Kingdom.

In Singapore, Cheong (1991) found that the disparity between cost plan estimates and contract sums is generally between 5% and 10%. Cheong's study had collected opinions across a wide range of Quantity Surveyors. Significantly, Cheong's analysis of 88 projects from one quantity surveying consultancy in Singapore found that variability values between cost plan estimates and contract sums ranged from 33.79% (over-estimates) to 31.30% (under-estimates). In the US, a coefficient of variation of 7.82% was obtained by Skitmore and Picken (2000) when they carried out an analysis of pre-tender estimating performance of a USA consulting firm on 217 building projects.

Similarly in Nigeria, Odeyinka and Yusif (2003) using cost data on preliminary cost estimates and lowest tenders that were supplied by 24 quantity surveying firms, found the following: 17 of 40 building projects (42.5%) had their lowest tender sums lower than the

Quantity Surveyors' estimates and this ranged between 1% and 47%. 23 of the projects (57.5%) had their lowest tender sums higher than the Quantity Surveyors' estimates and this ranged between 1% and 174%. An analysis of pre-tender cost estimating performance of a Nigerian consulting quantity surveying firm by Oladokun et al. (2011) found that on 81 building projects there was an estimate bias reflecting underestimates of about 34%.

However, Odeyinka (2010) asserted that no matter how much care and effort is put into the preparation of design stage elemental cost plans, deviations observed between them and the final tender sums are usually significant. According to Zou et al. (2007) the major reason for this is risk which is inherent in both design and construction. Several researches (Akintoye, 2000; Aibinu & Pasco, 2008; Odusami & Onukwube, 2008; Oladokun et al., 2011; Jafarzadeh, 2012; Enshassi et al., 2013) have indicated that pre-tender estimating inaccuracies are significantly influenced by the level of project information available to estimators. The current study posits that these submissions could offer a fundamental evidence of risk factors impacting budget variability.

Case Study Background

The case study collated data on elemental cost plans and final tender sums from completed projects in New Zealand. Access was obtained to project records held by three quantity surveying firms based in Auckland. A thorough examination of their project files within the limitations of the Privacy Act was undertaken. Data were sourced from five NZ-based consultant Quantity Surveyors of three randomly selected firms through interview sessions held over a period of two months April-May 2013. Initially ten out of seventeen registered quantity surveying firms were contacted by telephone after a random internet search limited to the website of New Zealand Institute of Quantity Surveyors (NZIQS). Ten firms were preferred owing to the fact that project cost planning / pre-tender estimating falls within their areas of concentration in practice. From these, three firms replied that they were willing to participate in the research. Meanwhile, five senior partners within the three firms were subsequently communicated with via telephone and e-mail requests for thirty minutes' one-on-one interviews.

Table 1 presents the project information for three commercial and four educational building projects located in Auckland and Christchurch, New Zealand. For the purposes of anonymity, the seven projects were coded: P01 – P07. More supporting information on the projects was obtained from key personnel within the host organizations through interviews. Apart from empirical collection, some underlying contextual information was also gained from the interviews.

Hence, general knowledge about cost and risk issues with a focus on the risk factors responsible for the disparity between design stage elemental cost plans and final tender sums in the selected commercial and educational building projects were obtained. There was also an aspect of the interview questions that sought possible solutions to this disparity. The table shows that disparity between design stage elemental cost plan and final tender sum is in the region of -14% and +16%. The risk factors generally responsible for the disparity observed in this study include: market conditions, client's change, design enhancements/variations, site investigation information, co-ordination errors, documentation errors/omissions, incomplete design information, incomplete documentation for cost plan and inadequate tender documentation. Meanwhile, improvement in design cost planning functions and improvement in market conditions are considered as opportunities rather than risk factors. These represent savings made on two different projects (see P02 and P05).

Specifically, P01 recorded a budget overrun of +5% as a result of such risks as market conditions, inadequate tender documentation, incomplete design information and site

investigation information. P03 registered a budget overrun of +6% and the risk factors responsible were market conditions, inadequate tender documentation, documentation errors/omissions, client's change and site investigation information. Budget overrun of +1% was noted on P04 while the risk factors found in the archive data were late client's changes, incomplete documentation for cost plan and co-ordination errors at tender documentation stage. Similarly, P06 overran +10% consequent upon market conditions, client's change, design enhancement and site investigation information. Also, P07 recorded an overrun of +16% as a result of client's change, design variations, market conditions and site investigation information as the evident risk factors. The generality of interviewees opined that the final tender sum is usually higher than the elemental cost plan on building projects.

TENDER PRICE FORECASTING METHODOLOGIES

The need for objective forecasting methods and the benefits of quantitative predictive cost models generally in the construction industry cannot be underestimated. Studies in Tender Price Forecasting to date have focused on developing and adopting mathematical / statistical models. Figure 1 shows a conceptual classification of these forecasting methodologies. As a result, a diversity of cost models of varying complexity were developed (Ng et al., 2004). As evidenced in Ng et al. (2002; 2004), Fuzzy sets (Chang et al., 1997; Mason & Kahn, 1997) and artificial neural network approaches (Williams, 1994; Fang & Tam, 1999), statistical methods were further extensively applied, with Regression Analysis (RA) being the most popular approach (Boussabaine & Elhag, 1999). In addition, multivariate discriminant analysis was adopted by Ng et al. (2000) for predicting tender price index directional changes.

Researches further suggested that the integration of techniques may enhance accuracy and predictive ability (Granger & Newbold, 1986; Granger, 2001). In Tender Price Index (TPI) prediction, the Regression Analysis (RA) and Time Series (TS) modelling received favourable attention and were most highly developed, with RA establishing the relationship between TPI and significant economic indicators (see Fellows, 1991; Fitzgerald & Akintoye, 1995; Akintoye et al., 1998; Chau, 1998).

Most recently, artificial intelligence techniques have been applied in modelling risk impacts on construction cost performance. Based on related previous studies and integration of predictive techniques, Odeyinka et al. (2012) applied artificial neural network (ANN) to model the risk impacts on the variability between contract sum and final account in traditional building procurement. Jafarzadeh (2012) employed both regression and neural network approaches for seismic retrofit cost modelling of existing structures, with critical comparison of results from both techniques. Ameyaw et al. (2015) applied the fuzzy technique for modelling risk impacts on variability between contract sum and final account in government-funded construction projects. Ameyaw et al. concluded that different countries may require specific empirical studies to investigate cost overruns, a similar methodology can be used and, findings compared.

After a review of the various forecasting methodologies, this study found that an integration of methodologies would be useful. The integration of Regression Analysis (RA) and Artificial Neural Network (ANN) employed by Jafarzadeh (2012) and Odeyinka et al. (2012), with a critical comparison of results from both modelling techniques could prove useful in assessing the impacts of the previously identified risk factors on the variability between design stage elemental cost plan and final tender sum. These methods could be useful in this study because of their predictive ability and reliability. Wilmot and Mei (2005) and Jafarzadeh (2012) suggested that each of the modelling techniques (RA and ANN) contains a unique combination of the most statistically significant predictors.

Table 1: Project information on commercial and educational building projects in Auckland and Christchurch, New Zealand without GST or value added tax (VAT) Exchange rate: NZ$1.00 = US$0.85 = AU$0.91 = £0.51 sterling (2014)

Project Code	Project Type	Elemental Cost Plan Sum (NZ$)	Final Tender Sum (NZ$)	Cost Difference (NZ$)	Percentage Difference (%)	Year	Project Location	Procurement System Adopted	Risks Identified
P01	Commercial building	1,985,000.00	2,085,369.83	+100,369.83	+5	2012-13	Auckland	Traditional	Market conditions, inadequate tender documentation, incomplete design information, and site investigation information
P02	Commercial building	31,000,000.00	26,593,185.00	-4,406,815.00	-14	2013	Auckland	Traditional	Improvement in design cost planning functions and improvement in market conditions
P03	Educational building	994,678.00	1,054,000.00	+59,322.00	+6	2013	Auckland	Traditional	Market movement, inadequate tender documentation, documentation errors/omissions, client change and site investigation information
P04	Educational building	2,403,619.00	2,417,000.00	+13,381.00	+1	2013	Auckland	Traditional	Late client changes, incomplete documentation for cost plan and co-ordination errors at tender documentation stage
P05	Educational building	984,000.00	906,409.00	-77,591.00	-8	2013	Auckland	Traditional	Improvement in design cost planning functions and improvement in market conditions
P06	Educational building	34,922,850.00	38,628,000.00	+3,705,150.00	+10	2012	Christchurch	Traditional	Market conditions, client change, design enhancements and site investigation information
P07	Commercial building	33,225,000.00	38,650,125.00	+5,425,125.00	+16	2011-12	Christchurch	Traditional	Client change, design variations, market conditions and site investigation information

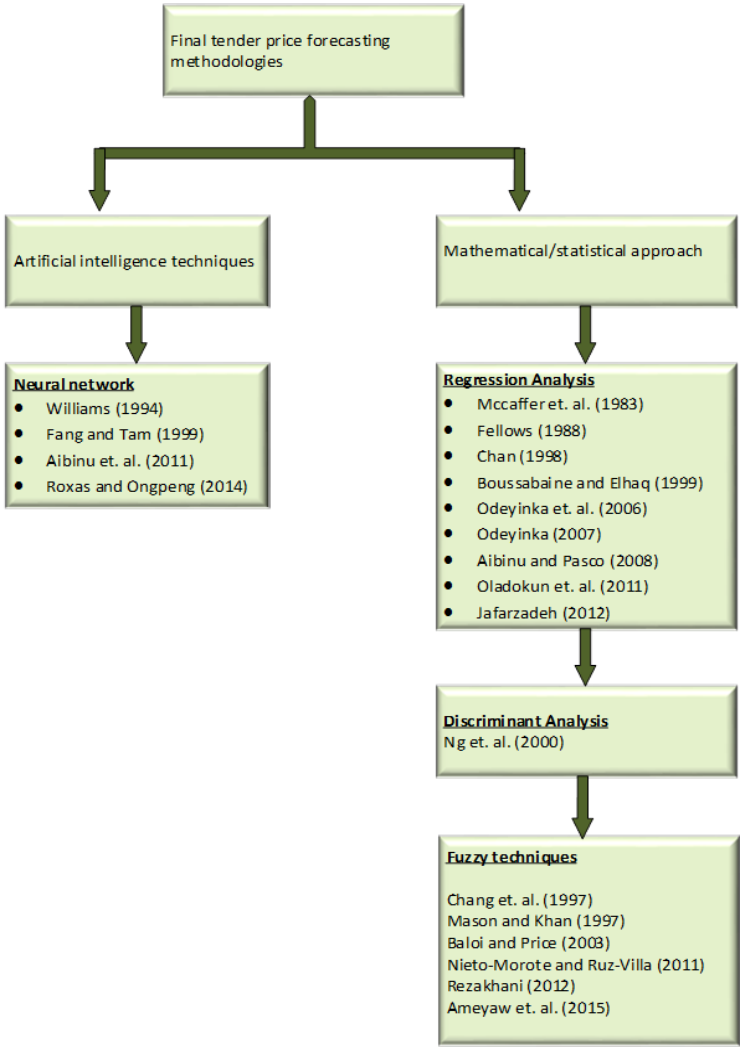

Figure 1: Conceptual Classification of Final Tender Price Forecasting Methodologies
Adapted from Odeyinka et al. (2012)

A Conceptual Framework for Assessing Risk Impacts during Cost Plan Production

Larkin et al. (2015) suggested the need to consider certain groupings in the analysis of risk factors impacting budget variability. These include the building type, procurement method employed and project participants. These groupings are employed in developing a conceptual framework for assessing risk impacts on budgetary performance in Figure 2. Basically, the framework considers the building type, for instance commercial building, it looks into the procurement method adopted for the particular project, say traditional method and the project participants depending on the procurement system adopted, say Architects, Quantity Surveyors, Engineers, and Project Managers.

Elemental cost plan sum and final tender sum data from the selected project in New Zealand are then obtained under the various groupings based on choice of building type, procurement method and project participants. Adopting an integration of predictive techniques (e.g. ANN and Fuzzy models or MLR and ANN) produces a more accurate result (Jafarzadeh, 2012; Odeyinka et al., 2012; Ameyaw et al., 2015). This suggestion has been taken into consideration; hence the framework anticipates the use of elemental cost plan sum and final tender sum data for risk modelling alongside the suggested groupings. Investigation of

inherent risk factors that occurred in executing the selected project is then carried out by project participants.

According to Soutos and Lowe (2005) regression analysis is a statistical process for estimating the relationships among variables. This includes the techniques for modelling and analysing several variables when the focus is on the relationship between a dependent variable and one or more independent variables. The most suitable approach for this study is the MLR. It is a flexible method of data analysis that is appropriate whenever a quantitative variable (dependent variable) is to be examined in relation to other factors expressed as independent variables. The linear additive regression model could be used to include any number of independent variables as expressed usually in the form stated below (Berger, 2003; Soutos & Lowe, 2005):

$$Yi = A + \beta iXi + \beta 2X2 + \cdots \ldots \ldots + \beta nXn + Ei$$

Where

Yi = the dependent variable (e.g. actual or project cost); A = the intercept;
βi = regression coefficient for the ith independent variable;
Xi = independent variable for the ith observation (e.g. risk factor); and
Ei = random error of the ith observation

MLR will be used to develop the predictive model on the complex interaction of significant risk factors impacting observable variability between the design stage elemental cost plan and final tender sum. The dependent variable is the final tender sum while the independent variables are the significant risk factors.

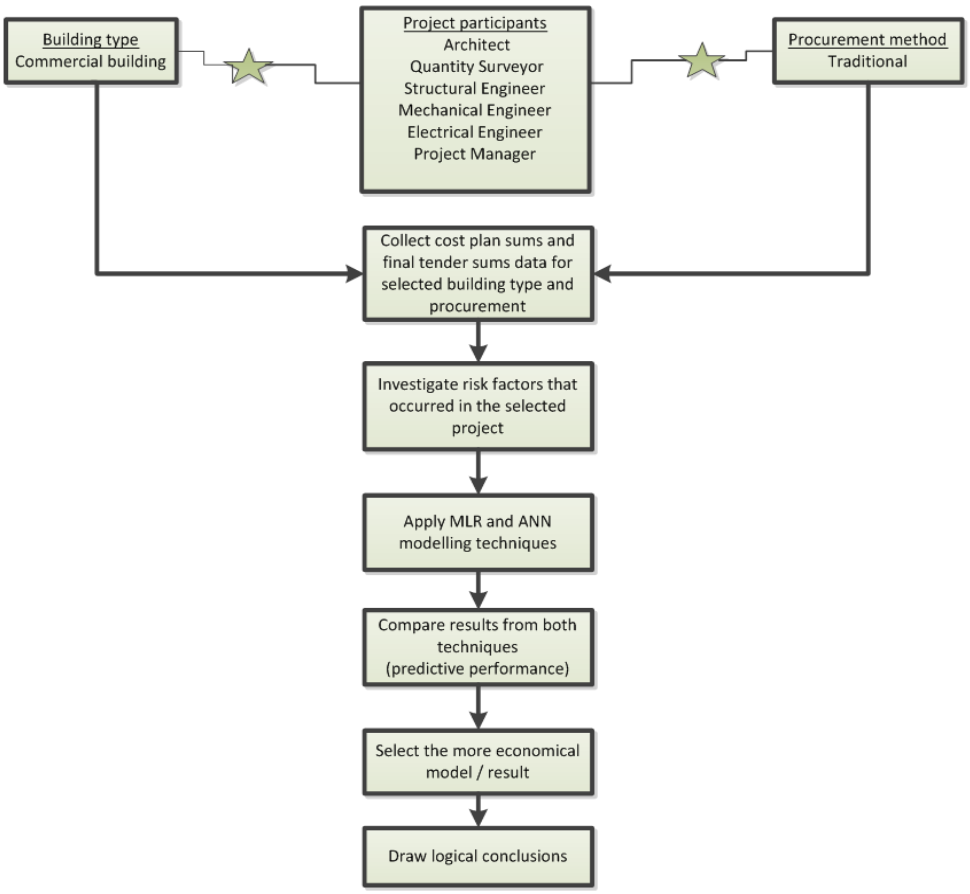

Figure 2: A conceptual framework for assessing risk impacts on budget variability based on New Zealand study
Adapted from Larkin et al. (2012)

Meanwhile, ANN is an information processing system whose architecture is inspired by the structure of human biological systems (Boussabaine, 1996). This system is developed as a structure that is similar to human body; hence it functions in a similar manner. The modelling process will be based on five main aspects: data acquisition, analysis and problem representation; architecture determination; learning process determination; training of the network; and testing of the trained network for generalization evaluation. ANN methodology is a promising alternative modelling technique for the establishment of sound predictive models (Odeyinka, 2012).

Following this, results from both techniques are critically compared and the more economical model / result is selected. The framework (Figure 2) illustrates the procedure to undertake in developing the predictive models, comparing the predictive performance of both techniques, and suggesting the more economical model for the industry. It is expected that this procedure will allow logical conclusions to be reached regarding risk impacts during cost plan production.

CONCLUSION AND FURTHER RESEARCH

This study clarified the need for project information during cost planning. The clarification was employed as a basis to identifying risk factors that are inherent in cost plan development. Based on a review of related previous researches in pre-tender estimating accuracy, a conceptual classification of final tender price forecasting methodologies was developed. A critical evaluation of these methodologies suggested that the MLR and ANN predictive modelling which possess an analytical ability, have the potential of assisting with an objective assessment of risk impacts during cost plan production. Critical comparison of results from both techniques will produce a more economical model/result. The combination of these two tools enhances accuracy and their predictive ability. These ideas were used to develop a conceptual framework that illustrates the procedure to undertake in developing the predictive models, comparing the predictive performance of both techniques, and suggesting the more economical model for application in New Zealand. Similar research is thin in New Zealand and no attempt has been made to develop a model that could assist construction industry practitioners to have a better and reliable prediction of final tender sums from cost plans. Hence, the implementation of this result could yield what others have not achieved in their study areas.

Further development of the work reported here, when data are collected and analysed, will provide more information for the development and validation of the predictive models for application in New Zealand.

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A Conceptual Model for Planning Construction Project in Abuja, Nigeria

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ABSTRACT

A research was carried out titled An Appraisal of Planning in Nigerian Indigenous Construction Companies with an aim of improving construction planning of Nigerian indigenous construction companies. The research collected data through two types of structured questionnaire accompanied by interview which was distributed to 50 construction companies in Abuja. The data were analyzed and result was presented in charts and relative importance index (RII) was used to rank each response among alternatives provided. Key findings from the research indicated that planning process among the surveyed organization was insufficient, this is evident considering 50% of the response indicated there is need for major improvement of planning, 46% of the response indicated that planning needs minor improvement while 2% of the response indicated that planning process in organization needs major over haul. Response from the research further indicated that Planning can be improved through application, adoption of ICT and computerized systems with RII=0.92, Continues monitoring and controlling of project with RII=0.92, Progress meeting / briefing with RII=0.90 and engaging project team members in planning the project with RII=0.84.Research findings was summarized into a model, the model consist of client, communication flat form, project team and the project represented by four phases of a project life cycle, namely initiation, planning, execution and closure. The research proposes adoption of the model which should serve as a basis for developing a frame work for planning construction project in Nigeria.

Keywords: Planning, Construction, Project, Model, Frame Work

INTRODUCTION

Planning was defined by the project management body of knowledge (2004) as the process that is performed to establish the total scope of the effort, time, and resources, refine the objectives and develop the cause of action that is required to attain those objectives. Though, Planning is the process through which the system adapts its resource to changing internal and external conditions, Adebayo (1980) indicated that Planning must create a feasible frame work and method statement for the execution of the works that provide the basis upon which the work will be performed.

The effect of planning on construction success was also studied by Harris and Mc Caffer (2005) who indicated that contractors of the developed countries have embrace planning, this is because performance and profitability of the companies was found to be directly influenced by planning, careful and controlled project delivery. But, Aniekwu and Audu (2010) asserts that many Nigerian indigenous construction companies are unable to meet their contractual requirements because of their in ability to prepare and implement a good plan for a successful project delivery. This according Saleh (2004) has contributed to the inability of the industry in meeting the construction needs of Nigeria.

Benefits of planning was further highlighted by the Project management institute (2003), which confirms that there is no genuine reason to show that a project can succeed without planning. Rather, PM BOK (2004) recommend project managers to invest heavily in planning of their projects, this is because despite the fact that planning alone without careful execution and controlling cannot guarantee success, definitely lack of planning will guarantee failure in the project. Therefore, this paper proposes a model as a way of improving planning in Nigeria.

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David and Elaim (2008) highlighted the confusion that exists in the literature in defining model, framework and methodology. Wong (2005) studied the terms and provided clear definitions for both terms, he defined methodology as an instrument which tends to answer "How to" type of questions, Model answers "What is" type of questions, while frame work seek to provide answers to both "What is and How to" questions. Wong (2005) further shows that both model and methodology are descriptive, while frame work is prescriptive in nature.

The model for effective planning of construction projects would therefore identify all the necessary items that must be considered for efficiency in construction planning, while a framework would not only present such element but would also present ways on how to put them into practice in order to achieve the desired outcome. This study aim at identifying the necessary items required for efficiency in planning construction project in Nigeria, hence, a conceptual model is proposed based on the findings of the study.

STAGES IN THE MODEL DEVELOPMENT

In order to address the question what is construction planning, a review of relevant literature was carried out and also the perception of respondents in the study area with respect to what is construction planning was collected through structured questionnaire accompanied by face to face interview.

Literature was reviewed to uncover the meanings of project planning, construction planning, process of planning in construction and also resources required for effective planning.

Project Planning

Project planning is a wide field of study not only in construction but in other fields of human endeavor. Undoubtedly, early planning impact positively on project, some of such benefits were documented earlier in previous works such as Laufer and Tucker (1987) and also in more recent works such as CORBON and NIOB (2014). Despite such benefits, researches still advocate for more to be done in improving planning such as Inuwa *et al* (2014). This is because, current planning was shown to be inadequate as indicated by Aibinu and Jagboro (2002) while organizations that spent substantial effort in planning, were however discovered to achieve better performance and profitability as documented by Aniekwu and Audu (2010).

PMI defines project as a temporary endeavor undertaken to produce unique product, service or result" (PMBOK 2004). This definition shows that a human endeavor can only qualify to be a project when it is done once to produce a specific product or service, has budget, scope and magnitude. Though, James (2007) believes an endeavor that is repetitive is not qualified to be called project, but if one consider construction activity which appear to be repetitive such as construction of flats in a housing estate, separated by distance in time, space or location, one will see such endeavor has qualified to be called project, since the difference in time or location could alter construction and pricing of the projects significantly.

Planning had undoubtedly generated interest in the past, hence previous works had tried to provide varying definitions which often studying one will see clear similarity among them, this include Islam and Faniran (2005) who define project planning as a conscious effort and process that determines the optimal method, sequence and timing of activities, required resources in order to maximize the chance for a successful project completion, But Ubani et al (2010) defines planning as course of actions taking in advance of performance which defines activities and actions, time and cost targets, performance mile stone which will result into successful project completion.

looking closely at various definitions and explanation of planning, it will be realized that planning involve conscious human effort, resources, time and management, Hence, planning

can be concluded to mean "a conscious management activity that is performed in advance of any action, which define the project objectives, and the most economical way of achieving those objectives with in an agreed and realistic time frame".

Construction Planning

Construction planning is a fundamental and challenging activity in the management and execution of construction projects. This according to Bamisile (2004) involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and identification of any interactions among the different work tasks.

CORBON/NIOB (2014) asserts that Planning of construction is generally concerned with completing work of designed quality in a short period as practically as possible which is compatible with economy of production. All future actions of the constructing company in relation to intended construction method, programme of the work, type of materials, labour, plant and equipment must be made known to the project team and more importantly the clients or his representative.

The futurity implication of planning suggests that forecasting is an important part of the whole planning process. Anticipation of the state, nature or the result of alternative courses of actions is an important and crucial phase of decision making process. Conscious effort has to therefore be made to anticipate nature and amount of technology, man power and financial requirement of the project in advance. Political and social climate in the organization, the host environment must also be anticipated, this helps the planning manager to avoid predictable pitfalls that might be disastrous to the project.

Process of Planning In Construction

Planning is a process through which the system adapts its resource to changing internal and external conditions. Hence, Adebayo (1980) indicates that planning must create a feasible frame work and method statement for the execution of the works that provide the basis upon which the work will be performed. Planning must start at an early stage of project, and it progress continues through the various phases of the project life cycle up to project closeout stage or hand over.

planning in construction involve defining all the stakeholders of the project, stating terms and condition of the contract, Identifying resources and constraints in the project, reviewing of all approval and requirements, identification of major activities and their sequence, establishment of time line for activity performance, and a proper management strategy must be selected.

Resources used for Construction Planning

The process of planning construction project requires the use of resources, this resources as identified from the literature include:

i. Planning Techniques

Planning techniques are usually methods of planning that are employed at project operational stage. Planning techniques involves establishing a method of statement for each activity, its relationship with other activities, timing of the projects and how its affect the overall project completion period. Project planning techniques allows for a detailed look at the project's resource requirements, which are not obvious at the strategic level, Harris and Mc Caffer (2005).

The common project planning techniques include the bar charts and linked bar charts, line of balance, network methods, programme evaluation and review techniques as indicated by Chitkara (2012). Graphical representation and review technique has also been identified as an

important planning technique that has been in used in other project management environment such as the military.

ii. Construction Documents

Construction documents are often prepared by recognized professionals and are often legal requirement to a contract. For an efficient planning, it's important to identify all the necessary documents that are required to successfully complete any construction project. The construction documents that should be included in the plan are, the bill of quantity, drawing and schedules, specifications, condition of contract, construction planning report, cost plan and the building production management documents. The building production management document include Construction methodology, Construction programme, Project quality management plan, Project health and safety plan, Early warning system chart and Information requirements schedule.

iii. Planning technology, software, applications etc.

Robson (1997) in CORBON/NIOB (2014) describes information technology to be a collective term that include the hardware (machinery) and software that is concerned with collection, processing, storage and transmittal of the information. Inuwa (2006), Lucey (2005) in CORBON/NIOB (2014) also describe ICT as a general expression covering the use and integration of computers, telecommunications and electronics.

Computers have proving to be a reliable tool in all spheres of human endeavor, Kerzner (2000) indicate the emergence of ICT capability has aided companies to implement project management very fast through the use of computer based software for project planning, estimating, scheduling, and control.

CORBON/NIOB (2014) believe the use of computer applications and ICT to perform core task of project management in project planning, cost data base, cost estimation and document management, have been found to improve project success, project profitability of construction process, and improve bid success ratio of construction companies, but Olaleye and Abdullahi (2014) find out that such computer applications and ICT were found not to be used effectively for planning and avoidance of cost and time overrun.

RESEARCH METHOD

The research aim at studying existing ways indigenous contractors within the study area undertake planning construction project, with a view of identifying methods that yield best result. This makes the research quantitative in nature and hence employed the use of structured questionnaires. Data from each organization was collected using two questionnaires administered each to separate staff of the company; this is design to achieve more factual and unbiased response from each organization. The research assume each contractor undertake planning in one way or the other; therefore seek to examine efficiency of planning in the organizations.

Questionnaire type A was used to determine how organizations plans, who is responsible for planning and instrument that are used for planning. This questionnaire was administered to management staff of Indigenous construction companies responsible for planning in their respective organizations.

Questionnaire type B was used to score the performance of planning in the organization; this questionnaire was administered to production senior staff or site engineers responsible for implementing the proposed plans.

The cooperate affairs commission (2014) provided a list of construction companies in Abuja, a population size of 1920 was determined and used, using Kish (1965), a sample size of 50 companies was used for the study at 90% confidence level.

Data obtain from the questionnaires was tabulated and analyzed using the software, Statiscal products and service solution (SPSS) for descriptive and inferential analysis. Tables, graphs and charts was used for descriptive analysis while Cross tabulation tables ware used for inferential statistics to determine relationship between research Variables.

Relative Importance Index (Rii)

Scott and James (2011) advocate for the wider use of relative importance index as a supplement to multiple regression analysis, this according to Scott and James (2011) is that relative importance indices provide information which is not readily available from indices typically produced from multiple regression. (RII) is determined by dividing the mean response with the highest value on the Likert scale used. Decision relating to most significant factor was taken base on the factor having the highest RII point in the group of the identified variables.

SUMMARY OF RESEARCH MAJOR FINDINGS

Despite identified benefit of planning by the respondents of the research who believe planning can avoid cost overrun(RII=0.88), time over run(RII=0.86) and compromised in project quality (RII=0.86), the process of planning was shown to be inadequate, this is proven by data from the research which show that 50% of the response indicated there is need for major improvement of planning, 46% of the response indicated that planning needs minor improvement while 2% of the response indicated that planning process in organization needs major over haul. This result support the assertion of Basil (2005) who attributed death of new indigenous construction firms with in first five years of incorporation to lack of planning, Idoro (2012) also attributed failure of indigenous construction companies among other things to ineffective and inefficient planning.

Findings in relation to what is planning and how planning should be carried out indicated close conformity with the existing body of knowledge. Example, the activities that defines planning among Nigerian contractors surveyed are ensuring complete, accurate and approved drawings and documents with RII=0.96, then, precisely defining the project with RII=0.92, and establishing exact client requirements with of RII=0.90. This result confirms findings of Adebayo (1980), Ibrahim (2004) who both believe planning should define the project, its objectives, resources and constraint. The result also hold the assertion of Bamisile (2004) to be true who indicated the need for construction managers to ensure complete, accurate and approval of all document while making special emphasis on building production documents.

The study attributed failure of planning to client financial integrity with RII=0.94, inadequate resources budgeted for planning with RII=0.92 and poor communication in the project team with an RII= 0.89. This result has provided more insight and more specific on what causes construction planning to fail by attributing such failures to financial integrity and ethical standards of client rather than to more generalized issue such as lack of finance as adopted in previous works.

Contractors surveyed indicated that Planning can be improved through application and adoption of computerized systems and ICT with RII=0.92, continues monitoring and controlling of project with RII=0.92, progress meeting and briefing with RII=0.90, and by engaging project team members in planning the project with RII=0.84.

Model Presentation

The next step in the model development was to create a schematic diagram of findings from the study. The diagram as represented in Figure 1 considered all the essential items that relate to planning as identified in the literature and from the result of data collected. The method presented two set of complimentary information; literatures information was used as normative means of planning which was tested on the population to test its applicability.

Elements of the Model

The schematic diagram in Figure 1 represents a proposed model for planning construction project in Nigeria. From the top to the bottom of the project as indicated by downward facing arrows, the model consist of project entities identified in the study area namely the client or client organization, a communication means or communication flat form, the project team which comprises every individual concerned or related with the project in one way or the other, and the project represented by the project stages namely, project initiation stage, project planning stage, project execution stage and the project closure stage.

Communication Flat Form

Findings from the research shows that failure of project planning was attributed to poor communication (relative importance index 0.89) among other factors, respondents to the research also believe improve in communication and awareness among the project team has great tendency of improving awareness and avoiding conflict there by improving the chance for successful completion of the project.

The model in Figure 1 identify the respondents perceived importance attached to communication, the flat form which is ICT compliant should be open, accessible, should serve as the nervous system of the project collecting, storing and transmitting information to those who need and when they need it. The flat form is placed between the client and the project team, this is to signify the need for connectivity between client and project team throughout the project duration.

The project team comprises of all professionals, artisans, craftsmen, suppliers and other stake holders in the project. Bamisile (2004) identify that in Nigeria, construction project involve the services of some identified professionals including the architects, builders, quantity survey, engineers, land surveyors etc.

A project can successfully be managed only if all the personnel involve are totally dedicated, project planning requires special skills and wisdom by the management team. The planning cannot be accomplished by one single individual, hence there is need to have a good understanding and relationship between all projects members, all members are required to plan their individual area of responsibility and the collective efforts be delivered uniformly in harmony with the input of others in same project.

In the model as represented in Figure 1, the project is shown to be placed right on top of the project throughout the project. This signify the importance attached with ensuring all the team is carried along through the project, the model also connect the project team with the client through the open communication flat form as indicated by arrows from the communication flat form to the project team.

In the model, it is shown that the full combination of all the project team was completed only at the project planning stage, this is because at the initiation stage, the only member employed is mostly the prime consultants who acts as client representative or together with the client, and hence such combination was considered to be part of the client.

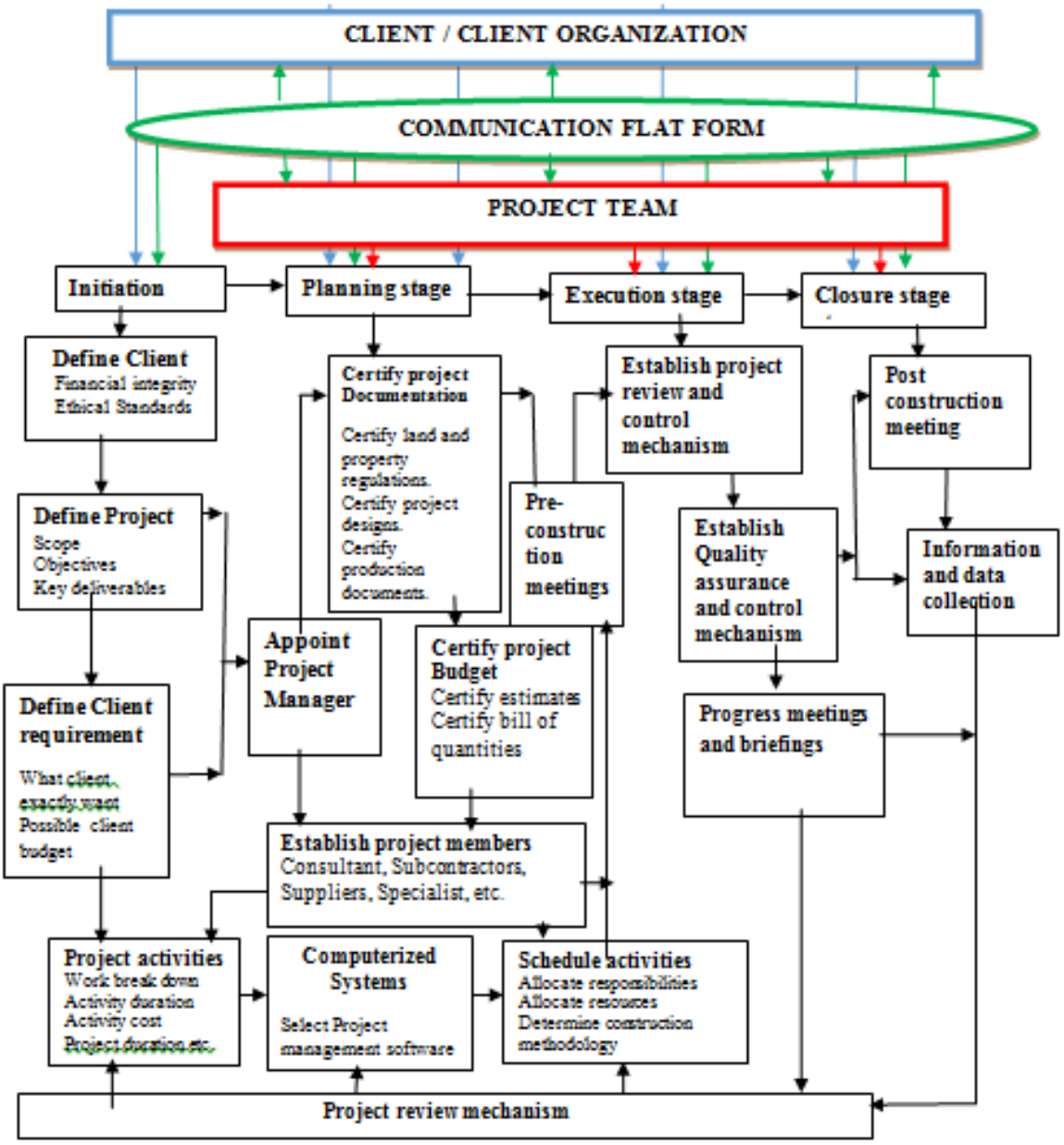

Figure 1: Proposed construction planning model for Nigerian

Project Team

The Project

In the model (Figure 1), the project is represented by the four phases of project life cycle as contain in the project management body of knowledge (2004), these phases are namely, the project initiation stage, project planning stage, project execution stage and the project closure stage. Based on the findings of the research, recommendations were made with respects to each stage of the project. The activities identified with respect to each stage are outline as follows:

i. Project Initiation Stage

Firstly, the model recognized the need for contractor to identify who the client is, client financial and ethical standard in doing business should be assess here, this is as contain in the findings of the research which rank identifying client as the most important planning activity before starting any project with relative importance index

(RII) of 0.91. Findings of the research also rank client financial integrity and ethical standard high among factors that causes project planning to fail with RII = 0.94 and 0.92 respectively.

Next the model identify the need for defining what the project is, the project scope, objectives and key deliverables in the project must all be specified, the model further identify the need to specifically define exactly what does the client need, with respect to quality standards, time of completion and budget capability.

The model also identify the need for contractors to specifically provide details breakdown of major activities in form of work break down structure for the proposed project.

Finally, planning at the initiation stage ends with appointment of project manager who is charge with duty of managing the project from that point onward to completion.

ii. Project Planning Stage

In the model (Figure 1), the necessary planning activities at the project initiation stage was shown to end with appointment of a project manager which could be a single entity or a cooperate body depending on size, complexity and several other project requirements, appointment of the project manager also mark the beginning of the planning stage of the project.

At the planning stage, results of the study shows that ensuring completeness, accurate and approved drawings and documents with relative importance index (RII=0.96) was ranked first among important activities that must be achieved while planning. The research also shows that certifying project budget, establishing exact individual activity duration and overall project duration, use of computerized system for planning, scheduling of the identified activities in the project are all important for an efficiency in planning.

Based on these identified findings, the model therefore placed such activities in order of the respondents' perceived importance and logical order of activity occurrence.

iii. Project Execution Stage

In Figure 1, activities necessary at the planning stage was shown to end with preconstruction meetings and briefings, this also marks the beginning of the project execution stage.

At the execution stage, the model, based on the findings of the study, identified establishment of project review and control mechanism (RII=0.91) to be an important activity the can improve planning. The research also shows that establishing project quality assurance and control mechanism (RII=0.91) and holding progress meetings and briefings (RII=0.90) to be other important activities that can improve planning.

iv. Project Closure Stage

The model based on research findings closed the project by identifying activities necessary for proper closure of the project, these activities as contain in the model are holding post construction meetings and gathering and storing information.

Finally, the model connect all the project stages through an extensive project review which was established as a means of reviewing project should the need arise without negatively impacting the overall project success.

CONCLUSION

Planning was shown to be the system through which a system adapts its resources to changing internal and external conditions. For planning to be effective, previous researches have highlighted the need for planning to create a feasible framework and statement for the execution of the works that will provide the basis upon which work will be performed.based on its findings, the research concludes that, Planning among Nigerian contractors is not sufficient, and hence requires improvement for it to be effective. For planning to be improved, the research advocate for better communication in any project, adoption of information technology in planning and reality check on client financial integrity and ethical standard. Findings, conclusion from the study are summarized into a model presented diagrammatically.

A conceptual model was proposed to aid planning construction in the Nigerian construction industry, the model seek to identify the key areas and activities necessary for an effective planning of construction works which was developed based on the findings of research carried out to appraise planning of Nigerian indigenous contractors.

The key components of the model are the client or client organization, a communication flat form, the project team and the project. The model placed importance to the client, though client is identified first and placed on top of the model. The client interact with the project and the team through a chosen communication flat form, the communication flat form which serve like a nervous system in the project connect every member in the project and is placed between the client and the project team in the model, while the model represent the project by the four phases of a project namely, project initiation, project planning, project execution and project closure stage. A project review mechanism was placed at the bottom part of the model which provide a means of reviewing project at every stage of the project, this makes the model a flexible means of approach to the project execution.

The model is though developed and its constituent components explained, as was explained the model summarizes planning needs of construction project, the research propose adoption of the model which will serve as a basis for developing frame work for planning construction projects can be developed.

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An Assessment of Solid Waste Management in Akure, Nigeria

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ABSTRACT

Solid waste collection is one of the most difficult operational problems faced by many cities in Nigeria of which Akure is not exclusive. This situation has rendered our cities to become the eyesore of the nation and an invitation to health hazards. This study therefore, aims at assessing the methods of managing solid wastes in Akure with a view to achieving the desired environmental sanitation for good health of the people. Data on sources and types of wastes generated, methods of disposal, regularity of disposal, dumping sites and processing were obtained from 368 sampled respondents coupled with information gathered from the Ondo State Waste Management Authority (ODSWMA). Descriptive statistics of frequencies, percentages and Likert scale were used to analyse data got. The results showed that most solid wastes were from residential houses and the refuse were dumped at roadsides waiting for government truck. The study revealed that ODSWMA truck cleared the wastes at least once in a week which the respondents adjudged satisfactory. It is recommended that the authority's refuse disposal trucks are well maintained while modern equipment for collection, recycling, processing, disposal and reuse should be procured for better efficiency.

Keywords: Environmental Sanitation; Refuse Disposal; Solid Waste; Waste Management

INTRODUCTION

Proper management of waste is critical to the health and well-being of urban residents (World Bank, 2003). The volume of waste generated in any city is often a reflection of the intensity of human activities such as increase in population, urbanization and social development, industrial development, resource exploitation and unchecked technological advances (Olanrewaju and Ilemobade, 2009). All these activities generate one form of waste or the other such as garbage, rubbish, ashes, trashes and dead animals. Most of our towns and cities are becoming more populated every day because of migration from rural to urban areas; the volume of solid waste generated has also increased tremendously and this makes solid waste a vital issue among the communities.

The production of waste material incudes the entire variety of refuse generated during domestic, industrial, construction and commercial processes (Bello, 2009). Solid waste is the term used to describe non-liquid waste material arising from domestic, trade, commercial, agricultural, industrial activities and from public services (Aibor and Olorunda, 2006). Solid waste management involves the storage, collection, and transportation of disposed refuse in a manner that is hygienically and aesthetically acceptable to avoid being detrimental to human health (Emeribe, 2000). The disposal of solid waste generated and the rate of evacuation or accumulation is an index of the degree of the effectiveness of solid waste management in an urban environment. Ojolowo (2007) is of the opinion that generation and disposal of waste is an intrinsic part of any developing or industrial society. Solid waste management is also an integral part of property management. It concludes that waste generation as an activity is not problematic per se, but subsequent phenomenal collection, storage and disposal are, in the face of urbanisation, pose challenges in many cities in Nigeria.

A study in Nigeria by Sridhar and Ojediran (1989) showed that municipal solid wastes were produced in the urban areas at a mean rate of 0.43 kg/head/day. Onibokun, Adedipe and

Adebayo, M. A. & Mbazor, D. N. (2016). An Assessment of Solid Waste Management in Akure, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 913-920

Sridhar (2000) also noted that it was not uncommon going through the length and breadth of the country (Nigeria) to find heaps of refuse littering the entire landscape, road sides and commercial centres, even on the premises of primary, secondary and tertiary institutions as a result of poor management strategies. Ossai (2006) discovered that waste generation nationally was alarmingly on the increase with an estimated annual rate of about 0.5 -0.7% and current figures ranging from 0.4 to 0.8 ton /capital /annum. It further stated that complexity in waste was also increasing with biodegradable waste accounting for over 50% amounting to an annual average of approximately 50milion tons per annum of waste burden on the nation with less than 10%waste management capacity. Yusuf and Ojo (2007) were of the view that about 75percent of solid waste collected in Nigeria cities was disposed in open sites thus marginalising the urban environment as a result of negative externalities generated.

The state of domestic solid waste management in Akure is of a serious concern. Wastes of all descriptions find their ways into public places such as open space, drainage channels, and road verges. The body in charge of Waste management in Ondo State is the Ondo state Waste Management Authority (ODSWMA) established in 1999, when solid waste management situation in Akure was chaotic and embarrassing to most of her residents. ODSWMA is solely responsible for the collection and disposal of waste in Ondo State. The desire of the state government to derive value from waste while at the same time effectively protecting the environment also led to the creation of the Ondo State Integrated Waste Recycling and Treatment Project under the Waste Management Authority. Though, waste management by nature is capital intensive and many state governments spend a good percentage of their funds on domestic waste management but what this amount could accomplish is dwarfed by the population it caters for. Moreover, the state of physical environment, especially in urban centres is a major source of concern and it is increasingly confronted with the necessity of developing more capacity to safely dispose of waste. With various strategies tried so far, to improve the situation, the success recorded has not been remarkable enough as noticeable in the heaps of wastes dumped by roadside road divides bus stops and other strategic points on the streets. It is therefore, imperative that an assessment of solid wastes management in Akure, the state capital is made with a view to improving on the existing strategies and exploring new methods as applicable.

LITERATURE REVIEW

According to Benneh, Songsore, Nabila, Amuzu and Tutu (1993), residential domestic wastes form the bulk of all sources of solid waste produced in urban areas. These household wastes were known to have high densities with high moisture content and the organic component of solid wastes, which properly accounts for about 70% to 90%, while tins, cans and paper are probably responsible for about 5% to 10% of the total waste produced. The study noted that because the capacity to handle all the household waste generated was still weak, about 83% of the population dump refuse in either authorized or unauthorized sites in their neighbourhood which creates unsanitary conditions. Ogedengbe and Oyedele (2006) showed that the rate of change in domestic waste quantities and composition in developing and developed countries was unprecedented. It further asserted that, generally the greater the economic prosperity and the higher the percentage of urban population, the greater the amount of solid wastes generated. Akinola and Salami (2001) observed that solid wastes had a lion's share among the total pollution of the earth's surface. Mainly solid waste composed of municipal and solid wastes (MSW), hazardous waste, plastic waste and e-waste. Municipal solid waste also called trash or garbage, is composed mainly of everyday items that are discarded by the public. Municipal solid waste can either be biodegradable (recyclable) and non-biodegradable.

Solid Waste Disposal and Management

Marshal (1995) stated that, waste materials that are organic in nature, such as plant material, food scraps, and paper products, were increasingly being recycled. These materials were put through compost and/or a digestion system to control the biological process to decompose the organic matter and kill pathogens. The resulting stabilized organic material was then recycled as mulch or compost for agricultural or landscaping purposes. Ajadike (2001) observed that most city residence dispose of their refuse either in open gutters, rivers, streets, open dumps, without regard to the environment and associated health hazards.

According to Medina (2002), the major models of disposal of solid waste in the United States were land filling or dumping and incineration. People want their refuse taken away and do not want it disposed of near their habitat, or at least not to where they can see or smell it. However, the European countries have resolved to improving waste disposal practices of solid wastes (including sludge), which may reduce the adverse environmental effects of such disposals and other aspects of solid waste disposals on land. This includes means of reducing the harmful environmental effects of earlier and existing landfills, means for restoring areas damaged by such earlier or existing landfills, means for rendering landfills safe for purposes of construction, and other uses and techniques of recovering materials and energy from landfills.

Solid waste management means the collection, keeping, treatment and disposal of waste in such a way as to render them harmless to human and animal life, the ecology and environment generally (Atsegbua, 2003). A survey conducted in urban centres in Iraq by UNEP (2008) revealed that solid waste management practices were generally very poor and these unsatisfactory practices were found in the collection, transportation, and disposal of wastes of all descriptions. The most serious challenge of the waste management situation in our cities is open dump systems adopted to manage solid waste.

Waste management requires a huge capital outlay. According to Akinwale (2005), Lagos state government spent between 20 and 25% of its funds annually on domestic waste management. The Waste regime in the UK provides a quintessence of a system that makes for effective monitoring of domestic waste prior to disposal and the steps to be taken on disposal. The regime distinguishes between controlled and special waste. Under Section 30 of the EP A, 1990, waste authorities in charge of waste administration have three basic functions: regulation, collection and disposal. Waste disposal authorities are to award waste disposal contracts through competitive tendering and are to make contracts with waste disposal contractors who may be private sector companies or companies set up by the local authority which must be at arm's length from the waste authority. The Waste regulation authority is responsible for issuing a waste management license. Under the regime, controlled waste may not be deposited, treated, kept or disposed of without a license. The licensing method issued as a means of controlling waste.

Malcolm (2005) identified lack of modem technology/lethargy in implementing efficient waste management methods as one of the challenges whereas different efficient ways of domestic waste management had long been in use in many developed countries. Recycling waste is one of the commonest ways of managing waste in developed countries. It involves the production of a useful material from waste garbage almost always has enough value to justify recycling parts of it. Financial instruments are used to encourage recycling and this is supported by environmentalists. In UK for instance, in keeping with the philosophy of introducing market forces into environmental regulation a system of financial credits was introduced by Section 52 of the EPA. It involves the waste disposal authority (the body

responsible for disposing of the waste), making payments to the waste collection authority (the body responsible for collecting the waste), in respect of waste which they have collected for recycling. This means that they would have less waste to take to the landfill site or to the incinerator. If a third party, e.g. a charity association collects waste for recycling they should be appreciated.

Landfill is currently the most common method of disposing of waste in many developed countries. It accounts for the bulk (90 per cent) of waste disposal in the UK (Mowoe, 1990). At its most basic, this involves digging a hole in the ground and filling it with rubbish. The practice usually is to bury different types of waste in the same landfill site (Malcolm, 2005). Usually domestic waste is disposed of with industrial waste; the latter serves to reduce the concentrations of components leached from the former-diluting the industrial leachate. In particular domestic refuse can serve to neutralize acid wastes which arise in considerable amounts in many countries including Nigeria. In the UK, legislation makes it possible for waste regulation authorities to grant licenses subject to conditions relating to the care of the site after it has been filled (Malcolm, 2005).

The other major method of waste disposal is incineration. This means burning waste in an incinerator. In many areas of Japan, France, Germany, Italy and Scotland, such low value recyclable waste (mostly paper and plastics) are incinerated (Mowoe, 1990). The reality is that much domestic waste in these forms i.e. paper and plastics (packaging waste) is a major contributor to the waste stream and to the problem of litter. Incineration could reduce the domestic waste volume by 95% (Atsegbua et al., 2003). When waste is burned, there are two consequences: gases will be emitted into the air and residues in the form of ash and sludge will be left behind. Until recently, disposal of this incinerator waste has been a continuing problem. In the mid-1990's successful experiments in France and Germany used electric plasma touches to melt incinerator waste into rounded glassy pebbles, valuable as concrete filler and they do not dissolve in water (Atsegbua et al., 2003).

Added to the above methods of waste disposal is a new technology for domestic waste collection called pneumatic collection system for domestic waste (Mowoe, 1990). This system conveys waste without the need for trucks driving through towns and is operational 24 hours per day every day of the year. The system was especially suited to the development of new urban areas and for renovation of historic centres. Pneumatic collection is a break away from conventional forms of collection in that it avoids the need to place waste on the public highway and does away with movement of trucks and all the associated nuisances. Running entirely underground, the system contributes to protection of the environment by creating cleaner urban areas that function better and are more environmentally friendly. It is an innovative service with a simple operating principle. Users deposit their waste boxes on the streets on building land or in the garbage disposal areas of residential building and hotels. Each box has an associated "waste value" allowing intermediate storage before transport of the bags to a central collection point.

The bags are then dropped automatically into tanks where the waste is compacted. The air needed to propel the bags is provided by high-power blowers and the system is entirely controlled from a computerized cock pit. Access to the drop boxes is available at any time, every day of the year and without restriction. Pneumatic collection has many economic advantages: designed to last for 50 years, the installation and operating costs are optimized by a high level of automation and energy -efficient processes (Ita, 2000).

THE STUDY AREA

Akure, the study area, became the capital of Ondo State in 1976. Since then, it has been influenced by the influx of people into the town. Akure is located at the centre of the state, approximately within Latitudes $7^0$15'N and $7^0$28'N North of the Equator and longitudes $5^0$6'E and $5^0$21' E East of the Greenwich Meridian. It is bounded in the north by Akure North Local Government in Iju Itaogbolu; in the west, by Ile-Oluji Local Government; and in the South, by Idanre Local Government.

According to the provisional figure of the 1991 national census, Akure had a population of 239,124 people and in 1996, the population increased to 269,207. NPC (2006) puts the population as 353,211 and now over 380,000 people by projection. However, this figure has increased immensely owing to the influx of the people into Akure from other parts of the country due to the various activities in the area.

Trading and civil service are the dominant occupation in Akure. Markets are built by the present administration and this has caused increase in solid waste in the area. There are also some commercial activities and industrial companies. As Akure grows commercially, it is abundantly endowed with well-developed and service oriented industries, insurance, banking, printing, advertising and public relations. These cause increase in solid waste generation in Akure.

RESEARCH METHODS

Survey research design was engaged in this study. The target population were residents of Akure and the officials of Ondo State Waste Management Authority. Structured questionnaires were administered on the sampled residents while interviews were conducted on the top management and actual workers that move from house to house to collect the wastes.

For the purpose of this research, the stratified random sampling method was used. Using this method, Akure, the study area was classified into three strata with each stratum having sub-division. The bases for this classification were location and population density which to a great extent determines the amount of waste generated in any neighbourhood (Agboola, 1999). The pattern of development in Akure is linear along its main roads which are Adesida Road, Arakale Road, Ondo Road and Oda Road. The three developmental strata and their sub-divisions arising from this pattern are:

i. Peripheral suburb: Alagbaka, Ala Quarters, Ijapo Estate and FUTA Area
ii. Newer inner suburb: Hospital Road, Oluwatuyi Quarters, Oshinle Quarters, Ijoka Road, Ilesha Garage, Oke Aro, Oke Jebu
iii. City centre: Oja Oba, Isolo, Oja Oshodi, Eyinke, Ijemikin, Odopetu, Araromi and Odo lkoyi.

A sample size of five hundred was used for this study. This was selected on the basis of administering 25%, 35% and 40% questionnaires in each of the three strata that is, Peripheral suburb, Newer inner suburb and City centre respectively. Using the stratified random sampling method, 125, 175 and 200 respondents from each of the three developmental strata to which Akure was classified were randomly selected. However, 368 returned and well completed were found useful for this study. The data collected were analysed with simple descriptive statistics of frequencies, percentage and 5-point Likert scale.

DATA ANALYSIS AND RESULTS

Table 1 shows the various types of solid wastes generated within Akure, the study area. Respondents were asked to tick the types of wastes generated within their household or business place.

Table 1 shows the type of solid waste generated by respondents. All the respondents i.e 100% confirmed that they generate food waste and nylon, 81.25% of them generates tin as wastes, 64. 67% generates old appliances as wastes while 61.41% generates carton as waste. 48.1% of the respondents generate paper and plastic as wastes, while 35.5% of the respondents generate planks as wastes. The findings conform with the conclusion of Akaninyere and Atser (2001) that the major components of waste are degradable materials (food remnants, paper, and rags) and non-biodegradable plastics, tins, metals, bottles, glass, and bones. The study asserted that in several Nigerian cities, garbage contributes substantially more than other components. This could be explained by the fact that most activities which affect the environment stem from the need for food; its production, processing and preparation. Moreover, the findings of this study also confirm that of Benneh *et al* (1993) in Accra, Ghana and Adewumi *et al* (2005) in Akure.

Table 1: Types of Solid Wastes Generated by Residents

Type of Waste	Frequency	Percentage
Food waste	368	100
Nylon	368	100
Tin	299	81.25
Old Appliances	238	64.67
Cartons	226	61.41
Glass	205	55.70
Paper	180	48.91
Plastic	180	48.91
Plank	131	35.59

Table 2: Waste Disposal Strategies

Method	Frequency	Percentage
Road side (expecting truck)	293	79.61
Dumping in bushes	198	53.80
Controlled dump sites	201	54.61
WMA containers	162	44.02
Burning	122	33.15
Gutters / Streams	72	19.56
Bury within compounds	45	12.22
Cart pusher	89	24.18

Table 2 shows the waste disposal strategies adopted by the residents in the study area. Most of the respondents 79.61% drop their solid wastes by the road side waiting for the Waste Management Authority's truck for evacuation. This method is followed by dumping wastes to controlled dump sites as attested by 54.61% of the respondents. Burning of wastes, dumping in gutters and streams and burying some within the compound are not very common among the residents. Only 33.15%, 19.56% and 12.22% respectively do these. The results of this study show the new orientation of the residents towards a better environmental sanitation. Moreover, the State Government through the Waste Management Authority monitors and penalise offenders of environmental sanitation.

Table 3: Frequency of WMA Collection System

System	Frequency	Percentage
Once in a week	208	56.52
Once in two weeks	102	27.72
Once in a month	35	9.51
No presence	23	6.25

Table 3 shows the frequency of the Waste Management Authority in collecting the solid wastes generated. From the Table, 208 representing 56.52% of the respondents indicate that WMA van comes to their neighbourhood to evacuate wastes, another 27.72% confirms that

the van comes once in two weeks. Only 35 of the respondents (9.51%) say the van only come not more than once in a month while 6.25% say they have never seen any government refuse collection truck in their neighbourhood. This result shows that the Authority in charge covers more than half of the city in a week and much more (84.24%) in two weeks. Perhaps the few areas not covered are due to location and inaccessibility owing to poor roads.

Table 4: Perception of Respondents to Waste Collection Management

	VS	S	N	LS	NS
Adequacy of dump sites	42 (11.41)	63 (17.12)	11 (2.99)	122 (33.15)	130(35.33)
Adequacy of containers	43(11.68)	51 (13.86)	42 (11.41)	120 (32.61)	112(30.44)
Regularity of Waste Collection	117 (31.79)	144 (39.13)	29 (7.88)	52 (14.13)	26(7.07)
Service charge	126 (34.24)	163 (44.29)	2 (0.54)	62 (16.85)	15(4.08)
Attitude of personnel	113 (30.71)	171 (46.47)	47 (12.77)	23 (6.25)	14 (3.80)
Final management of wasters	87 (23.64)	89 (24.19)	59 (16.03)	71 (19.29)	62 (16.85)

Note: VS- very satisfactory; S- satisfactory; N- neutral; LS- less satisfactory; NS- not satisfactory.

Table 4 shows the feelings and thoughts of the respondents towards the general management of solid wastes in the study area. 68.48 per cent of the respondents are not well satisfied with the provision of dump sites. Moreover, 63.05% have the same poor feelings to the adequacy of waste containers located at some points in the town. However, from the Table, 31.79% are very satisfied and 39.13% satisfied with the regularity of waste collection by the Management Authority. In other words, a total of 70.92% of the respondents are satisfied in this regard. The respondents, are also satisfied with the amount being charged for the service rendered; 78.53% of them affirms this. The attitudes of the personnel are also rated high as 30.71% of them show that they are very satisfied while 46.47% are satisfied. The perception of respondents to final management of waste show a sort of dissatisfaction as only 47.83% indicates satisfaction.

Outcome of Interview of Key Staff

The interview conducted on Ondo State Waste Management Authority indicated that the activities of the authority are mainly the collection, disposal and management of waste in the study area. Though there are several factors militating against the management of solid waste by the authority in the study area among them are lack of non-governmental organizations' participation in waste management, low political will to strengthen environmental management agencies and bodies, poor information management, non-compliance by the general public and adequacy of equipment for waste management.

It was further revealed that the state government has taken a step further in the management of solid waste by establishing an integrated waste management plant at Igbatoro road, Akure. It has production capacities of 25 tons of organo-mineral fertilizer per day, 5 tons of scrap metal recycling per day and 50 tons of nylon/plastic recycling per day.

CONCLUSION AND RECOMMENDATION

Generation of domestic solid wastes is a daily affair, though its management ought not to be a problem if correct approaches are employed. Waste management should be given adequate attention by both state and local governments. The study established the important role being played by ODSWMA in solid waste management. The authority is efficient in its services delivery in terms of waste collection and disposal and also the frequency with which the service is carried out in Akure. The authority is adjudged to be living up to its responsibilities according to the findings of this study especially in the regularity of waste collection, pocket friendly service charge and the courteous attitude of the personnel to their customers. However, it is hereby recommended that the state government should increase the annual

budget of environmental management in order to carry out mass repairs, overhaul and maintenance of the Authority's equipment for effective waste collection, disposal and management. For better efficiency, modern equipment for recycling, processing and reuse of wastes should be provided. In addition, more refuse dump containers should be placed on streets within the city to discourage people from indiscriminate refuse disposal.

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Perspectives of the stakeholders of the public transportation system on ICT solutions applicability in the Free State, South Africa

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ABSTRACT

Information Communication Technologies have recently been adopted by transportation systems around the world to improve their services. In adopting these technologies, the stakeholders' involvement and perceptions regarding ICT should be considered. This paper, considering the study area, reflects on the perceptions of different stakeholders of the public transportation system towards the introduction of ICT solutions to the system. The methodology adopted was to understand the expectations of drivers, passengers and operators on integrating ICT solutions into the public transportation system, focusing on mini-bus taxis and Interstate Bus Line buses. The significant results of the study show that ICTs are anticipated and long overdue development to the system but the stakeholders have varying expectations. These results reflect on the priorities of the stakeholders, i.e., passengers yearn for improved service quality; drivers are concerned with their working conditions while the operators' interests are profit motivated. This paper highlights the ICT interests of passengers, drivers and operators. It compares passengers' needs, in terms of technologies, to improve the public transportations system against what the operators are enthusiastic to provide.

Keywords: Information Communication Technologies, Perception, Public Transportation, Stakeholder

INTRODUCTION

Stakeholders' perceptions on technology play a crucial role in the adoption of ICT in the public transportation system. Enabling actions for successful deployment of ICT in transportation should include a consensus amongst the stakeholders (Idongesit & Knud, 2014).The goal of public transportation services is to provide safe, reliable, affordable and accessible public transportation to the public. The main concern of the stakeholders should be that the above factors are met. In the Free State, public transportation is provided by private mini bus taxi operators and bus services which are provided by a private company under government subsidy.

Although public transportation systems in the world have been taking advantage of the current technological momentum to improve their service provision, the Free State public transportation system have not done much yet to exploit the opportunities lying within ICT. Deployment of ICT solutions to improve the public transportations system in the province may however be anticipated by the different stakeholders for solving differing problems in the system and how they may improve their different affiliations to the public transportations system.

The uptake will also depend on how drivers view the development (Zwick, 2002). Innovations render knowledge obsolete, therefore forcing employees to undergo training in order to be able to adapt to the changes. Public transportation drivers will require training in order to use some of the new technologies.

With the public transportation systems facing problems of safety, lack of information, accessibility, and being unreliable; operators should be concerned with eliminating these

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problems to satisfy the needs of customers and improve the system for the passengers. The concerns of the operators may not be aligned with those of drivers and operators based on their different needs. The role of the operators, as the service provider is to ensure that the passengers and drivers are safe, they provide regular service for reliability. Service provision, in general, should be inclined with fulfilling customer needs other than protecting the operator's investment.

ICT Opportunities for Stakeholders in public transportation systems

ICT has the ability to improve the efficiency and effectiveness of public transportation systems, therefore improving mobility for the passengers, working conditions for drivers, and service delivery for operators. ICT has improved public transportation through technologies and applications in different scenarios:

Real time information through map and route display screen and trip planning applications

Passengers would use display screens for information on their location, time left to their destination, routes they are travelling on. This would reduce cases of inaccessibility of public transportation due to lack of information on routes in a sense that, a novice would have all the information they need made available through these screens. Studies show that technologies allow real time information transference between travellers and public transportation service providers (Filippi, Fusco & Nanni, 2013),and that usability of public transportation can be improved significantly if good real time traveller information systems are provided (Ferris, Watkins & Borning, 2010). Provision of real time information will enable travellers to enquire about arrival and departure times at locations of their interest, and the availability of this information is a way of increasing public transport ridership as it reduces anxiety of passengers, therefore increasing a sense of reliability towards the public transportation systems (Ferris, Watkins & Borning,2010; Park, Yang &Yi, 2011).

Real Time Tracking and Monitoring of Vehicles

Monitoring of bus stations, stops, and inside the vehicle is important for safety reasons. Currently, the method of payment in mini-bus taxis is such that passengers pass their fare to the person seated in front of them in the vehicle, in some cases money goes missing in the process without any means of tracing how and where it disappeared or identifying a passenger who did not pay. In these cases, the driver, who is the final designated recipient of the money, should be able to see, using CCTV as money is being passed around to solve this problem.

Electronic fare payment (EFP) systems

Electronic fare payments have made payment for journeys by public transportation more convenient and also made it easier for operators and bus conductors; improving public transportation for both passengers and service providers. These fare payment systems operate through electronic communication, data processing and storage techniques that have made manual fare collection an automatic, computerized system (Floridaapts, 2015). They have improved manual labour dealing with handling of cash, safety and security reasons as bus drivers and conductors do not have to be at risk of robberies and hijackings targeting the money collected from passengers. EFP methods include electronic ticketing and smart cards. They have provided a platform for accessibility of information on public transportation, meaning that public transportation has also become more accessible and safer. Information is very important to travellers especially those new to a place (Ben-Elia and Avineri, 2015).

LITERATURE REVIEW

Passengers and drivers' perspectives

Public transportation users have the view that ICT solutions will improve the public transportations system tremendously, by improving accessibility, reliability and safety, and general quality of service. As ICTs can be used by operators or governments to monitor drivers, they can be used to both monitor and mentor drivers. Negative impacts of monitoring such as invasion of privacy and compromising driver behaviour shall be balanced by mentoring. Noting that most operators have shown interest in tracking and monitoring technologies like CCTVs, tracking devices and speed monitoring devices. Operators aims of managing their enterprises through ICT can influence the attitudes can go beyond perceptions of transparency, privacy and fairness to determine the degree of trust in the system (Regan, Horberry & Stevens, 2014).

The Technology Acceptance Model (Davis, Bagozzi & Warshaw, 1989) was adopted to explain possible links between determinants of computer acceptance and user behaviour, can also be adopted to determine acceptance of ICTs by users. The users, i.e. operators, drivers and passengers', perception of how the technologies will be useful to them and how easy to use they will also determine their attitude towards particular technologies or applications. Perceived usefulness and perceived ease of use therefore are seen as the crucial factors determining acceptance. Perceived usefulness of technologies also influences the person's behaviour with regards to their intention to use or not use the technology. This model, based on drivers' perspectives, shows that drivers will accept technologies they assume will enhance their performance (performance expectancy) and improves their working conditions. Behavioural intentions (how the people intend to use the technologies) and their impact on the actual use of the technologies should also be considered. With all the stakeholder's main concern being the usefulness and ease of use of ICT, consideration should be made as to whether those impacts are the same for all the stakeholders, i.e. what the other stakeholders consider useful, will it have the same positive impact on the other stakeholders, and will other stakeholders be able to easily use.

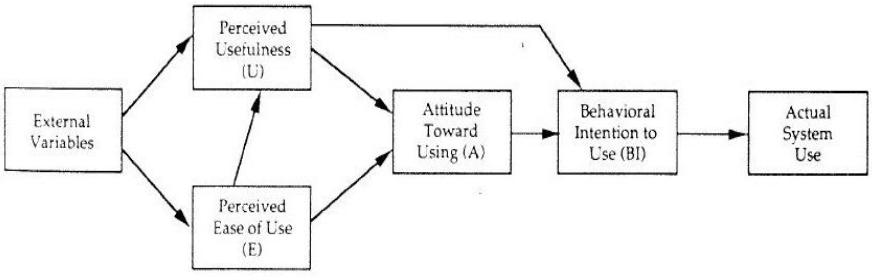

Figure 1: Technology Acceptance Model (Davis, Bagozzi & Warshaw, 1989)

Drivers and operators' perspectives

(Zwick,2000), implied that innovations are brought about to improve service availability, increase productivity, improve performance of employees, and client friendliness, flexibility and satisfaction. Passengers or public transportation users could have positive perceptions towards developments in technology if these technologies would improve service delivery and customer satisfaction, operators would have more interest in innovations that increase productivity, performance of employees, i.e. drivers. These goals somehow put pressure on the driver, as the facilitator between the operator and the passenger to deliver the transportation service in a way that customers will be satisfied and the operator's business.

Table 1: The responsibility of drivers and operators in service provision (Rohani, Wijeyesekera & Karim, 2013)

Items in Quality of service	Bus provider	Bus driver
Reliability	X	X
Responsive	X	X
Competence	X	X
Access	X	
Courtesy		X
Communication		X
Credibility	X	X
Security	X	X
Understanding / knowing the Passenger	X	X
Tangibles	X	

Table 1 shows the responsibility of drivers and operators in service provision as the driver also have responsibilities towards the passengers. (Rohani, Wijeyesekera & Karim, 2013) stressed the point that it is vital for drivers to have good communications with bus passengers and to be service oriented. Drivers in public transportation are in their working environment, therefore the ICT solutions improving the public transportation system should improve their working conditions. (Fourie,2003) listed bad working conditions, lack of skills and appropriate training, as some of the common problems in the public transportation industry.

Table 2: The degree of trust in the system (Regan, et al., 2014)

Monitoring	Mentoring
• Control of driver	• Care for driver
• Reactive advice	• Proactive advice
• Quantitative measurements	• Meaningful feedback
• Strict standards	• Support for improvement
• Comparison with co-workers	• Consider unique characteristics
• Under control of monitor	• Under control of driver
• Unfair standards and evaluations	• Fair and flexible evaluations
• Negative feedback	• Constructive feedback
• Invasion of privacy	• Respect for privacy
• System opaqueness	• System transparency
• Adversarial culture	• Supportive culture

As ICTs can be used by operators or governments to monitor drivers, they can be used to both monitor and mentor drivers, that way out the negative impacts of monitoring such as invasion of privacy and compromising driver behaviour shall be balanced by mentoring. Noting that most operators have shown interest in tracking and monitoring technologies like CCTVs, tracking devices and speed monitoring devices. Operators aims of managing their enterprises through ICT can influence the attitudes can go beyond perceptions of transparency, privacy and fairness to determine the degree of trust in the system (Regan, Horberry & Stevens, 2014).

With the current public transportation system, there is uncertainty these important attributes of the system, safety, accessibility. Uncertainty implies that the decision maker, the passenger or public transportation user does not have the perfect information (Ben-Elia & Avineri, 2015). Information availability and accessibility therefore provide certainty and assurance to the passengers. With journey planning and instant notifications there is an illusion of assurance, passengers can know the time vehicles arrive, departure time and in cases of delays and breakdowns, they can be assured of the next vehicle's arrival time or the exact time the vehicle is delayed by. Passengers avoid public transportation due to safety concerns. Monitoring and tracking technologies perceives safety and also deters crimes such as robberies in public transportation stations, vehicles and waiting areas. Passengers and drivers, unlike operators have relatively similar perceptions on what needs improvement in the public transportation system.

The quality of service provided by the operators determines the customer satisfaction, while the quality of service and driver behaviour also determines customer satisfaction. Driver

behaviour is also influenced by operators' behaviour. Therefore, in order to satisfy all the stakeholders, their needs must be aligned/ synchronised.

METHODOLOGY

Quantitative data collection via questionnaires was undertaken by employing stratified random sampling method to gather information from public transportation users, drivers and vehicle owners / operators. Owners of mini bus taxis and buses operating in the Free State province were asked about the technologies they would like to have in future, if conditions permitted, use in their vehicles. Passengers were also asked about the technologies they are willing to use. The study was carried out in the Free State province between June and August 2015. The questionnaires were given to operators at the Department of Police, Roads and Transportation licencing office where public transportation vehicle owners gather daily. Other questionnaires to passengers and drivers were administered at taxi ranks and Hoffman square where passengers wait for buses and drivers park their vehicles while waiting to leave at their scheduled times.

FINDINGS AND DISCUSSIONS

Passengers and drivers

Figure 2 shows the technologies which passengers and drivers are willing to use. The study looked at the technologies people are willing to use, therefore reflecting on what they think it's useful or will be easy to use. 38% of the respondents indicated that they will be willing to use tracking devices, while 20% indicated that they will be willing to use CCTV cameras. These technologies can be classified as monitoring technologies, which ensures secure and safer working conditions for drivers and perception of safety to the passengers. 25% and 22% of respondents indicated that they will be willing to use map and route display screens and buzzers respectively. Buzzers are a necessity as they will convey the message about a passenger willing to debus to the drivers and are also very easy to use. They will safely send the message to the driver without destructions as currently the passenger has to walk over to the driver and tell him to stop or shout the message across the vehicle to the driver.

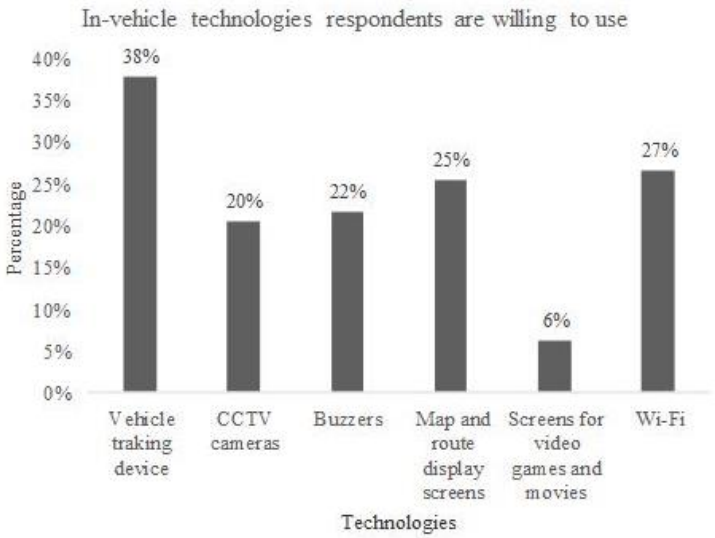

Figure 2: In-vehicle technologies respondents are willing to use

The usefulness of map and route display screens is indicated by the fact that information availability provides assurance and certainty to passengers. Drivers and users indicated that introducing screens for entertainment purposes (TV, gaming) is not a much needed technology as only 6% was willing to use them, these technologies may be easy to use but not

entirely useful as they do not promote accessibility or safety. Reliable internet availability plays a major role in real time information provision and accessibility, for some ICT application to fully function there should be connectivity. 27% of drivers and users indicated that they will be willing to use Wi-Fi if it is provided in the public transportation system. Wi-Fi can be provided at bus stations, bus stops and inside the vehicles for internet surfing, working and social networking. Public transportation users can use it to access the internet while waiting to board vehicles or during trips, as this will also create the illusion of time moving faster when they are kept busy.

Operators

44% of the operators indicated that they are willing to install buzzers in their vehicles for passengers to be able to notify the driver to stop. Buzzers are a way of sending information to the driver without distracting him, that making them useful and are easy to use as they do not require any skill to operate. 34%, 40% and 28% of operators indicated that they were willing to install tracking and monitoring technologies i.e. vehicle tracking devices, Speed monitors and CCTV cameras. Monitoring technologies however raises questions to whether the operator is ensuring customer safety or protecting their investments by monitoring drivers. Many operators would like to add vehicle tracking technologies to their vehicles, in order to monitor the movement of their vehicles and how drivers use the vehicles. As owners of vehicles, operators tend to be more concerned about the safety of their vehicles instead of satisfying the needs of the customers. Monitoring speeds is a way of ensuring the wise use of their vehicles by the drivers. Monitoring drive behaviour through CCTV, this may compromise the freedom of drivers as being under scrutiny all the time may make them uncomfortable.

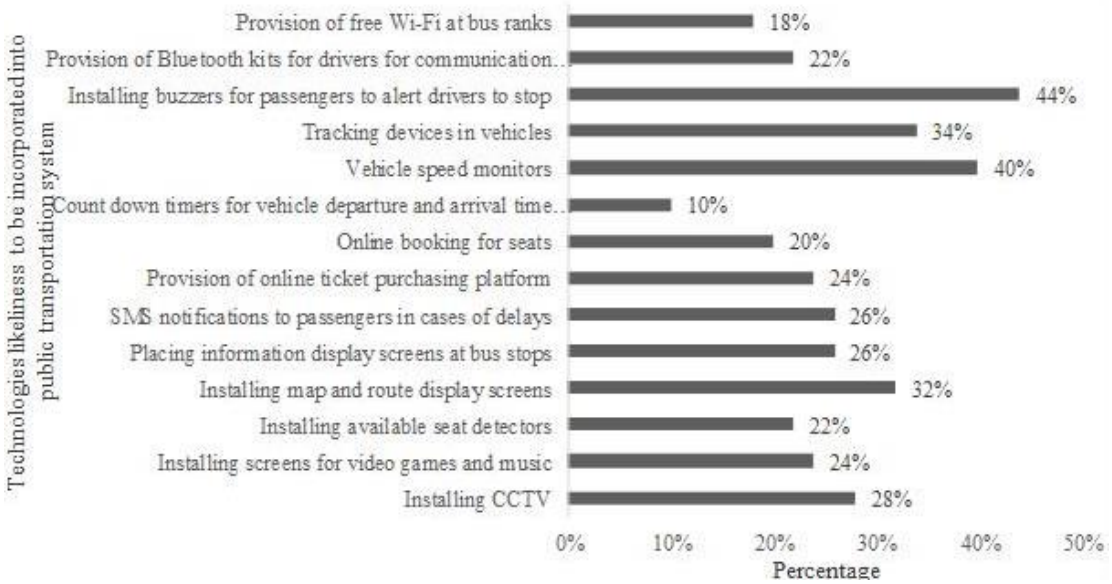

Figure 3: Information Communication Technologies the public transportation operators are willing to provide in future

26%, 26% and 32% of respondents indicated that they would provide SMS notifications to users install information display screens and map and rout display screens respectively. Information may be of fundamental importance to the users, but does it carry the same weight of importance to operators? Only 10% of operators were willing to install countdown timers to provide real time information on status or location of vehicles at bus stations or stops. This indicates that provision of information to passengers may not be a priority to them. Referring to the TAM, these technologies are useful and easy to use, but do not seem important to the operators. 24% of operators indicated that they were willing to provide technologies for

entertainment, by providing screens for TV and gaming, this compared to the passenger and driver's needs.

Drivers, Passengers and Operators

The figure below shows challenges likely to be faced by all stakeholders if ICTs are to be integrated into the public transportation system. These are the factors the drivers, users and operators will hinder the integration process and therefore should be addressed.

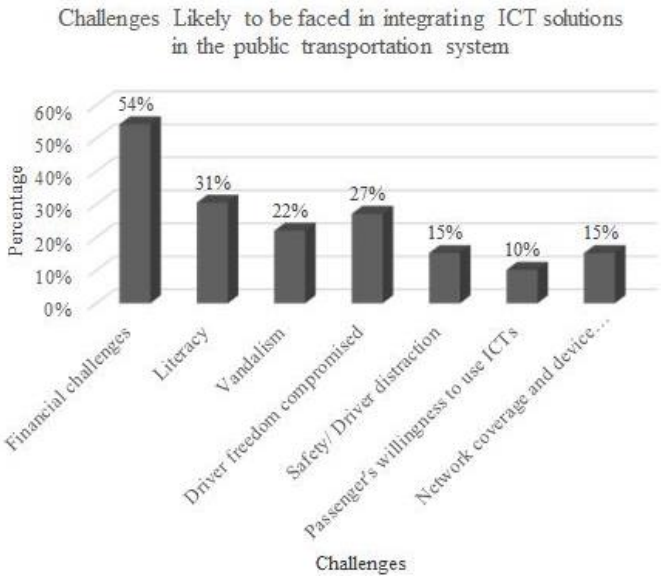

Figure 4: Challenges Likely to be faced in integrating ICT solutions in the public transportation system

Financial challenges: 54% of the respondents cited financial challenges:Installation of electronics and applications will result in financial implications for the operators, and some operators may not be able to install them at all. The passenger' take on financial implications will be the prices of internet connectivity, mobile data for downloading public transportation applications. There is a perception that improved public transportation services will result in increased transportation fare amongst public transportation users. This indicates that people in the Free State think that ICTs are likely to be not affordable.

Literacy: 31% of indicated literacy as a possible problem. This relates to ease of use of technology in a sense that, one should have a certain literacy level to be able to use some applications and technologies and be able to read.

Driver freedom is compromised: With tracking and monitoring technologies, drivers will no longer be free to use vehicles for their personal errands. 27% of respondents indicated that drivers' freedom will be compromised; their privacy will be invaded if they were to be monitored all the time.

Vandalism: 22% of the respondents indicated that vandalism of electronics and applications by users and drivers is also a possible course for concern. ICTs installed in vehicles and bus waiting areas may be deliberately destroyed. With security or monitoring technologies in place, there should be able to monitor any unlawful tampering with the installed applications.

15%, 10% and 15% of respondents respectively indicated that driver distraction, passengers' willingness to use ICTs and network coverage could also be possible challenges. Some technologies especially for entertainment purposes may distract the driver and cause accidents and damage to vehicles. If ICTs are introduced to the public, the people whose travelling experience they are meant to improve, the people should be willing to use them in order for the integration to be successful. Rural areas in the province have connectivity problems and

this may affect the use of mobile applications, web-based platforms such as trip planning and social networking sites.

CONCLUSION ANS RECOMMENDATIONS

The paper investigated the perceptions of Free State public transportation stakeholders towards using Information Communication Technologies in the system. The perceptions of the stakeholders' lean towards their involvement with the public transportation system.We need to remember that the main aim of public transportation service is to provide safe, reliable, affordable and accessible transportation. Within these lies factors such as comfort, certainty and freedom for all the stakeholders. The results the stakeholders have conflicting expectations from integrating ICT solutions into the public transportation system. The ICT solutions for a safer public transportation for instance are not perceived similarly by the stakeholders, they may be safety assuring measures to operators and passengers but not comfortable for drivers.

Drivers and operators should use their responsibilities towards passengers to surpass their personal needs and expectations from ICTs. Their responsibility is firstly to serve the passengers. Considering this, drivers should settle into the idea that monitoring technologies are for the safety of all stakeholders and operators should not abuse the monitoring technologies to make the working environment uncomfortable for the drivers.

Perceptions can also be a result of usefulness and usability of technologies as they are driving forces towards acceptance of technologies. Stakeholders are not willing to accept technologies they do not see useful or they will not be able to use. This should, for implementation in future, prompt decision makers to deploy useful and usable technologies in the transportation system.

Integrating ICT solutions into the public transportation system will have financial impacts on operators and passengers. Operators should provide these technologies in their service provision (installation, maintenance, and operation) while passengers need finances to access and use some technologies, e.g. smartphones, data / airtime. The passengers, taking into consideration the prices of the current transportation services think that improving the system for the better will also result in increased service fees. Generally, the perceptions are influenced by the current state of the system, user acceptance, based on perceived usefulness and ease of use of the technologies as well as the anticipated behaviour of stakeholders towards the technological innovations.

This paper provides more insight and understanding into stakeholders' perceptions to help in decision making concerning introducing new technologies and innovation in the public transportation system. It will therefore improve the decision making process and also help other stakeholders participate in the process and their perspective be taken into consideration.

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Impact of Risks on Tendering and Procurement of Building Projects in Lagos State

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ABSTRACT

The paper examines the impact of risks on tendering and procurement of building projects in Lagos state. The objectives are to investigate the significant sources of risks to tendering and procurement, probability of occurrence of risks in tendering and procurement, level of awareness and adoption of risk management techniques in construction tendering and procurement. The questionnaire for the study was administered on building contractors and consultants. 44 questionnaires were retrieved and used for the analysis of the study through SPSS 20 software. The findings of the study revealed that the significant sources of risk are bad management, errors and omission, unskilled staff and economical regulations. Risk types that have high likelihood of occurrence are safety of works, bribery, inadequate cash flow, insurance, contractor default, inappropriate specifications, and economic pressure and market conditions. In the same vein risk types that have the greatest impact on tender are safety of workers, interest rate, disposal of bad plant and equipment, unforeseen site condition, contractor default, change in scope, defective work and project management. Thus, from calculation, risks that have high probability of occurrence are equipment failure, market condition, financial default by client, insurance, inadequate cash flow, and bribery. The study concludes that in spite of the awareness of respondents of risk management techniques, their adoption are mainly at response level rather than identification and assessment level.

Keywords: Building Projects, Procurement, Risk, Risk Management, Tendering

INTRODUCTION

The construction industry, like many other industries is subject to risks due to its unique features and complexity (Smith, 2003). The industry is one of the most dynamic, risky, and challenging and rewarding fields because it is exposed to both predictable and unpredictable risk (Mill, 2001). As a result of the inherent risk in construction process, researchers (Tipili, & Ilyasi, 2014) concluded that risks cannot be totally avoided, so it must not only be recognised, it must be assessed and managed. Buertney,Abeere-inga and Kumi (2013) noted that risks and construction are not mutually exclusive. Risk is an event that can have a negative impact on project outcome or opportunities that are beneficial to project performance. FAA system (2000) defined it as the probability and severity of accidents or loss from exposure to various hazards including injury to people and loss of resources. Oyewobi, Ibrahim and Ganiyu (2012) described risk as the exposure of construction activities to economic loss due to unforeseen events or foreseeing events for which uncertainty was not properly accommodated. The construction industry is plagued by risks above most industries due to its unique features which include complexity of construction activities, long period of construction activities, complicated process, financial intensity and dynamic organizational structure and these risks which are not adequately dealt with result in overall increased cost, time and reduced quality.

Rezakhani (2012) defined it as the potential for complications and problems with respect to the completion of a project and the achievement of a project goal. Another concept of risk is risk management which is the process of controlling the level of risk and mitigating its effects (Ahmed, Azhar & Ahmad, 2001). As such, it involves a systematic approach for identifying, evaluating, and responding to risks encountered on a project. It was also noted that risk

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management is a process that involves identifying and assessing managerial resources with a co-ordinated and economic effort to minimize the probability and impact of unfortunate events so as to maximize the realization of poor project objectives. Risk management, according to Zou, Zhang and Wang (2007) is a way of looking at risk areas and determining how each should be treated. Mahendra, Pitroda and Bhavsar (2013) claimed that risk management identifies project risks, analyses them and determines the actions to be taken to avert the threats on any projects.

Risk is a pre-emptive concept rather than reactive and as such if not properly handled can lead to risk effects such as cost overrun, time overrun and poor quality. There are many kinds of risks which include safety risk, social risk, business risk, investment risk, military risk and political risks (Naphade & Bhangale, 2013) but the risks commonly faced by contactors are changes in work, delayed payment on contract, financial failure of owner, labour dispute, labour, equipment and material availability, labour productivity, defective materials, equipment productivity, safety, poor quality of work, unforeseen site conditions, changes in government regulation, political and ordinances, delays in resolving litigation/arbitration disputes, inflation, cost of legal process and force Majeure (Oyewobi, *et al*, 2012).

There is limited research on the effects of risks and risk management on construction tendering and procurement and this may be due to the fact that its importance is underestimated by both practitioners and academia. The concentration of research on construction risks have had efforts mostly being channelled towards effects of risks on construction cost, time and quality (Tam, et al, 2004), risk management at design phase (Chapman, 2001), construction phase (Abdou, 1996). Other people looked at risk from the life cycle perspective (Zou, et al, 2007), construction projects (Radujkovic & Car-pusic, 2011; Calzadilla, Awinda & Parkin, 2012), public private partnership, contingency (Buertney, et al, 2013), organizational performance (Agwu, 2012), Joint venture projects (Adnan, 2008) and insurance in construction industry (Naphade & Bhangale, 2013).

In view of this, it is evident that there is limited research on the impact of construction risks on the tendering and procurement of construction projects in spite of the importance of tender figures and procurement options for construction projects. The tendering and procurement phase is particularly an important stage in the design and construction of projects as it drives the eventual cost, time and quality of the project. Therefore, this study would contribute to the body of knowledge by determining the impact of risks and risk management on tendering and procurement of construction projects.

LITERATURE REVIEW

Sources of Risks

Ultimately, all risk encountered on a project is related to one or more of the following (Flanagan & Norman, 1993): failure to keep within the cost budget/forecast/estimate/tender, failure to keep within the time stipulated for the approvals, design, construction and occupancy, failure to meet the required technical standards for quality, functions, fitness for purpose, safety and environment preservation. For risks to be effectively eliminated, the sources must be identified and properly mitigated. According to Slattery and Bodapati (2001), the sources of risks are schedule, cost, quality, technical, unknown conduction, international, environmental and safety. It was noted in Zou, et al (2007) that cost related risks include tight project schedule, design variations, variations by the client, unsuitable construction program planning, occurrence of dispute, price inflation of construction materials, excessive approval procedures in administrative government departments, incomplete approval and other documents, incomplete or inaccurate cost estimate and inadequate program scheduling. Time related risks involve bureaucracy of government, high

performance or quality expectations and variation of construction programs among others. Quality related risks include low management competency of subcontractors and unavailability of sufficient amount of skilled labour. Environment related risk involve inadequate or insufficient site information (soil test and survey report) and serious noise pollution caused by construction. Safety risks are general safety accident occurrence and unavailability of sufficient amount of skilled labour. Environment related risk involve inadequate or insufficient site information (soil test and survey report) and serious noise pollution caused by construction. Safety risks are general safety accident occurrence and unavailability of sufficient professionals and managers.

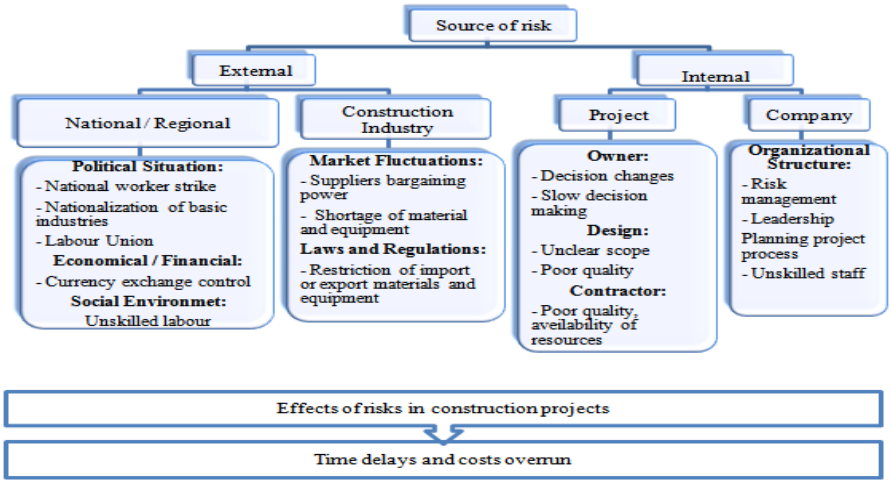

Figure 1: Sources of risks and their effects
Source: Calzadilla, Awinda & Parkin, (2012: 1215)

The breakdown of the sources of risks is as described in Table 1

Table 1: Breakdown of risk sources

Table 1: Breakdown of risk sources
Source: Radujkovic and Car-pusic (2011: 2)

EXTERNAL SOURCES –outside the project		INTERNAL SOURCES – inside the project	
LEGISLATIVE	1 - Local regulations	CONTRACT	1 – Unrealistic deadline
	2 – Permits and agreements		2 - Unrealistic price
	3 – Law changes		3 – Other contract provisions
	4 – Standards	TECHNICAL DOCUMENT	1 – Delay
POLITICAL	1 – Policy changes		2 – Incompleteness
	2 – Elections		3 – Imprecision
	3 – War		4 .- New solutions as a consequence of 2 and 3
	4 – Existing agreements	ORGANIZATION	1 – Bad management
ECONOMICAL	1 – Economic regulations		2 – Bad organization of works
	2 – Price rises	TECHNOLOGY	1 – Poorly chosen tech. solutions
	3 – Exchange rates		2 – Obsolete technology
	4 – Financing conditions	RESOURCES	1 – Shortage of workers
	5 – Economic policy changes		2 – Shortage of machinery
SOCIAL	1 – Education, culture		3 – Machinery breakdowns
	2 – Seasonal work		4 – Late delivery of materials
	3 – Strike	HUMAN FACTOR	1 - Productivity
	4 – Human fluctuation		2 – Sick leaves
NATURAL	1 – Climate		3 – Motivation
	2 – Soil		4 - Errors and omissions
	3 – Subterranean waters		
	4 – Natural disasters		

Source: Radujkovic and Car-pusic (2011: 2)

Calzadilla, Awinda and Parkin (2012) classified the sources or risks into external and internal. External sources consist of natural/regional sources and the construction industry

while internal sources consist of the project and company. Under the national regional sources, there is political situation (national worker's strike, nationalization of basic industries and labour union), economical/financial (currency exchange control) and social environment (unskilled labour). Construction industry consists of market fluctuation (suppliers bargaining power and shortage of materials and materials and equipment) and laws and regulations (restriction of import or export materials and equipment.

Types of Risks in Construction

There are four types of risks according to Mahendra, et al (2013) and they are (1) technical risks- incomplete design, inadequate specification, inadequate site investigation, change in scope, construction procedures and insufficient resource availability, (2) construction risks- labour productivity, labour disputes, site condition, equipment failures, design changes, to high quality standard and now technology, (3) physical risks are damage to structure, damage to equipment, labour injuries and equipment and material fire and theft and (4) organizational risks- contractual relations, contractor's experience, attitudes of participants, inexperienced work force and communication. The types of risks discovered by Ahmed, et al (2001) are acts of God (flood, earth quake, land slide, fire, wind damage and lighting), physical (damage to structure, equipment, labour injuries, materials and equipment fire and theft), financial exchange rate fluctuation, financial default of subcontractor and non-convertibility), political and environmental (changes in laws and regulations, war and civil disorder, requirement for permits and their approval, pollution and safety rules, expropriation and embargoes), design (incomplete design scope, defective designers and omissions, inadequate specifications and different site conditions), construction related (weather delays, labour dispute and strike, labour productivity, differing site conditions, defective work, design changes and equipment failure.

Risk categories according to Shrestha (2011) are political risk-direct political, political decision making, right of way risk, competing facilities risk, regulatory risk, protectionism and legislation change. There is also economic risk (pre-investment risk, toll revenues, financial risks and cost overrun risk), socio-cultural risks (public opinion, environmental risks, moral hazard, partnering risks and environmental justice), technical risks (project management risks, construction risks, design and latent defect risk, technology risks, force Majeure physical risks). The types of risks mentioned by Oyewobi et al (2012) are design risk (defective design, variation of work, changes of original design and deficiencies in description of work), financial risk (inflation, inadequate cash flow, exchange rates, cost overrun due to schedule delay and contractors default), construction risk (contractors competence, defective material, poor performance of supplier, poor quality of work, productivity of equipment, labour, material and equipment availability and unforeseen site condition) and political risks (political uncertainty, bank policies, changes in government regulations, permits and ordinances and force Majeure). Ritchie (2007) noted from two case study projects that the type of risks include, delay in award of tender, access to site, site conditions, design responsibility, ambiguities in documentation, extension of time, interface risks, fit –out works, subcontracting, scope of works, fit for purpose and cultural heritage. Banaitiene and Banaitis (2012) grouped risks into local, global, economic, physical, political and technological change. PMBOK (2008) categorised it into technical, external, organization, environmental or project management.

Ehsan, et al (2010) pointed out that the categories of risks are technical (inadequate site investigation, incomplete design, appropriateness of specifications and uncertainly over the source and availability of materials), logistical risks (availability of sufficient transportation facilities and availability of resources), management related risks (uncertain productivity of resources and industrial relations problems), environmental risks (weather and seasonal

implications and natural disasters) and financial risk (availability and fluctuation in foreign exchange, delays in payment, inflation, local taxes and repatriation of funds), socio-political (constraints on the availability and employment of expatriate staff, customs and import restrictions and procedures, difficulties in disposing of plant and equipment and insistence on use of local firms and agent).

Risk Management Techniques in Construction Industry

Al-Shilby, et al (2013) classified risk assessment methods in quantitative and qualitative methods, qualitative method involves direct judgment, ranking options, comparing option and descriptive analysis. Quantitative technique includes probability, sensitivity, scenario and simulation analysis. Qualitative assessment involves identifying (1) risks hierarchy which is based on probability of risk occurrence and its impact on the project and employees (2) risks scope and (3) risk occurrence factors. Quantitative risk analysis involves evaluation of the impact of all identified and quantified risk. The results of quantitative are more objective than those from quantitative risk analysis. Risk management is divided into risk identification, risk assessment, risk response and risk treatment. Risk identification involves identifying and applying procedures for identifying opportunities, identification of losses of risk, identify how and why risk arise, analysing process to identify risks, scenario analysis to identify risk, area of risk management, physical inspection to identify risk, risk source, use of questionnaire, interview, brainstorming, SWOT and examination of local/oversees experience to identify the risk.

Risk assessment involves analyses/evaluation of opportunities, SWOT, risk collation, analysis of risk according to likelihood, consequence, quantitative analysis methods, reputation impact, achievement of objectives, financial impact and qualitative analysis method. Risk response involves identification of risk management plan, considering limits to achieve risk management objectives, evaluate cost and benefits of identifying risks, finding out the effectiveness of available controls and risk management responses, prioritising risks that cause great losses and identifying up to rate business continuity plan. Risk treatment involves understanding the risk faced by organizations, regarding communication aboard risk, supporting effective management of risk between staff and management, providing appropriate level of control regarding risks, risk transfer, risk reduction, monitoring the effectiveness of risk management, avoiding risk and accepting/retaining risk. Risk management according to Mahendra, et al (2013) is in four stages – Risk identification, risk assessment, risk response planning and risk control. Risk identification involves brainstorming, Delphi technique, interview/export is categorised into quantitative and quantitative techniques. Quantitative technique involves risk priority numbers and quantitative technique involves sensitivity analysis, scenario analysis, probabilistic (Monte Carlo simulation) analysis, decision trees, Risk, response involves risk avoidance, risk transfer, risk mitigation/reduction, risk exploit, risk sharing, risk enhancement, risk acceptance and contingency plan.

Naphade and Bhangale (2013) noted that the methods of identifying risks are brainstorming, interviews, questionnaire, services specialists and past experience. Risk can be managed by using existing assets, contingency planning and investing in new resources. The risk management strategies are risk prevention (including risk avoidance), impact mitigation, risk sharing, insurance and risk retention. Ritchie (2007) claimed that risk elimination, reduction, transfer and retention are ways of mitigating risk. The risk identification techniques put forward by Kansal and Sharma (2012) are brainstorming, Delphi technique, interview/expert judgment, checklist, influence diagram, flow chart and cause-and –effect diagram. Risk management techniques according to Ehsan, et al (2010) are risk identification, risk quantification, risk response development and risk response control. Risk response is

classified into acceptance, quantification, monitoring the risks, preparing contingency plans, transferring and mitigating risk.

METHODOLOGY

The population for this study is the construction organizations that are involved in project tendering and procurement. Also, the consultants' views were obtained because they are usually involved in the selection process of contractors during the tendering and procurement stage. The construction organizations' list was obtained from the Federation of Construction Industry (FOCI) and construction professional bodies. In the same vein, consultants' firms were obtained from the lists provided by professional bodies such as Nigerian Institute of Building (NIOB), Nigerian Institute of Quantity Surveyors (NIQS), Nigeria Institute of Architecture (NIA) and Nigerian Society of Engineers (NSE). In view of this, organizations that are based in Lagos state were used for the study. A total of 120 questionnaires were sent out to capture relevant information on the study, 44 were retrieved giving a response rate of 36.7%. This response rate is acceptable and not uncommonly low as noted by Takim (2008) that 20-30% response rate is adequate for researches in the construction industry. The sampling was based on convenience as organizations on the lists that are equally willing to provide information were considered for the study. Interview was also used to lighten questions that need further clarifications.

Table 2: Background information of respondents, projects and organizations

Profession of respondents	**Frequency**	**Percent**	**Type of projects handled**	**Frequency**	**Percent**
Architecture	4	9.1	Residential	16	36.4
Civil/Structural engineer	8	18.2	Institutional	4	9.1
Quantity surveyor	16	36.4	Religious	4	9.1
Building	12	27.3	Commercial	20	45.5
Others, specify	4	9.1	Total	44	100.0
Total	44	100.0	**Procurement method**		
Type of service rendered			Traditional	4	9.1
Consultancy	16	36.4	Design and Build	20	45.5
Contracting	28	63.6	Project/Construction Management	20	45.5
Total	44	100.0	Total	44	100.0
Sector of project involvement			**Educational qualification**		
Public	20	45.5	HND/BSC	20	45.5
Private	24	54.5	MSC	24	54.5
Total	44	100.0	Total	44	100.0
Work experience			**Professional affiliation**		
1-5	16	36.4	NIA	4	9.1
6-10	16	36.4	NSE	8	18.2
11-15	8	18.2	NIQS	20	45.5
16-20	4	9.1	NIOB	12	27.3
Total	44	100.0	Total	44	100.0
Total	44	100.0			

DATA ANALYSIS, PRESENTATION AND DISCUSSION OF FINDINGS

Table 2 presents information of respondents, projects and organizations. Information covered include profession of respondents, type of service rendered, sector of project involvement, work experience, educational qualification, professional affiliation, type of projects handled and procurement methods used for projects. It can be deduced from Table 2 that builders and quantity surveyors dominate the study and contractors who work on both public and private projects are well represented in the study. Respondents with 1-15 years work experience, B.Sc, M.Sc and appropriate professional qualification are the information providers for the

study. Thus, the respondents of the study are well qualified. Then types of buildings handled by respondents' organization are 36.4% residential, 9.1% institutional, 9.1% religious and 45.5% commercial. Lastly, the traditional procurement method was used on 9.1% of projects, design and build method was used on 45.5% of projects and project/construction management method was used on 45.5% of projects.

Table 3: Sources of risks in construction tendering and procurement

Sources of risks	N	Mean	Std. Deviation	Significance	Rank
Poorly chosen technical solution	44	3.73	.973	Significant	1
Bad management	44	3.64	1.080	Significant	2
Errors and omission	44	3.55	.999	Significant	3
Unrealistic price	44	3.55	1.320	Significant	4
Unskilled staff	40	3.50	1.377	Significant	5
Economic regulations and price inflation	44	3.45	1.247	Significant	6
Education and culture	44	3.36	1.163	Mod. significant	7
Changes in law and standards	44	3.36	1.080	Mod. Significant	8
Climate and soil condition	44	3.36	1.080	Mod. Significant	9
Financing conditions	44	3.36	1.313	Mod. Significant	10
Late delivery of materials	44	3.36	1.163	Mod. Significant	11
Delay in preparation of document	44	3.36	1.313	Mod. Significant	12
Sick leaves	40	3.30	.911	Mod. Significant	13
Obsolete technology	44	3.27	1.370	Mod. Significant	14
Incomplete document	44	3.18	1.352	Mod. Significant	15
Unfamiliarity with local conditions	44	3.09	1.254	Mod. Significant	16
Human fluctuation	44	3.09	.910	Mod. Significant	17
Local regulations, permits and agreements	44	3.09	1.178	Mod. Significant	18
Inadequate contractor experience	44	3.00	1.141	Mod. Significant	19
Risk management planning process	44	3.00	1.294	Mod. Significant	20
Low productivity	44	3.00	1.141	Mod. Significant	21
Shortage of materials	44	2.91	1.326	Mod. Significant	22
Shortage and breakdown of machineries	44	2.91	1.326	Mod. Significant	23
Imprecise specification	44	2.91	1.460	Mod. Significant	24
Season-related work	44	2.91	1.254	Mod. Significant	25
Poor motivation	44	2.82	.724	Mod. Significant	26
Shortage of workers	44	2.73	.973	Mod. Significant	27
Suppliers bargaining power	44	2.73	1.227	Mod. Significant	28
Electioneering process of politicians	44	2.73	.872	Mod. Significant	29
Exchange rates	44	2.64	1.511	Mod. Significant	30

Table 3 indicates that the significant Sources of risks in construction tendering and procurement are poorly chosen technical solution (3.73), bad management (3.64), errors and omission (3.55), unrealistic price (3.55) and economic regulations and price inflation (3.45). Apart from these six sources, other sources used for the study are only moderately and slightly significant. This shows that if risks are to be averted, the significant sources discovered in this study are to be prevented fromoccurring.

Table 4 depicts the total risks and probability of occurrence of risk on construction tendering and procurement. The formulae for calculations are:

i. Total Risk = likelihood of occurrence (L) X degree of input (I)
ii. Probability of occurrence (P) = (Total risk/ cumulative total risk)

It is worthy of note that risks with high likelihood of occurrence and degree of impact are the ones that have high probability of occurrence. Hence, from the calculations in table 4, the risks with the highest probability of occurrence in tendering and procurement are equipment failure (0.022), market condition (0.021), financial default by client (0.023), insurance risk (0.026), inadequate cash flow (0.025), contractor default (0.023), bribery and corruption (0.021), safety of workers and materials (0.031), quality of work (0.021) and unforeseen site conditions (0.0241). The implication of this calculation is that, knowing the risk with the highest probabilities of occurrence will assist construction organizations to guard against them and device appropriate risk management technique to be adopted for them.

Table 4: Total risk and probability of occurrence of risk in construction tendering and procurement

Types of risks	Likelihood of occurence	Degree of Impact	Total Risk = Likelihood x impact	Probability of occurrenc = Total risk/∑ Total risk
Flood, earthquake, landslide, fire, wind	1.09	2.55	2.78	0.0075
Inclement weather	2.36	2.45	5.78	0.0156
Design failure/defective design	2.09	2.45	5.12	0.0138
Human resource management challenge	2.00	2.70	5.40	0.0146
Equipment failure	2.60	3.18	8.27	0.0223
Project complexity	2.20	2.82	6.20	0.0167
Project management	1.60	2.64	4.22	0.0114
Construction technology	1.82	2.45	4.46	0.0120
Inadequate site investigation	2.00	2.00	4.00	0.0108
Inappropriate specifications	2.67	1.73	4.62	0.0125
Labour and material supply challenges	1.91	2.73	5.21	0.0141
Equipment availability and productivity challenge	2.00	2.73	5.46	0.0147
Market condition	2.45	3.18	7.79	0.0210
Financial default by client	2.73	3.09	8.44	0.0228
Interest rate challenge	2.09	3.36	7.02	0.0190
Delayed payment	2.18	2.18	4.75	0.0128
Global economic pressure	2.64	2.27	5.99	0.0162
Incomplete design	2.27	2.82	6.40	0.0173
Differing site conditions	2.36	2.73	6.44	0.0174
Change in scope	2.18	3.00	6.54	0.0177
Estimation error/methods	2.27	2.60	5.90	0.0157
Low credibility of shareholders and lenders	2.36	2.27	5.36	0.0145
Change in bank formalities and lenders	1.55	2.45	3.80	0.0103
Insurance risk	3.00	3.18	9.54	0.0258
Inadequate cashflow	3.00	3.09	9.27	0.0250
Contractors default	2.73	3.18	8.68	0.0234
Local taxes	2.27	2.55	5.79	0.0156
Increased material cost	2.82	2.00	5.64	0.0152
Low market demand	1.82	1.91	3.48	0.0094
Legislative/statutory influence	1.73	3.00	5.19	0.0140
Customary rights and litigation	2.45	1.82	4.50	0.0122
Public opinion	1.45	1.64	2.38	0.0064
Availability and employment of expatriate staff	1.91	2.00	3.82	0.0103``
Difficulty in disposing bad plant and equipment	1.27	3.30	4.19	0.0113
Bribery and corruption	3.20	2.40	7.68	0.0207
Language and cultural barrier	2.09	2.18	4.56	0.0123
Bureaucracy	1.82	1.80	3.28	0.0089
Force majeure	1.20	2.09	2.51	0.0068
Defects in supervision	2.36	2.82	6.66	0.0180
Safety of workers and materials	3.36	3.45	11.59	0.0313
Quality of work	2.91	2.64	7.68	0.0207
Location of project	2.73	2.36	6.44	0.0174
Unforeseen site conditions	2.73	3.27	8.93	0.0241
Defective work	2.27	3.00	6.81	0.0184
Breach of contract by project partner	1.73	2.82	4.88	0.0132
Lack of enforcement of legal judgment	1.36	2.09	2.84	0.0077
Improper verification of contract document	1.73	2.18	3.77	0,0102
Uncertainty and unfairness of court judgment	1.45	1.55	2.25	0.0061
Internal management problem	1.55	1.73	2.68	0.0072
No past experience on similar project	1.18	1.27	1.50	0.0041
Short tender time	1.82	2.20	4.00	0.0108
Improper project feasibility study	1.64	2.27	3.72	0.0100
Poor relation and dispute with partner	2.09	2.09	4.37	0.0118
Team work	1.73	2.60	4.50	0.0122
Industrial relation problem	2.00	2.55	5.10	0.0138
Land acquisition	1.73	2.73	4.72	0.0127
Damage to structure and equipment	2.20	2.30	5.06	0.0137
Labour injuries	1.64	2.27	3.72	0.0100
Defective design	1.64	2.45	4.02	0.0109
Errors and omission	2.36	3.00	7.08	0.0191
Variation of work	2.18	2.55	5.56	0.0150
Changes of original design	2.00	2.55	4.72	0.0127
Deficiencies in description of work	1.64	2.36	4.59	0.0124
Construction procedure	2.27	2.80	4.95	0.0134
Logistics	2.09	2.18	4.56	0.0123
Contractual relations	1.73	2.73	4.72	0.0127
Contractors and work force experience	2.09	2.91	6.08	0.0164
Attitude of participants	2.55	2.64	6.73	0.0182
Communication	1.82	3.10	5.64	0.0152

Table 5 shows the respondents level of awareness of the risk management techniques for construction tendering and procurement. The respondents are mostly aware of past experience (3.40), interview/ expert opinion (3.20), ranking options (3.09) and risk control (3.0) among others techniques.

Table 5: Level of awareness and adoption of risk management techniques for construction tendering and procurement

Management techniques	Mean	Awareness	Rank	Mean	Adoption	Category	Rank
Risk sharing	2.64	Normal	9	3.55	Normal	Risk response	1
Comparing options	2.55	Normal	15	3.45	Normal	Risk assessment	2
Risk enhancement	2.64	Normal	9	3.27	Normal	Risk response	3
Contingency plan	2.45	Normal	19	3.27	Normal	Risk response	3
Risk transfer	2.45	Normal	19	3.27	Normal	Risk response	3
Descriptive analysis	2.73	Normal	6	3.27	Normal	Risk assessment	3
Interview/expert opinion	3.20	Normal	2	3.20	Normal	Risk identification	7
Ranking options	3.09	Normal	3	3.18	Normal	Risk assessment	8
Flow chart	2.64	Normal	9	3.00	Normal	Risk identification	9
Risk control	2.64	Normal	9	3.00	Normal	Risk control	9
Risk acceptance	3.00	Normal	4	3.00	Normal	Risk response	9
Risk exploit	2.73	Normal	6	3.00	Normal	Risk response	9
Brainstorming	2.64	Normal	9	2.91	Normal	Risk identification	14
Probabilistic analysis	2.64	Normal	9	2.91	Normal	Risk assessment	14
Risk mitigation/reduction	2.45	Normal	19	2.82	Normal	Risk response	16
Scenario analysis	2.45	Normal	19	2.73	Normal	Risk assessment	17
Decision tree direct judgment	2.64	Normal	9	2.55	Normal	Risk assessment	18
Risk priority number	2.73	Normal	6	2.55	Normal	Risk assessment	18
Questionnaire	2.27	Low	27	2.55	Normal	Risk identification	18
Monte-Carlo simulations	2.36	low	24	2.55	Low	Risk assessment	18
Sensitivity analysis	2.64	Low	9	2.36	Low	Risk assessment	23
Cause-effect diagram	2.30	Low	26	2.33	Low	Risk identification	24
Risk avoidance	2.55	Normal	15	2.27	Low	Risk response	25
Delphi technique	2.45	Normal	19	2.18	Low	Risk identification	26
Influence diagram	2.36	Low	24	1.73	Low	Risk identification	27

Also in Table 5, it is clear that the level to which respondents adopt risk management techniques in construction tendering and procurement include to adopt risk sharing (3.55), comparison (3.45), risk enhancement (3.27), contingency plan (3.27), risk transfer (3.27), descriptive analysis (3.27), interview/ expert opinion (3.20), ranking option (3.18), flow chart (3.0), risk control (3.0) and risk exploit (3.0). It is important to note that on top of the table are risk response strategies, followed by risk assessment strategies and then risk identification strategies. This indicates that many of the respondents' organization only do risk response and assessment while risk identification is utterly neglected. There may be less need for risk assessment and response because they would have been averted at the point of identification.

CONCLUSIONS

Based on the findings of this research, the study concludes that the sources of risks are poorly chosen technical solutions, bad management, errors and omission, unrealistic price, unskilled staff, economics regulations and price inflation. Also, safety of workers and material, interest rate challenge, difficulty in disposing bad plant, unforeseen site condition, equipment failure, contractor default, market condition, insurance risk, communication, financial default by client, inadequate cash flow, errors and omission, legislative influence, changes in scope, defective work, contractors and workforce experience, breach of contract by project partner, defects in supervision, project complexity, incomplete design, construction procedure, land acquisition, contractual relations, equipment availability and productivity challenge, differing

site conditions and variation of work have a high degree of impact on construction tendering and procurement.

Risks with highest probability of occurrence are flood, earthquake, inclement weather, design failure, human resource management challenge, equipment failure, project complexity, project management, construction technology, inadequate site investigation, inappropriate specifications, labour and material supply challenges, market conditions and financial default by client. The respondents are aware of the use of past experience, interview, ranking options, risk control, checklists, risk exploit, risk priority number, descriptive analysis, probabilistic analysis, risk enhancement, decision tree, direct judgment, flow chart, risk sharing, brainstorming, risk avoidance, comparing options sensitivity analysis, risk acceptance, risk mitigation, contingency plan, scenario analysis and risk transfer. Therefore, it is recommended that risk management follows the category of risk identification, assessment, response and control. This is against the usually trend of response and assessment that occurs before identification.

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Factors Affecting Ergonomics Practice Among Building Construction Craftsmen

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ABSTRACT

Health and safety is about the prevention of accident and ill-health among workers caused by their working conditions. Ergonomics is focused on preventing musculoskeletal injuries and illness which is one of the negative effects of construction activities on the human body. This paper addresses the prevention of musculoskeletal injuries through ergonomics adoption among construction craftsmen. The aim of the study is to assess the factors affecting ergonomics practice adoption by craftsmen. Data were collected using a questionnaire and interview administered and conducted with One Hundred and Twenty Five craftsmen (Masons, Electricians, Carpenter, Tilers and Iron-fixers) on construction sites in Abuja, Nigeria. Simple percentage was used to analyse data collected. The Research findings revealed that the awareness of ergonomics among construction craftsmen is very low as only 4% have of craftsmen have knowledge of ergonomics. The study found that training and education (77%), funding and government intervention (72%), involvement off labour unions (70%) and contractor support and commitment to ergonomics are factors that can drive adoption. The study concludes that factors militating against ergonomics adoption are lack of knowledge and understanding of ergonomics by craftsmen, cost of procuring ergonomic equipment, employees reluctant to use safety tools and gadgets and lack of legislation enforcing ergonomics practices. A frame work was developed recommending roles government, craftsmen, trade unions and contractors can play in enhancing adoption of ergonomics.

Keywords: Awareness, Craftsmen, Challenges, Drivers, Ergonomics

INTRODUCTION

The construction industry is labour intensive in nature. While industries like manufacturing have continued to mechanise and automate production the use of human efforts cannot be eliminated in construction. The industry provides a substantial source of employment for professionals, artisans as well as unskilled labour. The construction industry is characterized by the entire spectrum of health and safety hazards, namely physical, mechanical, ergonomic, biological, and chemical hazards (Kayumba, 2013; Muriri and Mulinge 2014).

According to Jabarani (2013) the construction industry has high rates of injuries and illnesses. Complexity of the projects and extensive scope of the works in construction industry make the workers to be exposed to injuries, illnesses, disabilities or even deaths. Ahankoob and Charehzehi (2013) assert that musculoskeletal disorder is the most common ergonomic injury problem in the construction industry. Buckley (2009) adds that strains, sprains and other physical ailments have long been a drain on construction productivity and a risk to overall worker health and safety.

The high prevalence of Musculoskeletal Disorders and the growing urge to improve health and safety in construction has led to introduction of new philosophy such as ergonomics. Ergonomics is one of the strategies in preventing musculoskeletal injuries and improving health and safety in construction (Albers and Estill, 2007; Al-Swaity and Enshassi, 2012; Sass and Smallwood, 2015).

One of the problems facing the Nigerian construction industry is the lack of qualified craftsmen or tradesmen (Ibrahim, 2010). Muhammad, Dodo and AbdulHafeez (2014) also observes that every sector of the construction industry is experiencing some labour shortage.

AbdulAzeez, A. D.; Mustapha T. & AbdulHafeez, I. (2016). Factors Affecting Ergonomics Practice Among Building Construction Craftsmen. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 941-948

Hence, there is need not only to give adequate attention to vocational training to produce commensurate number of competent skilled workforce to counter or ameliorate the menace but to adequately protect the health and safety of the current stock. It would be dangerous to lose the few qualified craftsmen due to illness and injuries caused by lack of a suitable working environment.

Despite the advantage of implementing ergonomics Nigerian building construction craftsmen have not been able to implement it, prompting this research. The objectives are

i. Assess awareness of ergonomic among building construction craftsmen
ii. To investigate factors affecting ergonomics among building construction craftsmen.

LITERATURE REVIEW

Ergonomics and Ergonomics Awareness

Ergonomics aims at avoiding injury and improve health, safety and comfort. The goal of the science of ergonomics is to find a best fit between the worker and the job condition. Too often employees perform job tasks that expose them to potential injuries and illness due to the poor working methods and tool they are using. According to Michigan Occupational Safety and Health Adminstration (2013) ergonomics involves the assessment of job tasks to identify ergonomic risk factors and appropriate engineering or work practices controls to reduce or eliminate the identified risk factors. Ergonomics tries to come up with solutions to make sure workers stay safe, comfortable, and productive (Albers and Estill, 2007).

Ahankoob and Charehzehi (2013) also described ergonomic as adapting the physical environment with physiological, physical, and psychological capability and limitation of the human by considering different discipline such as anatomy, physiology, psychology, sociology, physics, and engineering. There is a strong case for using ergonomic improvements both to reduce workers' exposure to risk factors for Work Musculoskeletal Disorders and to improve their productivity.

The motivation of implementing Ergonomics on the construction site according to Ahankoob and Charenzehi (2013) is to; improve quality, adopt human capability with optimal situation, balance requirement and limitation, increase productivity, make easy the human performance, provide a safe and healthy working environment, reduce disorders, decrease costs, and improve morale of the workers.

Ergonomic Risk Factors

The construction industry entails a wide range of activities, which expose workers to unfavourable ergonomic challenges. According to Al Swaity and Enshassi (2012) ergonomic risk factors are characteristics of a job that facilitate ergonomics stress on the body. The greater the exposure to these risk factors the greater probability of ergonomics injury and this is called work related musculoskeletal disorders (WRMD). Ergonomic risk factors do not affecting the individual immediately it affects the health gradually to the point where the worker cannot perform his daily task comfortably. Therefore, there is sufficient time to prevent occurring injury and cleaning the work environment from all risks by utilizing risk assessment process. Department of Employment and Industrial Relations (2007) mention the main five ergonomics risk factors as forceful exertion, repetition, awkward posture, vibration and duration. While according to MIOSHA (2013) the main ergonomic risk factors in construction industry are as follows: awkward posture, repetition, static posture, vibration, force, contact stress and extreme temperature.

Vedder and Carey (2003) conclude that accidents with construction tools; falling and tripping; manual handling, lifting, and carrying; noise; vibration; dust exposure; and poor

design of tool interfaces are the most important safety, health, and ergonomically related problems in construction. According to Ergonomic Process (n,d) other ergonomic risk factor includes repetition, poor body mechanics/poor posture, force carrying, vibration driving, impact hand tools, acceleration throwing objects, cold working outdoors, working in refrigerated areas and work-rest ratio overtime. Smallwood and Ajayi (2013) associated frequent bending; bending and twisting of the body; working above shoulder height; working below knee level; lifting; manual handling of heavy and irregular-sized loads, and adopting awkward work postures to high prevalence of work-related musculoskeletal disorders (WMSDs) and are a major ergonomic risk factor in construction. Ergonomic risk factors are discussed below.

RESEARCH METHODOLOGY

The Research adopted both the qualitative and quantitative research methods. Data was collected using a questionnaire and interview administered and conducted with Masons, Electricians, Carpenter, Tillers and Iron-fixers on construction sites in Abuja, Nigeria.

The number of craftsmen (Carpenters, Iron-Fixers, Tilers, Masons and Electricians) in the study area cannot be determined; therefore the research adopted an unknown population size. The sample size of 180 (Thirty Six (36) for each of the Five (5) construction craft) in total was determined using Chocrane formula for unknown sample size.

The interview was also used because of the educational background of the craftsmen which might not allow them fill a questionnaire appropriately. One hundred and eighty were interviewed. While One Hundred and Twenty Five responses were found worthy to be included in the study.

In the analysis of data obtained simple percentages method was used.

$$= \frac{Number\ of\ Respondents}{Total\ Number\ of\ Respondents}\ x\ 100 \text{ ---------- } \mathbf{1}$$

RESEARCH FINDINGS AND DISCUSSION

Craftsmen profile

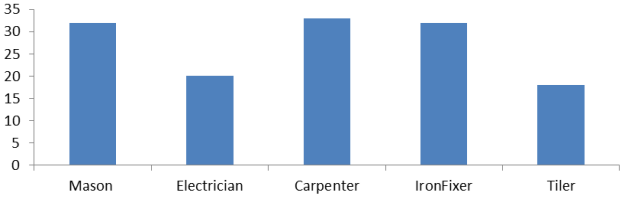

Figure 1; Craft of respondent

Figure 1 shows the distribution of craftsmen who responded to the survey. It can be seen that 25.6% were Masons, 16% were Electrician, 26% of the responded were Carpenter by trade. Other respondents were tilers and iron-fixers representing 16.4% and 17.6% respectively. The response rate were higher among masons, electricians and carpenters because most construction site visited were at the construction stage were these types of artisans are mostly found. Tillers and electricians are mostly found at the finishing stage.

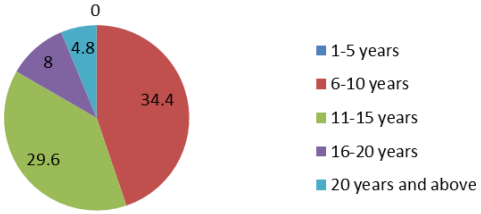

Figure 2 Working experiences of craftsmen

Figure 2 shows the working experience of respondents. It can be seen that 34.4% of respondent have working experience of 6-10 years, 29.6% have working experience of between 11-15 years and the least percentage 4.8% have working experience of 20 and above. Also 29% of the respondents have working experience of 1-5 years. 8% have working experience of between 16-20 years. It could be said that respondents have adequate knowledge and experience in their trades. It could also be seen that there is a blend of both new and experienced craftsmen.

Table 1 Type of Training

Type of response	Frequency	Percentage (%)
College based training	43	34.4
Non College based training	82	65.6
Total	125	100

Table 1 shows the type of training craftsmen went through to acquire their skill. While 65.6% passed through Non-college-based training: Apprenticeship, 34.4% of respondents have college-based training: Primary, Secondary, Technical College, Trade Schools, Polytechnics etc. It is imperative to note that most of the craftsmen in the building construction industry do not have formal education. Most of the craftsmen were trained informally.

After asking questions on the respondent's profile, the interview continued with questions on ergonomics awareness.

Ergonomics Awareness

Table 2: Awareness of ergonomics

Type of response	Frequency	Percentage (%)
Aware	24	80.8
Not Aware	101	19.2
Total	125	100

The study inquired on awareness of ergonomics. Craftsmen were asked whether they know ergonomics. Table 2 shows that 80% of respondents are not aware. Response from this questions included statement like '*I have never heard of it before*' and '*this is the first time am hearing the word*'. 20% of respondents said they are aware.

In ensuring that respondents who claimed to know ergonomics understand understands it. The researcher went further to ask what it means. Out of the twenty four only five gave answers related to ergonomics which included ergonomics as a study of people working, study of people at work, making the worker comfortable while working. Other response was related to economy, economics and studying air. This shows that shows that only 4% of the respondents really know what ergonomics is.

The awareness of ergonomics among craftsmen in the building construction industry is low. This might be due to the fact that most craftsmen were trained informally as shown in Table 1 and they may not been able to come across information on ergonomics. Due to the fact that most employers rarely train craftsmen most craftsmen might not have had the opportunity to come across information on ergonomics.

After the question on ergonomics the researcher chose to educate the workers on the definition of ergonomics and ergonomic interventions. This was done to help the respondents have a better understanding of the subject matter so they would be able to address other questions appropriately.

Factors Affecting Ergonomics Practice Adoption by Craftsmen

Factors affecting adoption of ergonomics practices by construction craftsmen in this study was classified into two, factors militating against adoption and drivers to enhance adoption.

Factors militating against ergonomic adoption among construction craftsmen

Table 3: Factors militating against ergonomic adoption among construction craftsmen

S/N	Factors militating against adoption	Frequency (Nr)	Percentage (%)
1	Lack of knowledge and understanding of ergonomics	99	79
2	Cost of procuring ergonomic equipment	86	69
3	Change can result in loss of jobs,	43	36
4	Employees reluctant to use safety tools and gadgets	75	60
5	Business and financial concerns	50	40
6	lack of legislation enforcing ergonomics practices	72	58
7	Temporary employment	63	50

The research probed into factors militating against adoption of ergonomics practices by craftsmen. Table 3 shows the perception of craftsmen. Lack of knowledge and understanding of ergonomics (79%), Cost of procuring ergonomic equipment (69%). Employees reluctant to use safety tools and gadgets (60%) lack of legislation enforcing ergonomics practices (58%) and Temporary employment (50%) were factors perceived to be militating against adoption of ergonomics.

From the interview it was observed that ergonomics awareness is very low among construction craftsmen. Many respondents haven't even heard of the word before. Many of the ergonomics interventions, working methods and equipments are not known to the craftsmen who are really affected by musculoskeletal injuries. Cost of procuring ergonomic equipments are high. Most craftsmen cannot afford to purchase these equipments. When an iron-bender was told it could take over a hundred thousand naira to purchase a Rebar tying tool. He was astonished. '*I can't afford it'* states an electrician. Carpenters are aware of how the nail gun can make their job easier but most of them complained on how expensive the nail gun is. A tilers also commented that they couldn't afford ergonomic personal protective equipment like the knee guard and kneeling creepers. It is the responsibility of the contractor os Subcontractor to purchase some of these equipments like the motorised screeding machine because of the high cost.

Some employees find it difficult to use the safety tools and equipments even when it is provided. From the interview some respondent an electrician complain of being uncomfortable wearing a helmet, knee guard and leg wedge together. The following statement of an electrician when asked why they don't like putting on safety equipments '*I don't feel comfortable using them, it affects me and I don't work well*'. Some craftsmen even stated that they work better when they are '*free'*. Respondent perceived that some of their colleagues choose not to use this equipment even though they are aware of the importance of using them.

There is absence of legislation enforcing ergonomics practices in the Nigerian construction industry. There is no provision for health and safety plan for construction projects and health and safety practices are not enforced. Currently in Nigeria ergonomics is not even part of the proposed health and safety plan in the National Building code. This notion was echoed during the interview when a mason said '*there is no law to enforce ergonomics'*, therefore implementation is by choice. If it was part of the law contractors and companies could be fined or sanctioned for refusing to implement ergonomic intervention.

Another important factor militating against adoption of ergonomics practices mentioned by respondents was the nature of their employment being temporary. Most craftsmen are employed on project basis and are being paid on either weekly or daily so the contractor and

employee do not provide any form of training. Most of the respondents believed they are employed through recommendation and it is believed that they can do a quality job so they are not given any form of training.

Factor to drive adoption of ergonomics among construction craftsmen

The interview also looked into ways to enhance the adoption of ergonomics by construction craftsmen. The response was grouped and shown in Table 4.

Table 4: Factors to enhance adoption of ergonomic among construction craftsmen

S/N	Factors to enhance adoption	Frequency (Nr)	Percentage (%)
1	Training and education	96	77
2	Funding and Government intervention	90	72
3	Pre-assembly and mechanization to reduce the effects of various ergonomic problems	54	43
4	Involvement off labour unions	88	70
5	Contractor support and commitment to ergonomics	74	60
6	Housekeeping	55	44
7	Changes in tools and equipment	63	50

The research also looked in to drivers to enhance adoption as shown in Table 4. Training and education is ranked highest with 77% of respondent agreed it will enhance adoption. Funding and government intervention (72%) was ranked second, closely followed by involvement off labour unions (70%). Contractor support and commitment to ergonomics (60%) and changes in tools and equipment (50%) was ranked fifth and six respectively.

Ergonomic training and education are very important in increasing awareness. Application of ergonomics is practical; it is achieved through better task design and work procedure and using ergonomic designed tools. Increasing awareness of the danger of Musculoskeletal injuries allows the construction craftsmen know the benefits of applying ergonomics. From the interview it was observed that most of the workers are not aware of the existence of some ergonomics equipment like knee pads, shock absorbing inserts in shoes and the adjustable saw horse. It is also important to note that after the interview and brief education on ergonomics some workers stated implementing some ergonomic practices like stretching before starting their day, during short breaks and after the working day. This shows the importance of training and education.

Respondents have earlier raised concern about the high cost to purchase ergonomic equipments. Most respondents believed if there is funding from organisation in the construction industry and government through grants and subsidies directed to subsidizing this equipment or into training education and research it would go a long way in enhancing adoption. That was why an iron bender speaking of a rebar tying tool said that '*if it was cheaper I will buy the equipment and use since it will make my work easier and faster*'.

It is usually believed that the roles of trade unions are usually to negotiate on wages increase for their members. It is important to note that the trade unions have important roles to play in ensuring the health and safety of their members. In the interview respondents felt trade union should be at the forefront of ensuring employers provide a safe working environment for them. They should also struggle to ensure that employers provide a safe working environment for their member that is free of accident and injury. Trade union roles could also include providing training to members on new working procedures and methods to improve health, safety and productivity.

According to the interviews craftsmen believe contractor and managers who are responsible for construction have an important role to play in enhancing adoption. This was echoed in most comment by respondents that site manager or supervisors consent is required to implement something new to your work process or methods. Without the manager's or

supervisor's consent it might be difficult. Two ways the management support can help in driving adoption. Firstly through education and training and secondly providing ergonomic equipment on site. When these equipments are provided they would use them. Even though they are not permanent staff after the work they would return them to the employer for future use.

Proposed frame work for ergonomics adoption by building construction craftsmen

The proposed frame work involves the following action plan. The framework includes role of professional bodies in the building construction industry, construction contractor and sub contractors, crafts union and the construction craftsmen.

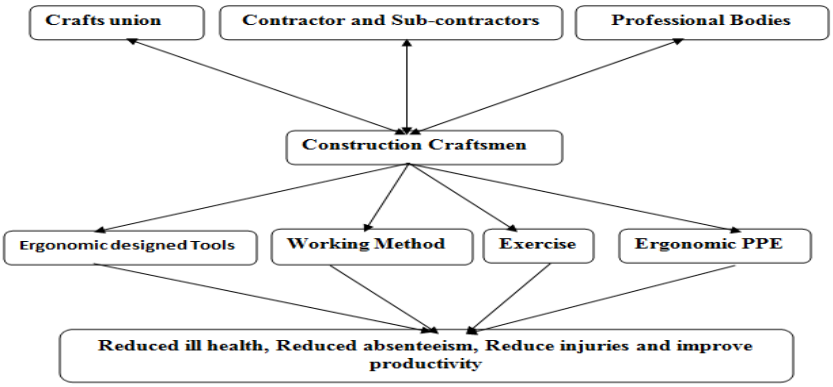

Figure 3: Framework for adoption of ergonomics among construction craftsmen

Professional bodies

The professional bodies in construction industry have many roles to play. They can train both the craftsmen and artisans. They can train both professionals and artisans through continuous professional development (CPD) and conferences and seminars. They can further train artisans during training and certification like the Nigerian Institute of Building artisans and craftsmen training programme.

Crafts union

Crafts union have a role in training their members on health and safety including ergonomics. They should also fight to ensure that employees provide a healthy working environment to their members.

Contractors

Contractors have very important role to play in adoption of ergonomics. One way they can do that is by providing ergonomic equipments for craftsmen like automated screeding machine, rebar tying tool and adjustable saw horse. They can also provide in addition to helmet, reflective jacket and safety boots ergonomic personal protective equipment like leg wedge, knee pads, shoulder pads, adjustable split level scaffold etc. They can also provide lifting equipment (carts and forklift) for lifting materials over the recommended manual lifting weight. Contractors and subcontractors can also take part in educating workers through on the job training of craftsmen this could be during short briefing or training before a project begins. Contractor can also enhance health and safety management through developing and implementing a health and safety plan for each project.

Craftsmen

Craftsmen have the most important role to play because they are the most affected. They have to adopt new working methods and they have to exercise. Craftsmen should use personal protective equipment. While purchasing personal working tools they should consider ergonomically designed tools.

It's important to note that the frame work is not designed from top to bottom but also flows from bottom to top. Craftsmen are also to provide feedback to their Trade unions, Employer (Contractor and Subcontractors) on musculoskeletal injuries and risk factors. Craftsmen should be involved in health and safety planning; they can contribute by making input during safety meetings. Craftsmen ideally should be affiliated to professional bodies like Nigerian Society of Engineers and Nigerian Institute of Building they should be able to share their problems and experience on the site.

CONCLUSION AND RECOMMENDATION

This study investigated factors affecting ergonomics practice among construction creaftsmen. The study concluded that. The awareness of ergonomics among construction craftsmen is very low as only 4% have of craftsmen have knowledge of ergonomics. Factors militating against ergonomics adoption are lack of knowledge and understanding of ergonomics, cost of procuring ergonomic equipment, employees reluctant to use safety tools and gadgets and lack of legislation enforcing ergonomics practices. Factor that could enhance adoption of ergonomics are training and education, funding and Government intervention, involvement off labour unions, Contractor Management support and commitment to ergonomics. The study also developed a frame work to enhance adoption of ergonomics among craftsmen.

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SUB-THEME THREE

Landscape Design, Tourism, Remote Sensing and Industrial Design

Resources, Process and Challenges of User-Initiated Transformation of Public Housing Units in Lagos, Nigeria

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ABSTRACT

The literature on User-Initiated Transformation (UIT) of housing suggests the actuality of the phenomenon as a trend in public housing estates in developing countries, despite the legal and planning implications, and the often negative official attitude towards it. Studies also highlight the significance of economic motivation in UIT. This paper therefore examines the resources for UIT in terms of the sources of finance, cost and duration as well as the process and challenges encountered. Systematic sampling method was employed to select 315 housing units from 8938 units in 3 purposively selected low-income estates for questionnaire administration. Findings revealed that the main sources of finance for UIT were individual savings (47.8%) and Cooperative societies' loans (35.8%); while 49.5% of respondents expended between N400, 000 and N600, 000 to transform their housing units. More than 64% of the transformations were completed within 1 year and 34% within the 2 years. Majority of the UIT (65.3%) was by direct labour while 32.3% was by the use contractors. Insufficient finances and unavailable materials were the key challenges encountered in the transformation process. The study concluded on the need to review the legal and planning policies for public housing, to encourage users' participation and incorporate design guidelines that are sensitive to residents' socio-economic realities and aspirations as reflected in UIT. The realistic approach would be to proactively envisage the possibility of UIT and make appropriate design provisions at the conception of public housing programmes.

Keywords: Challenges, Process, Public Housing, Resources, Transformation

INTRODUCTION

User-Initiated Transformation (UIT) has been observed world-wide in many housing settings and particularly in public housing, which represents a notable share of the housing stock in many developing countries (Sengupta and Tipple, 2007). Evidences in the literature show that public housing residents sometimes engage in alterations aimed at adapting their dwellings to better suit their needs or as a means of refurbishing housing that is considered to be inadequate, unsatisfactory or in poor condition (Tipple, Masters and Garrod, 2000; Kallus and Dychtwald, 2010). Tipple (1991:4) defines this tendency as "an alteration or extension involving construction activity and using materials and technology in use in the locality."

The literature on UIT suggests the actuality of the phenomenon as a visible trend in public housing estates in developing countries, despite the legal and planning implications, and the often negative official attitude towards it. It is common for owner-occupiers, through their own initiatives and efforts, to alter their houses in order to improve their housing conditions or meet the changing needs of their households (Salim, 1998). Housing transformation often involves modifications of the external and sometimes the internal parts of dwelling units. Much of the transformation is done either by the residents themselves or by small-scale hired contractors and artisans using locally available materials and labour (Tipple, 2000).

Ilesanmi, A. O. & Morakinyo, K. O. (2016). Resources, Process and Challenges of User-Initiated Transformation of Public Housing Units in Lagos, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. *Procs. of the Joint International Conference (JIC) on* 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 950-957

Studies highlight the significance of economic motivation in UIT. This views the requirement of additional space or conversion of existing spaces for income-generating activities and home-based enterprises (HBEs) as the main reasons for transformation. According to Kellet and Tipple (2000), a house is many things: a production place, market place, entertainment centre, financial institution and also a retreat place. Understanding the resources, dynamics and challenges of UIT from residents' perspectives is therefore essential to initiating policies, plans and programmes that could provide more satisfactory residential environments and improve living conditions. The aim of this paper is to examine the resources for UIT in terms of the sources of finance, cost, and duration; as well as the process and challenges encountered in selected public housing estates in Lagos, Nigeria. The paper proceeds in five sections, namely: the literature review on UIT and related issues; the research method; analysis, presentation and discussion of findings; recommendations; and concluding remarks. The study contributes to the literature on housing transformation and provides information that could inform public housing policy, design and management.

LITERATURE REVIEW

User-initiated transformation (UIT) describes any change to the original spatial configuration of a dwelling unit, by the occupants, in order to meet current needs and future expectations (Salama, 1999). Research in housing transformation is based on the theoretical assumption that people modify their living environments to achieve what they want. This implies that it is an intentional or purposive behaviour that occurs in the human-environment interaction. This conceptual conjecture also infers that UIT of public housing could be perceived as inevitably arising from the need to adjust personal environments rather than simply adapting to them.

Transformation of housing is a behavioural response not only to housing needs, but also to housing satisfaction and socio-economic factors. Through UIT, residents can increase the effective house size to gain more habitable or utility space, transform existing functions, or improve their living conditions (Kallus and Dychtwald, 2010). Manalang, Munemoto, Yoshida and Espina (2002) view UIT as self-built improvement, which depicts how users augmented for the deficiencies in their current residences. Tipple and Ameen (1999) argue for a change in the often negative official attitude to the UIT, while Tipple and Shahidul (1999) disavows the notion that these extensions or alterations helped to create slums.

The conceptual basis for UIT hinges on the principles of 'self-help' as captured in the ideas of: 'freedom to build', 'housing as a verb', 'housing as processes,' and 'housing by people' (Turner, 1976). Although many studies on UIT focus on the more visible phenomenon of 'outward extension,' Popkin, Rich, Hendey, Hayes, Parilla and Galster (2012) posit that it includes activities ranging from the rearrangement of internal furniture and painting a room, to structural amendments such as addition of rooms or demolition of parts of the housing unit.

Aina (2005) observes that transformation of housing was effected by housing speculators for economic reasons in particular. UIT is a major livelihood strategy amongst households in urban formal and informal settlements. Public housing households are motivated to transform their dwellings to provide for new activities, which in many cases were not part of the original concept. It is often carried out outside the established formal planning regulations.

Salama (1999) however observes that UIT by residents in public housing in Egypt not only increased the range of useful spaces within the dwelling units, but also created dynamic multi-functional estates that responded better to the changing needs of households. Tipple (2000) argues that UIT is common in public housing because potential residents are rarely involved in the planning and design of such housing: the houses are neither in tune with their socio-economic, cultural and religious characteristics, nor a reflection of their aspirations.

UIT is highly pronounced in public housing estates because negligible attention is usually given to users' preferences and lifestyles during the conception and design stages. It may thus be viewed as a manifestation of the lack of consultation with public housing occupants in the process of their housing delivery. Tamés (2004) also notes that UIT is pronounced in public housing due to its often uniform and monotonous nature and the limited opportunities for self-expression by the residents.

In addition, the economic motivation for UIT of housing has been variously affirmed. The dwelling is one of the few resources used for generating income. Tipple (1992) posits that, for many households, transformation has the economic potential to provide a better standard of accommodation for those in the low income group. This derives from rents accruable from room or shop tenants, and personal business outlets like shops and other services rendered from home. Spatial elements may be attached to or subdivided from existing structures, shops constructed on perimeter fences and used personally or rented out to others, and parts of the residence converted into office(s), schools, clinics, shops or other outfits. Such businesses which are carried out from places of residence are referred to as home-based enterprises (HBEs): that is, any form of money making venture carried out from the house.

Through UIT, the altered spaces are used for HBEs or let out for renting purposes. The range of HBEs found in housing estates include: tailoring, hair dressing, day-care centre, general trading, and even livestock keeping (Strassmann, 1986). The amount of money made often depends on the extent of transformation carried out. Mahmud (2003) observes the common practice among Asian women in Europe of converting rooms into corner shops for income generation. The Indian Sikh families in England are also known to modify garages into workshops for garments. Such changes are essentially economically motivated apart from the cultural and religious undertones. It is therefore important to better understand the nature of UIT of public housing in Lagos, in terms of the resources, process and challenges involved.

RESEARCH METHOD

This paper reports from a research that was conducted to analyze UIT of public housing in Lagos, Nigeria. The study adopted a survey research method and collected both primary and secondary data. Primary data were obtained through a survey conducted between September and November 2013. This involved the use of questionnaire, complemented by researcher observation and documentation. The majority of the public housing estates in Lagos State were provided by the Lagos State Development and Property Corporation (LSDPC), mainly during the mass housing era of the then welfare-oriented civilian administration (1979-1983). The three (3) largest of twenty (20) identified low-income public housing estates in Lagos were purposively selected, namely: Abesan, Isolo and Iponri housing estates. In addition, the choice of these three selected estates was based on the result of a preliminary survey which revealed that apart from providing housing for the low-income people, they shared similar physical characteristics and also had obvious manifestations of housing transformation. The sample frame from the 3 estates comprised of 1261 blocks of flats with 8938 housing units. Using systematic random sampling, one housing unit from every 4^{th} block was selected amounting to 156 housing units from Abesan, 128 units from Isolo and 31 units from Iponri housing estates giving a total sample size of 315 units as shown in Table 1.

Questionnaire were administered on the household heads to elicit information on their socio-economic and housing characteristics, patterns, process, reasons for and problems of housing transformation. The variables by which residents evaluated their housing transformation contexts consist of a checklist of parameters related to UIT as derived from the literature. These include information on sources of finance for UIT, amount expended to have the work

done to the desired level or taste, how the work was carried out, the duration and the problems or challenges encountered before and during the process of housing transformation.

Table 1: List of Selected Low-Income Public Housing Estates in Lagos

Selected Housing Estates	No. of Units	No. of blocks	One unit in every 4th block
Abesan	4272	624	156
Isolo	3664	512	128
Iponri	1002	125	31
Total	8938	1261	315

Source: Authors' Fieldwork (2013)

Two-hundred and ninety-five (295) questionnaires, representing 93.6% of the 315 units, were retrieved for analysis. The primary data were subjected to descriptive and inferential analysis. Secondary data in the form of drawings, maps and reports, were obtained from the LSDPC and analyzed qualitatively.

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DATA ANALYSIS AND DISCUSSION OF FINDINGS

Sources of Finance for the Transformation Process

Table 2 summarizes the responses concerning the sources of finance for the transformation process. Sources and means of financing UIT are multifaceted as residents tend to mobilize all manner of efforts to accomplish their aims. The major source of finance revealed in this study is through residents' accrued personal savings. The majority of respondents (47.8%) sourced for funds through savings, while lending money from cooperative societies was the next considered option (36.2% of the respondents). The least proportion (15.9%) sourced their funds as loans from banks that were willing to assist the financially inadequacy.

Table 2: *Sources of Finance for Housing Transformation*

S/No.	What was the main source of finance for the alteration or extension of your housing unit?	Selected Housing Estates							
		Abesan		Iponri		Isolo		Total	
		Freq.	%	Freq.	%	Freq.	%	**Freq.**	**%**
1	Individual saving	53	36.8	10	33.3	81	63.8	144	47.8
2	Cooperative societies	51	35.4	15	50.0	43	33.9	109	36.2
3	Loan from bank(credit)	40	27.8	5	16.7	3	2.4	48	15.9
	Total	144	100.0	30	100.0	127	100.0	301	100.0

Source: Field Survey (2013)

The generally poor saving culture, officious procedures and stringent criteria for obtaining mortgage loans from banks, and inability of the housing finance institutions to keep up with the demand for loans may account for these findings. Mortgage financing institutions tend to remain patently conservative and inflexible when it comes to collateral requirements. Invariably, low-income households are usually disadvantaged in favour of middle and high-income groups. The 'legal status' of UIT relative to the planning rules and regulations for the housing estates may also be a deterrent from sourcing through formal sources like banks.

Costs of the Transformation Process

Table 3 presents results of the responses regarding the costs of the transformation process. The findings showed that the cost of transforming for each household in the surveyed housing estates differed according to the taste, type and the magnitude of transformation. Almost half of the sample of respondents in the selected housing estates (49.5%; 147 of 297) expended between N400,000 and N600,000 to transform their apartments. Those who spent less that N200,000 accounted for a lower percentage of 15.2% and almost equal proportion (15.5%)

spent between N200,000 and N400,000 as transformation expenses. A considerably smaller percentage of respondents spent above N 800,000 to transform their houses.

Table 3: *Cost of Housing Transformation*

S/No	How much did you spend to get this apartment/house transformed to your desired taste?	Selected Housing Estates							
		Abesan		Iponri		Isolo		Total	
		Freq	%	Freq	%	Freq	%	Freq	%
1	Less than ₦200,000	20	13.8	11	37.9	14	11.4	45	15.2
2	₦ 200,000 - ₦ 400,000	35	24.1	9	31.0	2	1.6	46	15.5
3	₦ 400,000 - ₦600,000	54	37.2	6	20.7	87	70.7	147	49.5
4	₦ 600,000 -₦ 800,000	20	13.8	1	3.4	13	10.6	34	11.4
5	₦ 800,000 and above	16	11.0	2	6.9	7	5.7	25	8.4
	Total	145	100.0	29	100.0	123	100.0	297	100.0

Source: Field Survey (2013)

Given that UIT is usually economically motivated, and the low-income economic status of the majority of respondents, it is expected that they would be rational and prudent in their expenses for housing transformation. The minority proportion of respondents who spent the highest (N 800,000 and above), may likely represent the higher status residents of the estates or those who were engaged in housing transformation for purely speculative purposes, and would therefore assume an investment perspective to the whole idea of transformation.

Method of Execution of Transformation Process

Table 4 summarizes the results of responses regarding the predominant method of executing the housing transformation in the selected housing estates.

Table 4: *Method of Implementing Housing Transformation*

S/No.	How did you carry out this alteration most of the time?	Residential Zone							
		Abesan		Iponri		Isolo		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Self-help (Directly by yourself)	5	3.5	1	3.3	0	0.0	6	2.0
2	Contractor	60	41.7	9	30.0	28	22.2	97	32.3
3	Direct labour (separate tradesman)	78	54.2	20	66.7	98	77.8	196	65.3
	Total	144	100.0	30	100.0	126	100.0	300	100.0

Source: Field Survey (2013)

The direct labour system of execution had the highest patronage of 65.3% as the predominant method. This practice involved the engagement of different artisans and workmen separately under distinct, often informal, agreements. This was followed by those who implemented the transformation by engaging the services of contractors (32.3%). This arrangement removes virtually all burdens from the house owner and ensures a smooth and tidy execution of the project, but requires a steady flow of funds. While most of the 'transformers' engaged others in the transformation process, a small proportion (6.0%) utilised the "do it yourself method." In such cases, personal effort was directly expended without recourse to contractors or separate tradesmen-labourers (Tipple, 1991). Socio-economic and household characteristics as well as knowledge and skills in building construction may be important determinants of the choice of implementers of the extension process. The self-help approach is more common in the informal sector economies; while formal settings such as public housing are more amenable to the direct labour system of hiring separate tradesmen as confirmed in this study. This ensures more flexibility in terms of financial and time resources, which the contract approach may not permit. Public housing residents, especially the low-income, may be limited to methods which they can conveniently afford in terms of finance. Sometimes, time is not a yardstick as they tend to carryout transformation at their own pace – in phases – and as dictated by the inflow of required cash and material resources. The relatively low proportion for self-help transformation in this study may be due to the limited knowledge and skills of building construction possessed by most respondents.

Duration of Transformation Process

Table 5 presents the results relating to the duration of the transformation of housing units in the surveyed housing estates. The results reveal that 64.7% of the respondents spent less than 1 year to get their houses transformed; 33.3 % spent between 1 and 2 years, while lower percentages (1.0%, 0.3% and 0.6%) spent longer durations (2 years and above).

Table 5: *Duration of Housing Transformation*

S/No.	Duration	Selected Housing Estates							
		Abesan		Iponri		Isolo		Total	
		Freq.	%	Freq.	%	Freq.	%	**Freq.**	**%**
1	Less than 1 year	90	61.6	23	76.7	83	65.4	196	64.7
2	1-2yrs	51	34.9	7	23.3	43	33.9	101	33.3
3	2 -3yrs	3	2.1	0	0.0	0	0.0	3	1.0
4	4 - 5yrs	0	0.0	0	0.0	1	0.8	1	0.3
5	Ongoing	2	1.4	0	0.0	0	0.0	1	0.6
	Total	146	100.0	30	100.0	127	100.0	303	100.0

Source: Field Survey, 2013

The duration obviously varied from one household to another relative to issues of funding, extent, type of transformation, method used and quality expected. The majority in the 1-year bracket obscures possible variations in time for saving and planning for the actual work. The lack of a constant cash flow could account for cases that tend to drag over extensive periods.

Problems Encountered in the Transformation Process

Table 6: *Challenges of Housing Transformation*

S/N	Challenges encountered before and during the process of transforming your house.		Selected Housing Estates			Total
			Abesan	Iponri	Isolo	
1	Area boys and thugs	Count	3	0	0	3
		% within location	1.2%	0.0%	0.0%	
		% of Total	0.5%	0.0%	0.0%	0.5%
2	Harassment from officials	Count	0	1	0	1
		% within location	0.0%	1.5%	0.0%	
		% of Total	0.0%	0.2%	0.0%	0.2%
3	Lack of sufficient fund/finance	Count	109	23	81	213
		% within location	44.1%	34.3%	33.5%	
		% of Total	19.6%	4.1%	14.6%	38.3%
4	No action	Count	36	15	46	97
		% within location	14.6%	22.4%	19.0%	
		% of Total	6.5%	2.7%	8.3%	17.4%
5	Forced a change in what was built.	Count	20	4	49	73
		% within location	8.1%	6.0%	20.2%	
		% of Total	3.6%	0.7%	8.8%	13.1%
6	Unavailability of building materials	Count	76	23	66	165
		% within location	30.8%	34.3%	27.3%	
		% of Total	13.7%	4.1%	11.9%	29.7%
7	Penalty demand in monetary terms	Count	2	1	0	3
		% within location	0.8%	1.5%	0.0%	
		% of Total	0.4%	0.2%	0.0%	0.5%
8	Others	Count	1	0	0	1
		% within location	0.4%	0.0%	0.0%	
		% of Total	0.2%	0.0%	0.0%	0.2%
Total		Count	247	67	242	556
		% of Total	44.4%	12.1%	43.5%	100.0%

Source: Field Survey (2013)

Note: Multiple responses were allowed for this research item. Percentages and totals are based on responses

Although housing transformation seeks to obtain a more satisfactory residential environment, it is not without its challenges, which may indicate to what extent the process is worthwhile.

Table 6 summarizes the findings relating to the problems or challenges encountered before and during the process of housing transformation in the selected housing estates. Appreciable proportions of the 'transformers' indicated that lack of sufficient fund/finance (38.3%) and unavailability of materials (29.7%) were the key challenges encountered in the transformation process. Interestingly, 17.4% of the residents indicated the challenge of 'no action' a seemingly "double-edged" problem, as such seasons of inaction may make the project prone to other problems such as the harassments received from 'area boys.' Being forced to make changes in what was built accounted for 13.1%. Even though challenges such as harassment from area boys and government officials, and penalty demand in monetary terms, each accounted for less than 1% of the sample, information derived from interviews revealed instances among the few cases when the problems led to complete stoppage of work or slowed down the pace of work during the transformation process.

RECOMMENDATIONS

Although the phenomenon of UIT has legal, planning and property management implications, which explain the often negative official attitude towards it, this study further confirms its reality and seeming inevitability as a trend in public housing estates. The implications relate to the need to obtain planning approvals for any alterations to the original uses of housing. However, the pragmatic response of many public housing residents (especially the low-income) is to address functional and economic-related needs, rather than the planning or legal considerations. This may be described as the ascendancy of inevitability above illegality.

Institutional and legal impediments to UIT may therefore need to be revisited. Legal and planning policies for public housing should encourage users' participation and incorporate design guidelines that are sensitive to residents' socio-economic realities and aspirations as reflected in the investment of resources of money and time in UIT. The realistic approach would be to take into cognizance the reality of UIT and make appropriate design provisions at the conception of public housing schemes. The concepts of adaptable or flexible design and user-involvement in the housing delivery system could be adopted. While fundamental changes to the form and structure of housing units should be discouraged, non-structural modifications (slight, surface and service) should be envisaged and proactively incorporated from the design stage. This could enhance the character and quality of transformations that residents carry out, which does not preclude their need to obtain official approval.

CONCLUSION

This study evaluated the resources, process and challenges of UIT in selected public housing estates in Lagos, Nigeria, as representative of the context of developing countries. It reported findings from respondents' assessment of the sources of finance, cost, methods, duration and challenges encountered. The extensive investment of finance, time and skilled labour into the transformation process indicates the existence of an informal pool of social capital that may be better channelled into the housing delivery system than is presently recognised by planning and property management. This also points to the actuality and seeming inevitability of the phenomenon of UIT of housing. Transformation shows that people will endeavour to expend resources and make rational changes to enhance the efficiency, functionality, utility or income-generating value of their housing, notwithstanding legal or planning restrictions. It is therefore necessary to review policies related to public housing with a view to encouraging users' participation and incorporating design guidelines that are sensitive to residents' socio-economic realities, needs and aspirations. The realistic approach would be to proactively envisage the possibility of UIT and make appropriate design provisions at the conception of public housing programmes.

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Landscaping and Sustainable Housing Development in Akure, Nigeria

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ABSTRACT

With the current global challenge of climate change, there is need for professionals in the building industry to attach greater importance to sustainable buildings that are energy efficient, with indoor comfort and in agreement with sustainable home codes. One way to advance the green agenda is through incorporating landscaping into buildings. Apart from having the effect of maintaining the balance of oxygen in the ecosystem, vegetative landscaping materials also act as a source of natural ventilation. However, not many home-owners are aware of this benefit. This paper therefore examines the views of home-owners in a selected residential estate to the benefits of landscaping. Case study was used and data collection was done using stratified random sampling technique to administer close-ended questionnaires to homeowners. Data were presented and analysed using descriptive statistics. Findings show that homeowners are concerned mainly with the aesthetic benefit of landscaping and quite unenlightened about other importance of landscaping to the sustainability of the housing development. The paper recommends the need to make landscaping a requirement for building approval by the planning authorities and enlightening homeowners on the benefits of landscaping. This paper therefore reveals how the sustainability of housing development can be enhanced through landscaping.

Keywords: energy conservation, landscaping, Nigeria, sustainable housing

INTRODUCTION

The need for landscaping in residential properties cannot be over-emphasized. With the globe getting warmer and in tropical countries especially, there is an urgent need to make use of natural means of ventilating homes without further energy consumption. For a housing development to be sustainable, it must be functional in all aspects and use energy minimally. Nyuk and Yu, 2009 has shown that about 25-80% savings on air conditioning can be achieved with proper landscaping. Large trees can provide shading for walls which can reduce outside wall temperatures and also provide shading for windows. This paper discusses the benefits of landscaping and how it can increase the sustainability of housing units especially through reduction in energy consumption on ventilation by adopting natural ventilation through vegetative landscaping. The cost of energy is quite high in most residential neighbourhoods all over the nation as households procure fuel to power generators due to incessant power supply by the Power Holding Company of Nigeria. The need for ventilation and reduced energy consumption cannot be over-emphasized. This paper wants to examine the level of awareness of homeowners to the benefits of landscaping in a residential estate in Akure.

REVIEW OF LITERATURE

Concept of Landscaping

Landscaping can be defined from different perspectives depending on the area of interest and background. Landscape is the art of designing, planning, management of the land, arrangement of natural and man-made elements there on, through application of cultural and

Ajayi, M.; Adegbie, M. & Omole, F. (2016). Landscaping and Sustainable Housing Development in Akure, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 958-964

scientific knowledge with concern for resources conservation so that the resultant environment serves a useful, healthy and enjoyable purpose (Fadamiro, 1998). Landscape deals with the beautification and management of the environment by the organization of space with proper cognizance of the basic principle of design. Landscaping reflects the interaction of the built environment and nature. It is the interaction between man as an individual or part of human society on one hand and nature on the other. It deals with the process of shaping, modifying and creating attractive outdoor scenes in order to effectively express the functional and supportive attributes of the environment of human habitation to enhance the dynamism in city development (Fadamiro, 2001). Landscaping is an expression of the lifestyle and value of the residents which reflects their personality and their attitudes towards the environment. The search for a qualitative, well landscaped environment, proper use of land and its resources are crucial issues for residential development. The environment which people live and how it is organized have profound consequences both for the society and individual. Therefore the need to give permanent solution to the perpetual devastating soil erosion, noise pollution and wind damage in the residential area is very necessary. Through landscaping, sustainable residential environment can be attained.

Landscaping is more than just an arrangement of plants, to be really functional, landscaping needs other items. There are two types of landscaping materials which includes hard landscape and soft landscape elements. Hard landscaping is a term used for the installation of hard or static features in the landscape. It also refers to the use of non-plant materials in the development of landscaping. Examples include walkways, driveways, patio, decks, walls, ponds, fences, steps, landscape lightings, fountain, furniture, containers for potted plants, swimming pool etc. Hard landscaping can be used to compliment the plants component to meet the need of homeowners. Soft landscaping or vegetative landscaping refers to the plant component of landscaping. It entails the use of plants of all categories that are natural in a landscaping. This includes palms, trees, shrubs, grasses, herbaceous plants, flowers etc. The plantings of especially indigenous plants species ensures integration of structure into the natural environment, thus appearing natural in nature. Both soft and hard components are employed to realize a beautiful and functional landscape.

Importance of Landscaping

The benefits derivable from landscaping are varied and accrue to the individual, the house and the environment at large. They include:

Aesthetic: The visual beauty of home and property can be enhanced through creative landscaping. Fadamiro, 2010 stated that constant improvement in the landscape quality of the outdoor environment in housing neighborhoods has direct improvement in resident's perceived quality of living. Moreover, Ayeni (2012) noted that landscaping offer amongst others, environmental aesthetics, seasonal colours and splendour, privacy, break in monotony of views, habitat for animals and security.

Health benefit: Tom (2009) reported that the U.S Department of Agriculture estimated trees in New York City to remove 2,000 metric tons of pollutants each year. It further reiterated that an environmentally- friendly yard, or ecological landscape, needs less chemical treatment and less water; applying fewer fertilizer and chemicals, is much safer for home owners as well as the eco system. The direct health benefits of a "green" landscape come from cleaner air provided by trees, shrubs and grass as they remove pollutants such as Nitrogen oxide, Sulfur dioxide, Carbon monoxide and dust, thus making the environment more conducive for human habitation. According to Massey (no date) one tree can reduce 26 pounds of CO_2 from the atmosphere each year.

Energy consideration: Carefully positioned trees can reduce household energy consumption for heating and cooling by up to 25%. Computer models from the U.S. Department of Energy estimate that three properly placed trees can save an average household between $100 and $250 in heating and cooling energy costs annually. In the same vein, Morakinyo, Balogun and Adegun (2013) investigated the effect of trees on building microclimate, the results shows that trees constitute an excellent passive cooling system for building and conserve energy.

A well designed landscaping reduces heating and cooling cost. It is a well-known fact that garden landscaping by professional can reduce utility bills and conserve the energy. This is because during the winter months, the garden's trees, hedges, grass and shrubs can protect the home from harsh winter winds while capturing the winter sun. On the other hand, in the summer the garden's tree and hedges can absorb heat from the sun to help keep the home cooler.

Enhancement of the neighborhood and increase in property values: According to Associated Landscape Contractors of America reported by Marc (2003) landscaping can add as much as 14% to the resale value of a building and speed its sale by as much as 6 weeks. Landscaping can transform a simple structure into an attractive one. Estate agents and property experts are quick to point that a well-landscaped garden can increase the value of a property dramatically. In some cases, trim and beautiful garden can increase the value of home more than a newly built and decorated lounge or kitchen. In the same vein, a study by Ajayi, Omole, Bako and Ogunleye (2013) revealed that landscaping has an incremental effect of 11% on values of properties in Ijapo Estate, Akure, Nigeria.

Natural Ventilation: Proper landscaping enhances natural ventilation by redirecting wind flow to enter the house, and it was noted by Walker (2010) that natural ventilation has been recognized as a means for sustaining the environment as it relies only on natural air movement and can save significant amount of fossil fuel based energy by reducing the need for mechanical cooling and air conditioning. Reducing electrical energy used for cooling contributes to the reduction of greenhouse gas emission. In favourable climates and buildings types, natural ventilation can be used as an alternative to air-conditioning plants, saving 10% ─ 30% of total energy consumption.

Wind break: Landscaping with coniferous evergreen trees and masquerade trees can provide excellent wind protection to homes by reducing the speed of strong winds. They also reduce heating cost considerably as cool breeze reaches the house rather than a storm. The amount of wind reduction depends particularly on the height and shape of plants and the density and width of planting. A wind break will reduce wind speed for a distance of as much as thirty times the wind break's height. During the raining season, rains may come with strong and catastrophic wind that can blow up the roofs that lie along the direction of operation. Planting trees on its course can deflect such wind while life and property are secured from destruction.

Control of erosion: Planting of grass cover will reduce the rate of erosion. In residential environment water that fall from the roof of individual houses may combine with those that fall directly on the ground to create erosion. Such water is necessary to be drained away from houses environment. Erosion may remove million of tons of soil surface after a considerable number of years.

Other reasons why landscaping is important to homes and environment as a whole include glare reduction, shading, recreational grounds, reduction in noise and environmental pollution, control of vehicular and pedestrian traffic (as flowers can be used to indicate walk areas), source of food and sense of achievement.

Sustainability in Housing Development

Sustainability is the ability of a society, ecosystem, or any such ongoing system to continue functioning into the indefinite future without being forced into decline through exhaustion or overloading of key resources on which the system depends (Gilman, 1992). There is need to consider the sustainability of housing development especially in developing countries such as Nigeria where infrastructures are not usually provided in the housing environment (Ajayi and Omole, 2012).

Using Gilman's definition, Foley, Daniell and Warner (2003) outline that for a system to be sustainable; all of the resources upon which the system relies must be managed appropriately, including natural, financial, social, and man-made (infrastructure) resources. Appropriate management requires knowledge relating to the system boundary, system resources, interactions between adjacent systems and allowable limits, or thresholds, for each resource. Considering a complex urban housing development system, the key resources, processes and interrelations of a housing development can be defined in terms of six interrelated models, namely water, carbon dioxide (CO_2), waste, ecosystem health, economic, and social.

i. the water model incorporates all the water related processes of the development, including rainfall runoff, infiltration, and potable and non-potable water use;
ii. the CO_2 model accounts for both embodied and operational energy use, calculated as an equivalent mass of CO_2, which incorporates the effects of building materials, infrastructure, electricity and gas use, and occupant transport use;
iii. the waste model accounts for all solid and liquid waste, both produced on site, and leaving the site, including sewage, compost, waste to be recycled, and waste sent to landfill;
iv. the ecosystem health model encompasses environmental aspects of the development such as biodiversity and land use changes, as well as air and water quality;
v. the economic model accounts for both the microeconomic processes of each household based on income, expenditure and corresponding levels of debt, as well as the macroeconomic processes which affect the housing development, such as inflation and interest rates; and
vi. the social model incorporates levels of occupant satisfaction relating to comfort, living conditions, access to services (transport, health, education, shopping), employment, as well as equity amongst occupants.

Out of these models of sustainability of the housing environment, the ecosystem health model which encompasses environmental aspects of the development is relevant in terms of air quality which can be enhanced through landscaping. Also, the CO_2 model is relevant as energy requirement to power fans and air conditioning units are reduced.

THE SETTING AND METHODOLOGY

Akure is a city in south western Nigeria and capital of Ondo state. It lies between latitude7^o 13' and 7^o 15' North of the Equator and longitude 5^o 10' and 5^o 12' East of the Greenwich Meridian at an altitude of 370m above sea level. The vegetation of Akure city is equatorial rain forest. Two seasons are experienced by the city - the wet or rainy season from April to October and the dry or harmattan season from November to March. Akure enjoys a moderate tropical climate with maximum temperatures rarely rising above 33°C and minimum temperatures rarely falling below 20°C. Relative humidity is also moderate with maximum relative humidity rarely rising above 86% and minimum relative humidity rarely falling below 40%. The approximate annual precipitation is 1410mm with double maxima occurring in June/July and September/October. There is usually more than six hours of sunshine, even during the rainy season (Ogunsote, Prucnal-Ogunsote and Adegbie, 2010). The population of

the city according to the 2006 Population Census is 353,211 (Federal Republic of Nigeria, 2007).

The case study for this paper is Ijapo Housing Estate located at the periphery of Akure. It was chosen because it is one of the oldest housing estates in Akure and has a lot of landscaped houses. 75% of the total land area is developed while 25% is for planting flowers and trees. Ijapo Estate as a residential area has complementary uses like educational, commercial, recreational and religions properties. The land and properties are sold at affordable prices. Access roads, electricity and other facilities are provided in the estate. It is occupied mainly by medium and high income class. The target population consists of occupiers of landscaped housing units in Ijapo Estate. There are 187 housing units in the estate according to records of the Ondo State Property Development Corporation. Research instrument was a set of close-ended questionnaire administered using stratified random sampling technique. Landscaped houses in the various streets were sampled using one occupant per house. A total of 140 housing units, representing approximately 75% as sample size were sampled. Descriptive method of analysis was used giving rise to the report below.

DISCUSSION OF RESULTS

Data were gathered on the type of landscaping materials, cost of landscaping and the reasons or benefits derived from landscaping. The results are presented in Tables 1, 2 and 3 respectively.

Table 1: Type of materials used for landscaping

Responses	Frequency	Percentage
Flowers	26	18.6
Flowering plants & Trees	32	22.8
Flowers, Shrubs & Trees	42	30.0
Others	40	28.6
Total	140	100.0

Table 1 shows that out of the 140 housing units sampled, 100 houses units were landscaped using vegetative landscaping materials, that is soft landscaping such as flowers, shrubs and trees. This means that a large number of the occupants of landscaped properties in the estate prefer the use of vegetative landscaping to hard landscaping. The study area being in the rainforest belt of Nigeria, tree planting is not difficult to achieve.

Table 2: Cost of Landscaping

Amount ($)	Frequency	Percentage
$300 and below	25	25
$301 - 650	32	32
$651 - 950	28	28
$951 -1250	15	15
Total	100	100

Table 2 shows that the cost of vegetative landscaping ranges from $300 to $1250. Cost of landscaping between $951- $1250 had the least percentage, 15%. ($1= ₦160 as at August 2013). The table shows that the cost of landscaping is not too exorbitant especially when compared to the benefits derivable which is shown in the next table.

Respondents who used soft landscaping were asked to rank the benefits derivable from landscaping and their reasons for landscaping their properties on a 4 point Likert scale of very high, high, low and very low.

Responses on the perceived benefits of landscaping from occupiers of houses who used vegetative landscaping materials were ranked. The most important reason for landscaping by respondents was beautification, followed by increase in property values and wind break. Lowering noise level was ranked least as the estate is a low density area where the noise level is minimal. The other benefits of landscaping such as erosion control, shading and health benefits were ranked low by homeowners. This shows that the level of enlightenment on the contribution of landscaping to sustainability of the housing development is quite low among homeowners in the study area.

Table 3: Reasons for landscaping

Reasons for landscaping	Very high (4)	High (3)	Low (2)	Very Low (1)	Total	Mean score	Rank
Beautification	60	20	14	6	100	3.34	1st
Increase in property values	50	24	14	12	100	3.12	2nd
Wind break	44	26	20	10	100	3.04	3rd
Erosion control	40	30	20	10	100	3.00	4th
Shading	35	35	15	15	100	2.90	5th
Health benefits	40	20	20	20	100	2.80	6th
Lower noise levels	32	30	21	17	100	2.77	7th

Erosion through water run-off could be a menace in the rainforest belt of Nigeria especially in places where the soil structure is loose. Erosion may remove million of tons of soil surface after a considerable number of years. Planting of grass cover and trees will reduce the rate of erosion and prevent the exposure of the substructure of the house, which could have devastating effects. Plants provide shade for houses by absorbing heat from the sun to help keep the home cooler thus reducing the energy cost of air conditioning. In a country like Nigeria where there is erratic power supply, this will also reduce the cost of fueling power generators and consequently reduce the volume of carbon monoxide released into the atmosphere.

CONCLUSIONS

This paper has considered the importance of landscaping to the housing environment. One of the ways to ensure that housing development is sustainable is vegetative landscaping which has benefits of aesthetics, wind break, shading and erosion control among others. The study has revealed that most homeowners use vegetative landscaping in the study area and the cost of landscaping could be as low as $300 and not higher than $1250. Furthermore, the reason or benefit that homeowners consider as most important was aesthetics. Other benefits such as erosion control which protects the building itself and shading which reduces energy cost and pollution were ranked low. Professionals in the building industry need to enlighten clients on the importance of landscaping to the sustainability of the housing environment. This paper recommends the incorporation of landscaping into building design and as a requirement for building approval by the planning authorities.

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Mapping and Analysis of Urban Land Use and Land Cover in Akure, Nigeria

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ABSTRACT

Land use and land cover are some of the many interrelated aspect of a modern nation's activities where adequate information is necessary in order to make decisions. Land use/land cover data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained. This study has to do with the determination and analysis of land use/land cover (LULC) dynamics within the period of 41 years. Three multidate datasets comprising Landsat satellite images of 1972 MSS as the base map, 1986 Landsat7 TM, 2002 Landsat7 ETM and 2013 Landsat7 ETM using the combined technologies of Remote Sensing (RS) and Geographic Information System (GIS) to determine the magnitude, rate and dynamics of change in land use within the study period. From the satellite images, submaps created were classified by the method of supervised classification based on the following classification schemes: Bare land/cultivated, built-up areas, dense vegetation, light vegetation, exposed soil, rock outcrop, water body. The maps and statistical data obtained were analyzed to infer changes that have taken place within the period of study. The result showed significant 2.5% - 4.3% rapid growth in urban areas annually. The annual rate of change in land use/land cover was determined and used as an index in predicting changes for the future. Adequate recommendations were made for the town planners, administrators and policy makers for land use/land cover development in Akure Township.

Keywords: Land Use, Land Cover, Remote Sensing, Geographical Information System, Environment

INTRODUCTION

A modern nation possesses many complex interrelated aspects. To make quality decisions, nations in these contemporary times must be equipped with adequate information on the activities of its complex interrelated aspects. One of such aspect is the land use and land cover. Knowledge about land use and land cover has become increasingly important to nations in proffering solutions` to various problems of haphazard and uncontrolled development, deteriorating environmental quality, loss of prime agricultural lands, destruction of important wetlands, and loss of fish and wildlife habitat to mention a few. Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels.

One of the prime requirements for adequate use of land is information on existing land use patterns and changes in land use over time. Knowledge of the present distribution and area of such agricultural, recreational, and urban lands, as well as information on their changing proportions, is needed by legislators, planners, state and local governmental officials to determine better land use policy, to project transportation and utility demand, to identify future development pressure points and areas, and to implement effective plans for regional development.

The variety of land use and land cover data needs is exceedingly broad. Current land use and land cover data are needed for equalization of tax assessments in many countries. Land use and land cover data also are needed by Federal, State, and Local agencies for water- resource

Ogunlade, S. & Enisan, G. (2016). Mapping and Analysis of Urban Land Use and Land Cover in Akure, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 965-971

inventory, flood control, water-supply planning, and waste-water treatment. Many Federal agencies need current comprehensive inventories of existing activities on public lands combined with the existing and changing uses of adjacent private lands to improve the management of public lands. Federal agencies also need land use data to assess the environmental impact resulting from the development of energy resources, to manage wildlife resources and minimize man-wildlife ecosystem conflicts, to make national summaries of land use patterns and changes for national policy formulation, and to prepare environmental impact statements and assess future impacts on environmental quality.

In change detection and assessment of urban land use and land cover, remote sensing is used to gather information at a distance by detecting and recording electromagnetic radiation from the target areas in the field of view of the sensor instrument. It depends on observed spectral differences in the energy reflected or emitted from features of interest. In an effort to derive information about these features and their distributions, multispectral remote sensing which is the science of observing spectral response of features at varied wavelengths (spectral signature) is used (Campbell and Wynne, 2011).

The aim of the paper is mapping and analysis of urban land use and land cover in an urban center in Nigeria, using Akure in Ondo State as a case study for the purposes of urban development and renewal. This was done by detecting the land use/land cover changes that occurred within the study period, identifying the dynamics of the land use/land cover changes, identifying, quantifying and classifying the nature, magnitude and direction of land use changes and the determination of annual rate of change for all land use classes within the period. Finally the study also assesses and displays the land use change pattern within the period of study.

THE STUDY AREA

The study area (Fig.1) is Akure and its environ which is a sub-mapped portion of Landsat imageries of 1972, 1986, 2002 and 2013 (path 191 row 55) covering Osun, Ekiti and Ondo states of Nigeria. It is covers an area of 917590.68 hectares bounded by top Min X, Y (674894.25, 785987.25) and Max X, Y (803172.75, 857978.25) coordinates.

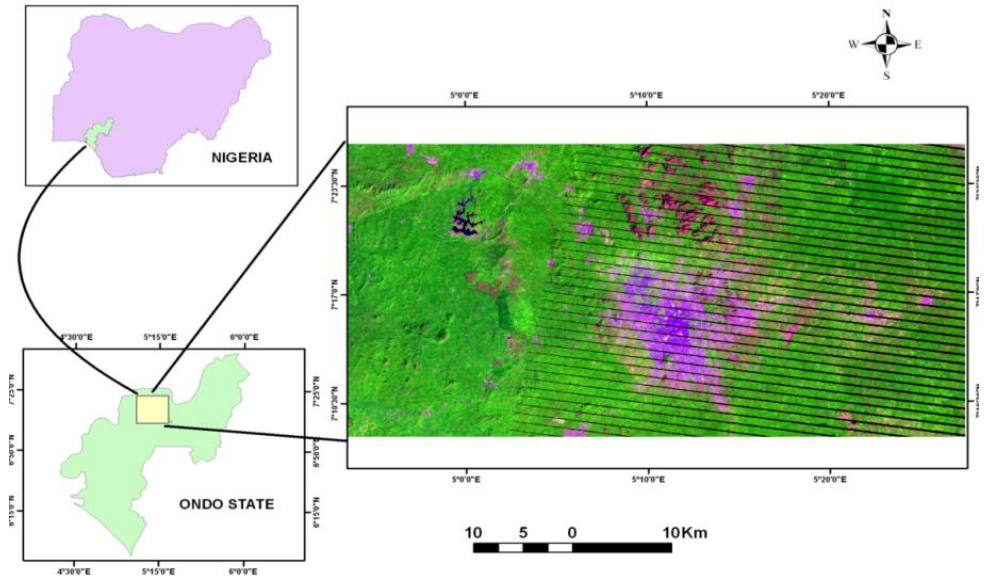

Fig. 1: Morphology of Akure (Source: Department of Surveying and Geo-Informatics, FUTA)

THEORETICAL APPROACH

Land Use

Land use involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, managed woods. It also has been defined as " the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it" (FAO, 1997a; FAO/UNEP, 1999 cited in Wikipedia 2015).

Land Cover

Land cover is defined as the physical material surface of the earth. It include grass, asphalt, trees, bare ground, water etc. Earth cover is the expression used by ecologist Fredrick Edward Clements that has its closest modern equivalent being vegetation (Wikipedia, 2015).

Land Use and Land Cover

Concepts concerning land cover and land use activity are closely related and in many cases have been used interchangeably. Land cover is distinct from land use despite the two terms often being used interchangeably (Wikipedia, 2015). Land use is a description of how people utilize the land and of socio-economic activity. The purposes for which lands are being used commonly have associated types of cover, whether they are forest, agricultural, residential, or industrial. Urban and agricultural land uses are two of the most commonly known land use classes (Anderson et, al. 1976).

Remote Sensing and Land Use Land Cover

Remote sensing is used in change detection and assessment of urban land use and land cover, to gather information about features and their distributions, by observing their spectral responses at varied wavelengths (spectral signature) (Campbell and Wynne, 2011). Remote sensing image-forming devices do not record activities directly. The remote sensor acquires a response which is based on many characteristics of the land surface, including natural or artificial cover. The interpreter then uses patterns, tones, textures, shapes, and site associations to derive information about land use activities from what is basically information about land cover (Randall, 2012). Zubair (2006) has observed that a major step forward in the application of Remote Sensing Technologies for environmental monitoring and future change detection studies has been the initiation of consistent land cover / land use (LCLU) mapping and database development efforts at the global, continental and national scales. Orisakwe (2008) observed that land cover and land use patterns are basic data used for physical planning and environmental evaluation. Therefore periodic land use change patterns are needed for many applications including map revision and updating, natural resources inventory and management, urban planning, agricultural land development, forestry and wide life management and demographic studies. Orisakwe (2008) further said that the basic principle in digital evaluation of LCLU changes lies in the fact that there are differences in the spectral reaction of image elements from two or more different periods, if the LCLU have changed within the interval of two or more periods respectively.

Classification

Classification is the process of developing interpreted maps from remotely sensed images.

In LULC classification Supervised and Unsupervised classification are two common methods of classification generally adopted. Supervised classification involves the extraction of the spectral features of some "training areas" of known land cover types from the image. Every pixel in the whole image is then classified as belonging to one of the classes depending on how close its spectral features are to the spectral features of the training areas. Supervised classification procedures require considerable interaction with the analyst, who must guide the classification by identifying areas on the image that are known to belong to each category

(Karen and Zsolt, 1994; Eastman 2012). Unsupervised classification involves grouping the pixels in the image into separate clusters, automatically by the computer program depending on their spectral features. Each cluster will then be assigned a land cover type by the analyst. (Goodchild and Gopal, 1999; Eastman, 2012).

Change Detection

This has to do with the determination and analysis of Land Use/Land Cover (LULC) dynamics within a period. A multi-date datasets comprising a basemap and satellite images of some epochs together with the combined technologies of Remote Sensing (RS) and Geographic Information System (GIS) are used to determine the magnitude, rate and dynamics of change in land use within the study period of an area.

MATERIAL AND METHODS

Three multi-date datasets comprising Landsat satellite images of 1972 MSS as the base map, Landsat 7 Thematic Mapper of 1986, Landsat 7 Enhanced Thematic Mapper of 2002 and Landsat 7 Enhanced Thematic Mapper of 2013 were obtained for the research.

Before information was extracted from the imageries they were first processed and analysed using ILWIS 3.2 Academic and ArcGIS 10.1 software: The images was loaded into the software, the bands one after another, via gateway and in the .tif format. The colour composite was performed in the image processing menu. The area of interest (AOI) was identified. A sub-map of the AOI was created. Coordinate system was created so as to input the Projection, Ellipsoid and Datum parameters (UTM, WGS 1984, Minna Zone 31N). Colour separation was then performed to put the image into its different band of blue, green, red and infra-red. Each of the band/colour was filtered to remove noise or perturbation on the image after which the land use land cover mapping was performed usng the supervised classification scheme.

FINDINGS

From the maps and the statistics obtained, the 1972 map was used as the reference and Akure (red) was the urban focus, the following were adduced:

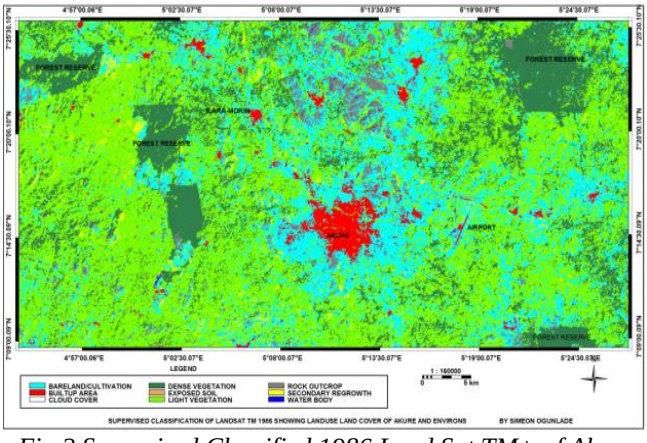

Fig.2 Supervised Classified 1986 Land Sat TM+ of Akure

Fig.2 (1972-1986): Starting from a 328 hectares of land in 1972 there was a sharp increase urban (Akure) growth of 4226 hectares and 1288%. This is expected, because of the change in governments from military to 1st and 2nd republics, creation of Ondo State and making Akure the state capital in 1976 and emergence of various establishments. For instance Federal University of Technology Akure (FUTA) was established in 1981. The Airport by the right

came in. This might have led to a decrease in (37% Dense and 25% Light) vegetated areas and the secondary regrowth (yellow) 11%. Development might have led to a push of the waters hence an increase in the water body (blue) 86 Hectares. The non-existent exposed soil in 1972 has gained about 80ha of land, and the rock outcrop received an exposure of 10144ha. This might be due to exposure coming through turning the forests into farmlands as a result of servicing the developing urban area.

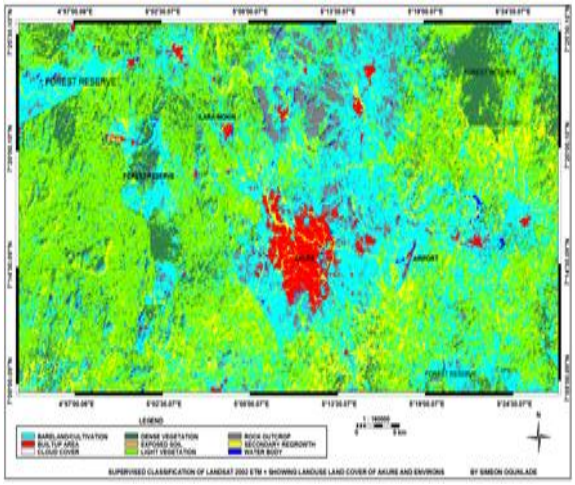

Fig.3 Supervised Classified 2002 Land Sat TM+ of Akure

Fig.3 (1986-2002): There was a 36% increase (1642 hectares, 2.25% per year) in urban growth, lower than 1972-2002. This can be adduced to Ekiti state created out of Ondo State in 1989 but with that, the state capital kept growing. More infrastructures from FUTA, the state government etc. kept rolling in. The effect is seen on the decrease in the vegetation. There is an increase in the secondary regrowth (yellow) which may be as a result of the tree planting campaigns by the government and various horticultural activities within the state. The water body increased from 86 to 905 Hectares. The bare land also increased by 33.3%. The decrease observed in the exposed soil and the rock outcrop might be connected to cleared sites turning to structures and rocks been broken for building and other purposes, a venture still observed till date.

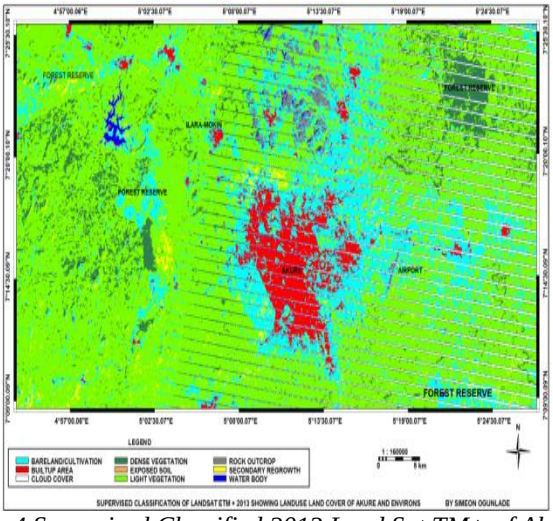

Fig.4 Supervised Classified 2013 Land Sat TM+ of Akure

Fig.4 (2002-2013): A 47.5% increase in the growth of Akure during this period, an 11.5% difference from that of 1986-2002. This is evidenced by lots of estates, nearby villages

merging with Akure as people build their own houses. The influence of FUTA and its staffs toward Eastward (Ilara Mokin) is clearly noticeable. The Dense vegetation kept decreasing due to many farmlands that are undergoing serious conversion to building sites, while an increase in the Water body and Light
Vegetation is noticed. This may be because of the presence of the Owena Dam constructed and various fish farming that suddenly sprung up at this period, which might have caused vegetation growth around the dam and along it channels. Secondary regrowth had a decrease so also is the bare land, which may not be unconnected with stability of the government's horticultural and re-afforestation activities and the fact that many people are leaving the villages for paid jobs. The rock outcrops decreased tremendously and the exposed soil is non-existent in 2013.

FUTURE TRENDS

With particular attention to 1986-2002 (16 years) and 2002-2013 (11years) it is observed that there is a yearly increase of 2.25% (102.64ha) and 4.3% (267.71 ha) respectively that amounts to 2.05% difference for two epochs. The growth is becoming faster as periods rolled by. If the trend in 2013 continues, it can be forecasted that by the year 2023 (10 years) the growth will have increased by an average of 2677.1 hectares per year with all things been equal. This will have an extensive influence on the land cover except if re-afforestation programs are intensified.

CONCLUSION AND RECOMMENDATION

The Land Use/ Land cover mapping and analysis for the purpose of urban development and renewal of Akure and environs has shown a gradual 2.25% and 4.3% yearly increase in urbanization of the study area from 1986-2002 and 2002-2013 respectively and a 2.05% difference between the periods. Akure that started with 328 hectares of land in 1972 has grown to 9141 hectares in 2013, a difference of 8813 hectares in 41 years, at an average of 215 hectares per year. This is about 70% increase per year had all other factors has been kept constant. But an average of 4.3% yearly increase between 2002 and 2013 (11 years) has also been identified. This will be an asset for the town planners, administrators and policy makers for landuse development in Akure Township.

An insight into development in Landuse/Landcover behavior would only be brought into limelight through change detection studies. This fact could be seen in the periodic changes in areal extent of the designated Landuses. This finding however, tells the urban growth in Akure and it's environ. With the outcome of the Landuse/Landcover changes presented according to range and annual changes, it is observed that there is a steady Landuse/Landcover development in the study area apparent in the range period 1986-2002 and 2002-2013. This scenario should be given positive intervention from the concerned authorities such as the Urban Development Board of Ondo State, Ministry of Environment, Ministry of Health and more importantly Ministry of Lands and Housing in synergic collaboration with the Local Government Council so that it will not eventually lead to chaotic situation and a slum development resulting to poor sanitation, absence of land for government projects in the right locations and inevitably persistent socio-economic problems. Therefore, government intervention is hereby necessary and inevitable for sustainable development in Akure Township.

The forecast can be made more accurate if the imageries used are on a yearly basis for the period of 41 years considered. LULC studies using higher resolution imageries will give better assessment and detection of changes not only in Akure Township but in other

neighbouring towns. University-State Government relationship should be strengthened so that researches form the universities can get to the awareness and usage of policy makers.

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Assessing Nature-Based Tourism Potentials for Socio-Economic Development in Ekiti State, Nigeria

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ABSTRACT

Nature-based tourism is a vital part of the global tourism industry, and its components and features vary considerably from one destination to another. This paper reviews the strength and attractions of tourism potentials in eighteen nature-based sites that spread across the three senatorial districts of Ekiti State, as a framework for sustainability and diversification of her economy from relying on dwindling federal allocation. To determine the viability of these tourism centers, simple random sampling technique was used to select twenty respondents from each of the tourist centres. In all, a total of three hundred and sixty designed questionnaires using larker scale of measurement and analysis were filled by the interviewees who constitute the population. The research revealed that, Ikogosi warm spring, Arinta water fall and Ero river/dam were the three strongest and attractive sites, while Opa Aje was the least attracting site in the state. Bad roads, insecurity, poor publicity as well as shortage of public utilities were major constrains against the expected development of tourism in the state. The study concludes that tourism is an agent of social-economic development only when the huge potential is explored. It further suggests that tourism sector should be strengthened through public- private partnership (PPP) in order to alleviate poverty and attract visitors to the state.

Keywords: Attraction, Ekiti-State, Nature Tourism, Publicity, Sustainability

INTRODUCTION

Nature-based tourism is a rapidly growing phenomenon and has become the largest in tourism industry in the world (Memetoglu, 2006). The impact of nature-based tourism varies extremely. On one hand, it plays an important and certainly positive role in the socio-economic and political development in destination countries by, for instance, offering new employment opportunities. In other to match consumer demand, there must be an increasing need to provide more natured- based tourism attractions to visitors. The term nature–based tourism is generally applied to tourism activities depending on the use natural resources which remain in a relatively undeveloped state, including scenery, topography, waterways, vegetation, wildlife and cultural heritage (Ceballos-Lascurain, 1996). People in millions travel each year to see and experience natural environment, and the scale of such movements leads inevitably, to some disturbance or damage to visited sites. While such damage is attributed directly or indirectly to tourists and their activities, it is often unclear whether their actual behavior is responsible for the major negative impacts on nature and related activities such as the construction and development of infrastructures and facilities. Generallytourism has grown rapidly to become one of the World's foremost economic phenomena. The World Tourism Organization (WTO) estimates that international tourist arrivals in (2020) will reach 1.6 billion worldwide and tourism receipts will exceed 2 trillion US dollar (WTO, 2000). According to the International Ecotourism Society (2000), about 60% of the international tourists can be considered as nature-based tourists. A study done by the World Resources Institute also claimed that this type of tourism is increasing at an annual rate of 10% to 30% and will continue to play an important role in international tourism (Reingold, 1993).

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There are many western nations such as U.S.A, United Kingdom, and Canada that have utilized the benefit of tourism to sustain their economy. However, over the years, tourism sector has been experiencing disdain in Nigeria. The Nigeria economy solely relies on crude oil with total neglect of other sectors such as tourism and agriculture which are the mainstay of a good economy (Ojo 2014). Over– concentration on oil sector has a great implication for the survival of Nigerian economy. The nonchalant attitude of government towards the development of the tourism sector has been major challenge facing the sector in Nigeria. In other for Nigeria State to be a beneficiary in the tourism prospects come year 2020, a lot still need to be done. While Ekiti State is blessed with abundant tourism (Ecotourism) potentials such as waterfalls, spectacular rock formations, beaches, hydrological bodies, springs and games reserves, only Ikogosi warm spring has been converted into tourism resorts (Bankole, 2002). Others are left fallow without any conscious efforts either by the government or private organizations towards its development.

According to Munn (2003), in order to design aMaster plan for realistic tourism development, tourism potentials of town, villages and their environment need to be evaluated.The evaluated factors need to relate to natural conditions, existing facilities and tourism performance as well as to environmental factors. Based on the present states of the nature-based tourist centres in Ekiti State, the study will therefore assess their strength, attractions, accessibility and amenities to see how they can turn around the dwindling fortunes of the state in particular and Nigeria in general.

THEORITICAL FRAMEWORK

Tourism is of central importance to social, cultural and economic lives in the twenty-first century. Goeldner, Ritchie and Mclntosh (2000) identified three operating sectors within the tourism industry: (1) the transportation sector, (2) the accommodation sector and (3) the attraction sector. According to Gunn (1988) attractions are described as the “first power”, “Iodestones for pleasure” and the real energizer of tourism in a region. Pigram (1983) takes a more pragmatic approach by stating that without attractions, tourism would not exist. Attractions are a central component of the tourism industry and Gunn (1988:37) states that “without develop attraction, tourism as we know it could not exist; there would be little need for transportation, facilities services and information system”. Attractions are important to the tourism production system as they often as the reason to visit specific destinations or places. This emphasizes the importance of tourism attractions and highlights the need to understand the range and the type of attraction that exist. According to Swarbrook (2000), visitor attractions are the heart of the tourism industry; they are the motivators of that make people want to take a trip in the first place”. In opposition, Richards (2001) points out that it can be argued that attractions do not always literally attract visitors, however, they certainly do provide a focus for much tourist activity, and are essential weapon in the arsenal of tourist destinations engaged in a competitive struggle for tourist business.

There have been many attempts to explain the multitude forms in which visitor attractions exist (Holloway, 1995; Smith, 1998). Visitor attractions range from very small to enormous size, from free entrance to expensive fees, and include both natural and built features or a combination of these two (Prideaux,2002). Laarman and Durst (1987) define Natural Based Tourism Attraction (NBTA) as type of tourism activity that combines three specific elements, namely education, recreation and adventure. Valentine (1992) also incorporates the recreation element in his definition, and state that NBTA is primarily concerned with the direct enjoyment of some relative undisturbed phenomenon of nature. He suggested that there are three types of activities that come under his definition: experiences that are dependent on nature, experiences that are enhanced by nature and experienced for which a natural setting is

incidental. According to Jenkins and Pigram (2003), nature-based activities may be defined as all forms of leisure that rely on the natural environment and include many activities, ranging from sitting under a tree to hiking in the wilderness. Due to the diversity of activities and the variation in styles, there is a plethora of expressions for NBTA. According to Newsome, Moore and Dowling (2002) NBTA may be labeled as adventure, wildlife and ecotourism while Mckercher (1998) expands it further to alternative tourism, educational tourism, sustainable tourism, responsible tourism and other forms of outdoor-oriented non-mass tourism.

Furthermore, Manwa (2012) argued that for tourism to be sustainable the community has to benefit directly from it, this will enable them to protect and conserve the resources upon which it is based. This is further emphasized by Smith (2007) that apart from the type of tourism, the extent to which tourism confers economic benefits on any country also depends on the expectations of the tourists and the host country's ability to provide appropriate and adequate facilities. Unless economic policies to promote tourism remain a focus in developing countries, tourism will not be a potential source of socio-economic growth (Ekanayake and Long, 2012). This has been a problem for the developing countries like Nigeria with inadequate infrastructure generally and tourism supporting infrastructure in particular. There is nowhere the problem of inadequate infrastructure is most pronounced than in Nigeria where the dearth of infrastructures is compounded by the inability to maintain the few existing ones and replicate infrastructures to areas lacking in amenities usually outside of the capital and major cities. In Nigeria, poor state of infrastructures is most pronounced in the rural areas where incidentally most of the tourist sites are also located. Nevertheless, efforts at developing infrastructure to support tourism in Nigeria paltry as they may be happen only in the urban areas (Briedenhann and Wickens, 2004). This is where and how tourism is expected to have its most impact on socio-economic development given the infrastructure and income it can attract to rural Nigeria to spur socio-economic growth and development in rural areas and the regions (Yang, 2010). In this regard, tourism can facilitate the replication of infrastructure to the regions and the rural areas of Nigeria, which are usually the areas that lack amenities (Hawkins and Mann, 2007; Yang, 2010).

CASE STUDY AREA PROFILE

There are strong indications that Ekiti State which is located in the southwestern part of Nigeria derived its name principally from its hilly environment and as such the name when pronounced in its original form, it is *'OKITI'* meaning mountain area (Afolabi, 1992). The state is situated entirely within the tropics with diverse and variegated ecosystem of flora and fauna most of which remain uninterrupted. The state lies between longitude $4^{0}45^{'}$ and $8^{0}5^{'}$ north of equator and occupying an area of about 7000sq.km,The state is bounded in the north by Kwara and Kogi States, on the west by Osun State and on entire south and east by Ondo State. The state according to Afolabi (1992) is mainly an upland zone rising above 250 metres above the sea level. It lies within the area underlined by metamorphic rocks of the basement complex. Generally, the state has an undulating land surface with a characteristic landscape that consists of old plains broken by steep-sided outcrops dome rock that may occur singularly or in group of ridges.

Like some states in Nigeria, Ekiti State with sixteen local government areas parades some of the world's most exciting and fascinating tourist centres. With most of the physical areas in the state is still untouched, Ekiti State is famous for its natural environments and cultural heritage which when fully harnessed will influence the development of the tourism industry to generate local economy. Based on the potentials of the state to be developed as natural tourism destination, sixteen destinations (fig.2) were selected for natural assessment as

follow: *Ureje River/Dam, Ado- Ekiti, OkeAyoba Hill, Ado- Ekiti, Olota Hill, Ado-Ekiti, Ikogosi Warm Spring, Ikogosi-Ekiti,Arinta Waterfall, IpoleIloro-Ekiti, Kosegbe stone, IpoleIloro-Ekiti, Sacred fish River, Erinjiyan-Ekiti*0, *Orole Hill, Ikere-Ekiti,Olosunta Hill, Ikere-Ekiti,Forest/Game Reserve, Ikere-Ekiti, Efon- Alaaye Hill, Efon-AlaayeEkiti,Obalu Drinking Place, Efon-AlaayeEkiti, Elemi Lake, Igede-Ekiti, Esa Cave, Iyin-Ekiti, Ero River/Dam, Ikun-Ekiti, Egbe River/Dam, Egbe-Ekiti, Forest/Game Reserve Aromoko-Ekiti* and *OpaAje, Emure-Ekiti.*

RESEARCH METHODOLOGY

Eighteen natural tourist attraction sites which fall within nine local government areas but spread across the three senatorial districts of Ekiti-State were selected in carrying out this study. Data were collected through mixed method approach involving household self-designed questionnaire using larker scale of measurement and field observations. Questionnaire was used to collect raw data because it involves the collection of data in its natural state; since the phenomena cannot be directly observed and obtains the desired results therefore people's opinions are needed for the study.

Twenty (20) questionnaires per attraction centre were administered using simple random sampling technique representing a total of 360 respondents. Only those who were keen to complete the questionnaire were selected based on their perceived educational level. Furthermore, aside personal observation, data were also collected from various secondary sources, staff of the resource centres and community heads as means of exploring background information of the study area. Collated data were analyzed using simple statistical tools such as frequency and percentage. Each tourism attraction was weighted and calculated based on Sedai (2006) postulation by multiplying the total responses about a tourist attraction with each grade and summing them all up i.e. total respondents that choose very attractive x 4 (Its grade) + total respondents that choose attractive x 3 (Its grade) + total respondents that choose fair and finally + total respondents that choose low x 1 (Its grade).

RESULTS AND DISCUSSION

The findings of this study were explained based on four categories which are: Strength, Attraction, Accessibility and the public utilities of the tourist destinations .In table 1, the strength of the eighteen nature-based tourists attraction centres were determined through the responses of the 360 respondents interviewed. All the tourism attractions were strong enough to attract visitors from near and far as 265 respondents (73.6%) agreed that the sites are in good positions to attract tourists to them. Only 25 respondents (6.94%) viewed the sites as very poor to lure visitors to them. By implication, all the sites stand a good chance to grow and develop because Sedai, (2006), avers that a strong tourism attraction is a prerequisite for any destination to be considered by tourists.

The visited tourism attractions were ranked (Table 2) to actually know those that can attract more visitors based on the existing facilities, location and accessibility. Here, the result confirmed that Ikogosi Warm Spring was the most ranked among them all with 78 total weights. Arinta waterfall came second with 77 while Ero River/Dam was ranked third with 73 total weights. However, OpaAje was considered to be the least attractive with 47 total weights. The reason for the results obtained from this ranking could be as a result the present developments in these sites. While the first three most ranked could have been enjoying some positive touches from government at various levels, virtually nothing has been done to improve the least ranked sites.

According to Hawkins and Mann (2007), the tourist attraction sites that have strong attraction will continue to move tourists than those that are less attractive. It is therefore necessary to

develop both more attractive and less attractive sites together so that those that are more attractive can help pull tourists to those that are less attractive in the same area since visitors always love visiting as many sites as possible within the same location.

Table1: Strength of the tourist sites as perceived by respondents

Tourism attraction	Very strong	Strong	Weak	Poor
Ureje river/ Dam	04 (20)	07(35)	06(30)	03(15)
OkeAyoba Hill	10 (50)	06(30)	04(20)	00(00)
Olota Hill	04(20)	06(30)	07(35)	03(15)
Ikogosi warm spring	18(90)	02(10)	00(00)	00(00)
Arinta water fall	17(85)	03(15)	00(00)	00(00)
Sacred fish river	03(15)	15(75)	01(05)	01(05)
Orole hill	12(60)	06(30)	01(05)	01(05)
Olosunta hill	08(40)	08(40)	03(15)	01(05)
Forest/game reserve (Ikere)	03(15)	05(25)	10(50)	02(10)
EfonAlaaye hill	05(25)	07(35)	06(30)	02(10)
Obalu drinking place	02(10)	08(40)	07(35)	03(15)
Elemi lake	04(20)	14(70)	01(05)	01(05)
Esa cave	07(35)	08(40)	03(15)	02(10)
Ero river/dam	17(85)	03(15)	00(00)	00(00)
Forest/game reserve Aramoko	05(25)	06(30)	07(35)	02(10)
Egbe river/dam	14(70)	05(25)	01(05)	00(00)
Kosegbe stone	04(20)	12(60)	03(15)	01(05)
Opaaje	03(15)	04(20)	10(50)	03(15)

Notes: Figures in parentheses are percentages

Table 2: attraction of the tourist sites as perceived by the respondents

Tourist attraction	Very attractive (04)	Attractive (03)	Fair (02)	Low (01)	Total weight	Ranking position
Ureje river/Dam	04	07	06	03	52	14th
OkeAyoba hill	10	06	04	00	66	5th
Olota hill	04	06	07	03	51	15th
Ikogosi warm spring	18	02	00	00	78	1st
Arinta water fall	17	03	00	00	77	2nd
Sacred fish river	03	15	01	01	60	8th
Orole hill	12	06	01	01	69	4th
Olosunta hill	08	08	03	01	63	6th
Forest /game reserve (Ikere)	03	05	10	02	49	16th
EfonAlaaye hill	05	07	06	02	55	12th
Obalu drinking place	02	08	07	03	49	16th
Elemi lake	04	14	01	01	61	7th
Esa cave	07	05	03	02	60	8th
Ero river/dam	14	05	01	00	73	3rd
Forest/game reserve (Aramoko)	05	06	07	02	54	13th
Egbe river/dam	07	08	03	02	60	8th
Kosegbe stone	04	12	03	01	59	11TH

It was not a fair result on the path of accessibility (Table 3) as most of the sites had no good roads. Worst still, two of the tourist centres, Orole and Olosunta hills both in Ikere-Ekiti have no access and were both culturally shielded from tourists. Okoko (2001) opined that transportation is the live wire of any country's economy and if by chance the roads were in deplorable states, such country's economy will be millions of miles away from countries who parade excellent road networks. Many more tourists, according to the interviewees would have visited these sites repeatedly only if the roads leading to them were good and spiritual barriers placed on some were removed.

Table 3: Accessibilities of the tourist sites as perceived by the respondents

Tourism attraction	**Good Road**	**Fair Road**	**Poor Road**	**No access**
Ureje river/ Dam	04(20)	15(75)	0(05)	00(00)
OkeAyoba hill	16(80)	04(20)	00(00)	00(00)
Olata hill	08(40)	11(55)	01(05)	00(00)
Ikogosi warm spring	10(50)	08(40)	02(10)	00(00)
Arinta water fall	08(40)	10(50)	02(10)	00(00)
Sacred fish river	05(25)	08(40)	07(35)	00(00)
Orole hill	00(00)	00(00)	00(00)	20(100)
Olosunta hill	00(00)	00(00)	00(00)	20(100)
Forest/game reserve (Ikere)	01(05)	02(10)	17(85)	00(00)
EfonAlaaye hill	05(25)	05(25)	10(50)	00(00)
Obalu drinking place	03(15)	04(20)	13(65)	00(00)
Elemi lake	00(00)	07(35)	13(65)	00(00)
Esa cave	02(10)	05(25)	13(65)	00(00)
Ero river/dam	01(05)	03(15)	16(80)	00(00)
Forest/game reserve (Aramoko)	02(10)	01(15)	17(85)	00(00)
Egbe river/dam	06(30)	05(25)	09(45)	00(00)
Kosegbe stone	09(45)	10(50)	01(05)	00(00)
Opaaje	05(25)	10(50)	05(25)	00(00)

Notes: Figures in parentheses are percentages.

Table 4: condition of public utilities at the tourist sites

Tourism Attraction	Electricity			Accommodation			Telecommunication			Security		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Ureje river/ Dam	00	04	16	00	04	16	00	04	16	00	04	16
	(00)	(20)	(80)	(00)	(20)	(80)	(00)	(20)	(80)	(00)	(20)	(80)
OkeAyoba Hill	10	10	00	12	08	00	15	05	00	18	02	00
	(50)	(50)	(00)	(60)	(40)	(00)	(75)	(25)	(00)	(90)	(10)	(00)
Olota Hill	00	06	14	08	12	00	10	10	00	03	10	07
	(00)	(30)	(70)	(40)	(60)	(00)	(50)	(50)	(00)	(15)	(50)	(35)
Ikogosi Warm Spring	03	05	12	15	05	00	08	11	01	18	01	01
	(15)	(25)	(60)	(75)	(35)	(00)	(40)	(55)	(05)	(90)	(05)	(05)
Arinta Waterfall	02	05	13	02	03	15	06	13	01	05	10	05
	(10)	(25)	(65)	(10)	(15)	(75)	(30)	(65)	(05)	(25)	(50)	(25)
Sacred fish River	03	06	11	02	04	14	08	12	00	01	10	09
	(15)	(30)	(55)	(10)	(20)	(70)	(40)	(60)	(00)	(05)	(50)	(45)
Orole Hill	05	05	10	10	09	01	08	10	00	05	07	08
	(25)	(25)	(50)	(50)	(45)	(05)	(40)	(60)	(00)	(25)	(35)	(40)
Olosunta Hill	06	02	12	12	08	00	10	10	00	05	06	09
	(30)	(10)	(60)	(60)	(40)	(00)	(50)	(50)	(00)	(25)	(30)	(45)
Forest/Game reserve	02	02	16	07	12	01	05	05	10	10	08	02
(ikogosi)	(10)	(10)	(80)	(35)	(60)	(05)	(25)	(25)	(50)	(50)	(40)	(10)
Efon-Alaaye Hill	03	07	10	03	05	12	04	14	02	05	04	11
	(15)	(35)	(50)	(15)	(25)	(60)	(20)	(70)	(10)	(25)	(20)	(55)
Obalu Drinking place	02	10	08	03	06	11	03	15	02	04	06	10
	(10)	(50)	(40)	(15)	(30)	(55)	(15)	(75)	(10)	(20)	(30)	(50)
Elemi Lake	03	05	12	02	02	16	06	12	02	06	06	08
	(15)	(25)	(60)	(10)	(10)	(80)	(30)	(60)	(10)	(30)	(30)	(40)
Esa Cave	03	07	10	02	04	14	07	10	03	07	04	11
	(15)	(35)	(50)	(10)	(20)	(70)	(35)	(50)	(15)	(35)	(20)	(55)
Ero Dam/River	08	08	04	01	03	16	05	13	02	12	07	01
	(40)	(40)	(20)	(05)	(15)	(80)	(25)	(65)	(10)	(60)	(35)	(05)
Forest/Game reserve	01	03	16	02	08	10	04	05	11	12	07	01
(Aramoko)	(05)	(15)	(80)	(10)	(40)	(50)	(20)	(25)	(55)	(60)	(35)	(05)
Egbe River/Dam	02	02	16	03	05	12	07	09	04	14	05	01
	(10)	(10)	(80)	(15)	(25)	(60)	(35)	(45)	(20)	(70)	(25)	(05)
Kosegbe stone	03	06	11	02	03	15	05	13	02	04	05	11
	(15)	(30)	(55)	(10)	(15)	(75)	(25)	(65)	(10)	(20)	(25)	(55)
OpaAje	03	01	16	04	10	06	04	15	01	08	07	05
	(15)	(05)	(80)	(20)	(50)	(30)	(20)	(75)	(05)	(40)	(35)	(25)

Notes: Figures in parentheses are percentages.

Table 4 vividly showed that the entire state is ravaged by poor electricity. All but one tourist sites (Oke Ayoba Hill) had poor electricity rating and this singular factor has serious implication on tourism development in the state. Tourists' security is compromised in the dark and tourists especially the foreigners may refuse to visit these sites if their enquiries reveal that most sites lack electricity. On the state of accommodation in the selected sites, though, not too excellent, but tourists according to the interviewees are assured of average accommodation

These hotels and other rest houses should be improved upon to meet international standards. This will go a long way to persuade tourists to spend more days than they may have earlier bargainedfor. Table 4 also revealed that virtually all the sites and their environs were served with good or fair telecommunication network. This could be a plus for them as tourists can effectively communicate with families and friends any hour of the day. On the aspect of security, information from table 4 showed that only Oke Ayoba Hill and Ikogosi Warm Spring had good security. This is worrisome because when tourists visit and purchase artifacts and souvenirs, they need sufficient protection from robbers in order to prevent them from being attacked. In addition, the security of their hotels is important. Ikogosi Warm Spring enjoys fair patronage as a result of adequate security, while Oke Ayoba Hill benefited from the state security because the government house is situated on the peak of the hill.

CONCLUSION

Undoubtedly, Ekiti State remains a land of stupendous potentials and all the government need to do is to get its act together and lure private organizations to participate and partner the state government towards the development of these astonishing and fascinating sites in the state. According to Ojo, (1978), Aref et al.(2010) and Pongponratk, (2011) Tourists come from far and near sources to enjoy the areas of outstanding natural and artificial beauty, plants and wild animals as well as cultures and traditions. It is therefore quite expedient to the private sector in the management and reorganization of tourism and rural areas in the state.

This research confirmed that the state is adequately blessed with a large concentration of natural tourist attractions which are still at low level of development. Some of the identified odds against the expected development of tourism in the state are lack of publicity, insecurity, bad roads as well as shortage of or non-availability of public facilities. It is expected that findings from this work would enhance the interest of the government, private individuals and policy makers in the development of rural tourism potentials. Finally, based on the strength of the tourism potentials of the state to attract both local and foreign visitors, who says Ekiti State will not be economically and socially viable through tourism?

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Geospatial Analysis of the Distribution of Health Facilities in Peri-urban area of Ifedore, Nigeria

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ABSTRACT

Growth of peri-urban area is a consequence of high rent, need of individual dwellings and employment opportunities. Hence, many social services like housing, education, transportation, infrastructures, and healthcare are relatively inadequate owing to unplanned growth. The distribution of most public facilities in peri-urban area of developing countries is characterised by locational disparity. Often time, facilities are concentrated in one location than the other. This has given rise to geographic inequality. This study examined the level of accessibility of peri-urban population to health facilities in Ifedore Local government area of Ondo state while analysing the efficiency of location of the facilities and suggesting recommendations on how to increase the utility of inefficiently placed facilities. The study also assessed distribution pattern through spatial analysis operation using ArcGIS. Nearest neighbour technique was explored to determine current pattern of the distribution at Ifedore. The value of the spatial operation was 1.24 associated with z score of 2.3 and p-value of 0.02. This indicates that facilities were dispersed across the study area. Buffer analysis was carried out to enhance graphic comprehension of the shortfall in location of the facilities. Thus, it was established with the value that facilities are not evenly distributed in the peri-urban area. Results indicate that a facility is presumed serving 9,481 people as against 1:5,000 people recommended by World Health Organization. The study recommends mapping of health facilities and establishing GIS for all health facilities in the country as well as developing criteria for siting of new health facilities at all levels. In addition, the study recommends rehabilitation of some substandard facilities that are in deplorable state.

Keywords: Health facilities, spatial analysis, nearest neighbour analysis, peri-urban, distribution pattern

INTRODUCTION

Peri-urban areas are zones of transition from rural to urban land uses located between the outer limits of urban and regional centres and the rural environment. The boundaries of peri-urban areas are porous and transitory, as urban development extends into rural and industrial land.

Accessibility coverage measures how health-care facilities are physically accessible to the teaming population. Often time, facilities might be available but inconveniently located, therefore hindering physical access. Leapfrogging growth of physical development and disordered distribution of health facilities may have likely imposed an undesirable consequence on the access to qualitative health-care service and the environment at large. According to Haggertya *et. al.* (2014), the issue of equality of access to health care has become a research priority in many countries. As a broad principle, Aregbeyan (1992) reported that the greater the distance between two points, the lower the probability of these points being functionally related. He further expressed that most studies maintained that there is a regular decline in accessibility to health facilities with increasing distance on the trip to hospitals. The significance of using GIS in site selection and distribution of health care centres is to enhance decision-making. The use of GIS for measurement of physical distribution is well established and has been applied in many areas including retail site analysis, transport network planning and analysis, emergency services, and health care services (Wilkinson, 1998).

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Every year, governments work with other Non-Governmental agencies by allocating substantial part of their annual budgets to improve health sector. Despite this financial commitment, many citizens are denied easy access to good health care services mainly, because of the inability of the government to respond quickly to increasing demands for health facilities to catch up with the rate of urbanization (Olawuni, 2007; Adetunji, 2010;). Adewara (2011) opined that distribution of primary healthcare services in Nigeria is characterized by substantial disparity. He added that such disparity is obvious in the ways some medical facilities are concentrated in one geo-political region at the expense of others. This often resulted in spatial inequality that typifies Nigeria's socio-political landscape. Though government has shown serious commitment towards addressing these inequalities, much is still expected in the areas of technical expertise. Many households in the urban area in developing cities do travel over long distances and spend significant proportion of their income in order to procure healthcare services elsewhere (Adetunji, 2010).

Spatial analyses of location and distribution of health care facilities are important as suburban expansion influences the way health care facilities are located and accessed. Spatial expansion of suburb area is partly influenced by population dynamics. Therefore, investigation of distribution of public health care facilities in relation to demographic characteristics forms an important scope of concern in research.

Several models have been developed for locating static and mobile facilities. They include health care delivery models and nearest neighbour analysis model. Three typical models are evident in health care delivery models. Firstly, politically driven healthcare delivery operates five levels of health care facilities, provided in a hierarchical order of dispensaries at village level; health centres at ward level; district hospitals at district level; regional hospital at regional level; and national hospital at national/zonal level (Msami, 2011). Its organisational structure forms a pyramidal like structure where dispensaries are at the bottom, health centres at the middle and hospitals at the apex. Secondly, the centralised model of healthcare operates on specified standards for locating and distributing community facilities such as health and education, which are provided in master plans on a threshold of population and planning units, on neighbourhood, community, district, and central business levels (Msami, 2011). Thirdly, the Public-Private Health Care Service Delivery Model driven by neo-liberalism theory and decentralization notion. It is an effort to bridge the gap of health care delivery left by the first two models (Msami, 2011).

Nearest neighbour analysis as reported by Taleb and Uddin (2012), is concerned mainly with the spatial pattern of various species of plants and trees on the earth. The analysis compares the existing distribution with the expected distribution that might occur under random conditions. The Average Nearest Neighbour tool measures the distance between each feature centroid and its nearest neighbour's centroid location. It then averages all these nearest neighbour distances. If the average distance is less than the average for a hypothetical random distribution, the distribution of the features being analysed is considered clustered. If the average distance is greater than a hypothetical random distribution, the features are considered dispersed. The average nearest neighbour ratio is calculated as the observed average distance divided by the expected average (Environmental Systems Research Institute-ESRI, 2012).

Average Nearest Neighbour (ANN) has five values: the observed mean distance, the expected mean distance, nearest neighbour index, z-score, and p-value. If the index (average nearest neighbour ratio) is less than 1, the pattern exhibits clustering. If the index is greater than 1, the trend is toward dispersion. The equations used to calculate the average nearest neighbour distance index and z-score are based on the assumption that the points being measured are

free to locate anywhere within the study area (for example, there are no barriers, and all cases or features are located independently of one another). The p-value is a numerical approximation of the area under the curve for a known distribution, limited by the test statistic (ESRI, 2012).

Health Care Institutions in Nigeria

The three healthcare structures in Nigeria include primary, secondary and tertiary health institutions. Primary Health Care (PHC) by policy arrangements is within the purview of the Local Government. They are known within the system by the context of a health centre, maternity home/clinic and dispensaries (Ademiluyi & Aluko-Arowolo, 2009). Secondary health centres include comprehensive health centres and general hospitals and are usually within the control of state governments (Ademiluyi & Aluko-Arowolo, 2009). Tertiary health institution, also called specialist/teaching hospitals, handles complex health problems/cases either as referrals from general hospitals or on direct admission to its own. The present lopsided distribution of health facilities between urban and rural areas in Nigeria is inherited from colonial era as the urban areas where the educated, the rich and the powerful live, received the lion share of infrastructure (Ademiluyi & Aluko-Arowolo, 2009).

This study examined the level of peri-urban household accessibility to health facilities in one of Nigeria's rapidly developing region in Ondo state. It explores spatial limitations of public health care service delivery, which enlightens areas for effective interventions by the government institutions. It also highlights on the policy issues that need urgent responses in the area of equity, access and hierarchy issues persistent in the location and distribution of health care facilities in the public health institution. The study tested a hypothesis, which explains the relation between the distribution pattern of healthcare facility and willingness of residents to patronise such healthcare facilities.

MATERIALS AND METHODS

Study Area

Ifedore Local Government Area is located in Ondo State, Nigeria as shown in Figure 1. It occupies 295 sq.km area of land. Its total population figure projected from 2006 population census to year 2016 at 3% growth rate is 237,029 . It lies on 732061.27, 823043.63 to the North while 739975.24, 812467.11 to the East. It is bounded by Ikeji in Osun State, Igbara Odo, Ikere in Ekiti State, Iju-Itaogbolu, Ipinsa and Apomu in Ondo State. It has three primary towns namely; Igbara-Oke, Ilara Mokin and Ijare (see Figure 2). It has its headquarters located in Igbara-Oke town. Igbara-Oke is a Yoruba town in Ifedore Local Government Area (LGA). Educational institutes in the LGA include St. Paul Anglican primary school – the first primary school established in Akure and Elizade University. Facilities available include 18-Hole Golf Course and Abiye Safe-Mother-Hood project.

Materials

The study utilised both spatial and attribute data from the field to answer research questions, which led to understanding and explanation of the pattern of healthcare facility distribution. Spatial data was acquired from satellite images including Google Earth imageries while attribute data were collected from the respondents of the study area and the National Population Commission. The health care facilities were treated as point data obtained through the use of geographic positioning system (GPS) for which feature data set were created. The study was targeted at residents of the study area, including members of the household, in the study area.

Methods

The population frame for the study is estimated to be 8465 buildings with an average of 7 people per household and 4 households to a building. The study made use of the cluster sampling technique. The study area was delineated into twenty-five clusters, being the total number of public health care facilities in Ifedore local government. Buffer analysis was conducted for 250 meters radius of the health facility in accordance to World Health Organization (WHO) standard. Likewise, buffers of 500 meters and 1 km were included in the analysis in recognition of the possibility of variation in the size and capacities of the facilities. The number of buildings that fall in the stipulated buffers with the aid of ArcGIS and Google Earth Imagery is 2504. This thus forms the target frame for the study. In determining the sample size, 10% of the target population was used which gives a sample size of 250 and hence, forming the number of questionnaires administered. The study then used a systematic sampling technique to determine the buildings for questionnaire administration. Neyman Pearson approach was adopted for testing the stated hypothesis. The null hypothesis for this study is "there is no significant difference in the distribution of health facilities in Ifedore Local Government Area. The hypothesis suggests that facilities are evenly distributed in the study area. Nearest Neighbourhood Analysis (NNA) was calculated based on the average distance of one facility to the other, which was expressed in ratio (index).

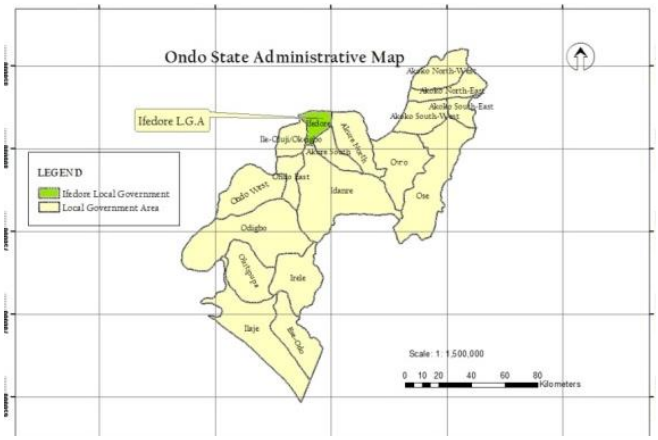

Figure 1a: Map of Study Area in the context of Ondo State
Source: Author's fieldwork, 2016

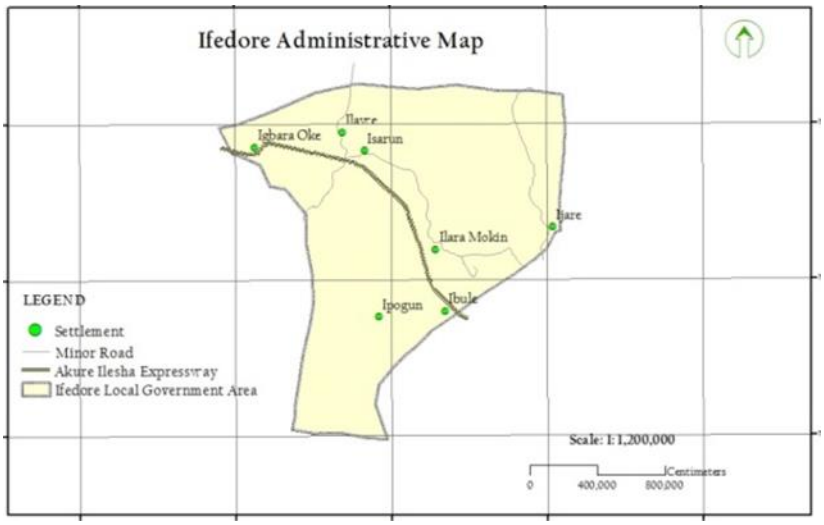

Figure 1b: Map of Ifedore Local Government Area showing primary settlements
Source: Author's fieldwork, 2016

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics

Findings reveals that the larger percentage of the respondents were females with a 51.6% while males were 48.4% with 61.2% of the sampled population married while 27.6% are single, 6.0% divorced and 5.2% widowed. Results revealed that 60.4% of the respondents are self-employed while 19.2% are unemployed; government employed 10.8% of the respondents whereas 8.4% were engaged by private sector. A review of the nature of job for most of the self-employed residents reveals that farming and trading are preferred alternative for livelihood in the study area. This agrees to the fact that the area is peri-urban, and supports agricultural activities. A sizeable 74% of the respondents are permanent residents while 24% are temporarily living at Ifedore.

Results revealed that 96% of the residents do patronize government owned facility, among which a significant portion, 68.0%, maintained that they chose the government health facility because of good quality of services offered by health workers while 14.8% held that it is due to closeness to their abode. Apart from this, 12.8% of the respondents submitted that service cost is not high in comparison to private clinic while 4% gave varying reasons for their patronage. It was further realised that the main reasons for preference to government health care include affordability, free maternal child health, availability of diagnostic equipment in a selected primary health centre, a coordinated referral system, skilled and competent medical staff. Affordability is considered as there is low cost of treatment in government owned facilities, free advisory services in relation to reproductive and child health (RCH) and availability of limited drugs. Thus, patients consider government health facilities accessible without recourse to the additional cost for consultation, diagnosis and certain medicines. Referral system is coordinated such that it paved way for patients whose case cannot be handled in the receiving health centre to higher order centre.

Income is one of the basic determinants that affects access to healthcare service. Access to qualitative healthcare is connected to income level of the household in a developing country. It is believed that high-income earners do have unequal access to better healthcare than their counterpart whose monthly income is relatively low. It is important to state that travel cost is an inclusive cost to the overall healthcare cost.

Spatial Analysis of Health Facility Distribution

There were twenty-five public health facilities in Ifedore: twenty-one basic health centres, two comprehensive health centres, one primary healthcare centres and one general hospital. Nearest neighbour analysis (NNA) was adopted in determining the pattern of the distribution. NNA outcome is mostly expressed as a ratio or index. The index ranges from 0 to 2.15. Spatial operation of the facility means showed that observed and expected mean distances were 1942.51 meters and 1566.38 meters respectively. This was further computed into a ratio or index making up 1.24. The index indicates that the pattern of distribution is dispersed. The derived NNA index was accompanied with z-score (standard deviation) of 2.3 and p- value of 0.02. Hence, the null hypothesis is rejected. Result of NNA index establishes that facilities were not evenly distributed. Furthermore, facilities were not sited consistently on a prescribed pattern. Presently, the distribution pattern depicts scattering, which indicates that efforts have not been intensified by government to coordinate planning of healthcare facilities in Ifedore local government area.

Buffer Analysis

WHO (1997) suggested a catchment area of 0.25 km as adequate for health care facilities. These could be further extended, in relation to the size of the facility. As a confirmation of the observations inferences drawn from output generated from the NNA, a buffer analysis

was carried for the facilities. The catchment size (250 meters radius) suggested by WHO was adopted. Also in recognition of the possibility of variation in the size and capacities of the facilities, 500 meters and 1 km were also considered. Although it must be stated that these are inadequate especially in case of emergency considering that emergency services are not at the desired operation level in most developing countries. It could be inferred from the output of the buffer analysis that the developed (inhabited) portion of the study area are largely outside the catchment area of the concerned facilities. The Ifedore region is a rapidly growing region in socio-economic terms and physical developments. The implication of this is that with increasing physical development activities and growing population of the region, the available facilities will not only be insufficient, but also inefficiently positioned, hence, the need to ensure effective planning before the provision of additional facilities.

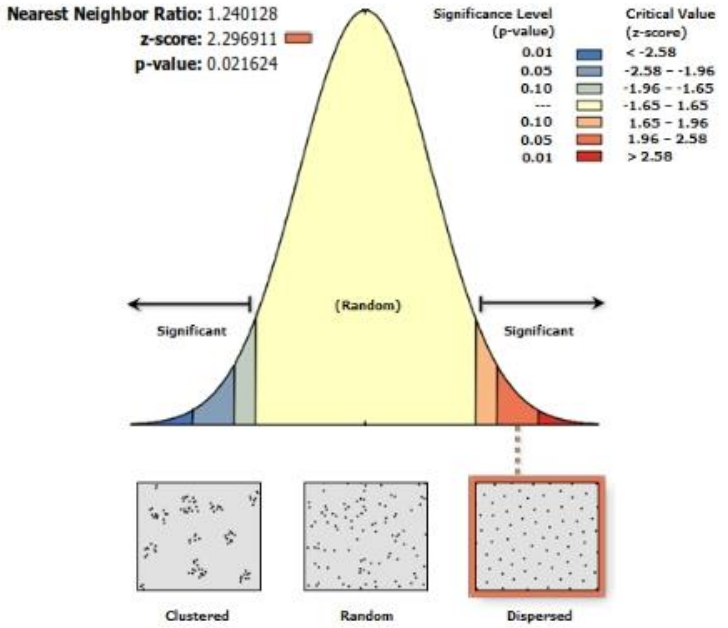

Figure 2: Nearest Neighbour Analysis Output

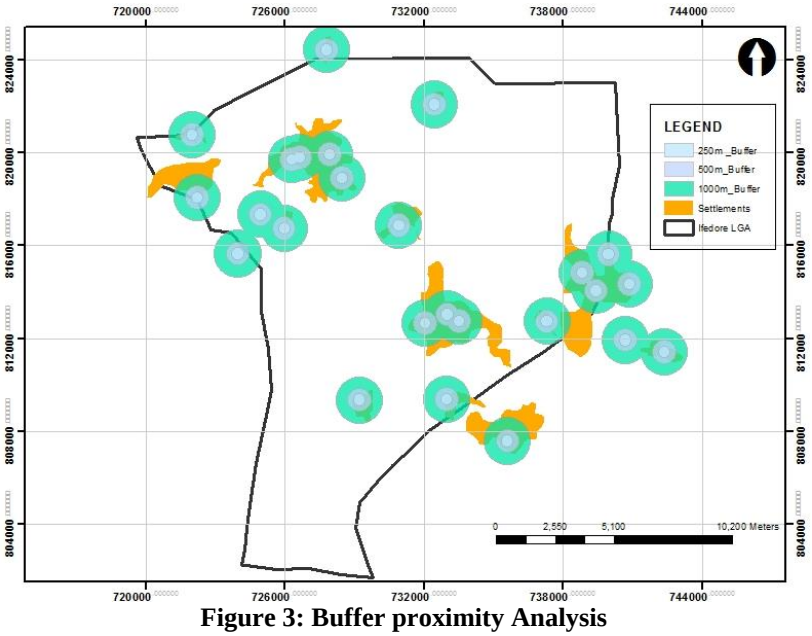

Figure 3: Buffer proximity Analysis

Healthcare Facility – Population Ratio (HFPR)

Population is a fundamental input and an imperative element in planning for the healthcare facility. It defines the number and level of facilities to be provided. The relationship between health services and population is an important area in the public health practice. Facility-population ratio is a fraction adopted to measure present capacity of a facility with a given population. The specification of WHO is that for every five thousand population, one healthcare facility is required for efficient service. Ifedore population is approximately 237,029. Presently there are twenty-four facilities with one general hospital. Thus, the ratio is 1:9,481. This simply means that a health facility is expected to serve a population of 1:9,481. This is grossly inadequate, should there be a need to attend to several patients at the same, for instance in times of natural disaster or epidemic. This inadequacy and insufficiency is in stark contrast to the goal of health-for-all as envisioned by WHO.

SUMMARY OF FINDINGS AND CONCLUSION

Summary of Findings

Facility-population ratio is one of the key parameters to measure the efficiency of healthcare delivery system. It attempts to measure supply of facilities to a required population. It is established from this study that the present healthcare facilities in Ifedore LGA is not sufficient to meet the standard of WHO concerning population. A wide gap exists between recommended and expected facility-population ratio. Though efforts were not made to ascertain the ratio of health workforce to anticipated population, yet it can be presumed that there are insufficient numbers of public health officials in the study area.

Location of facility is fundamental to health facility planning and a well-located facility does enhance accessibility. It was discovered that location of the facility strongly relied on the availability of space, physical accessibility, and government policy. It is agreed that nearness to facility strongly influence low-income earners' access to healthcare. However, this is not so for high-income earners who can find their way out to far distance for qualitative healthcare.

Spatial planning is connected with the spatial arrangement and service population in order to achieve convenience. There are various suggested standards in the aspect of health facility distribution. It is imperative to state that any recommended standard must define such facility capacity that is required for such. However, the present condition of the said facility is not up to the standard of World Bank assisted project specification.

Policy Implications

This study analyzed the spatial pattern of health service delivery system in Ifedore LGA. A major objective of government is to improve geographical equity and access to quality care. This is suggested to involve mapping of health facilities, establishing GIS for all health facilities in the country as well as developing criteria for siting of new health facilities at all levels. However, it is evident that this is not the case in the study area. The fact that facilities are scattered shows that geographic equity has not been achieved and some facilities appeared substandard. The Ondo State government has made a bold effort in achieving universal healthcare coverage. This is noted with Abiye Caring Heart Motherhood Programme financed by Ondo state and the World Bank. However, efforts need to be intensified to address present shortfalls. These will necessarily include the rehabilitation of existing and substandard health facilities in deplorable state.

CONCLUSION

It is evident in the locations of the existing facilities that proper consultation and analysis were not carried out. This error can be pardoned, in light of the fact that most of these

facilities were developed at a time when planning as an activity and profession was still taking root in Nigeria. Although application of sophisticated tools such as GIS and its affiliated wares are still evolving, there are numerous GIS tools, methodologies, and models (both mathematical and symbolic), that have been developed, which are available to help in decision making for efficient facility location. It is therefore important for policy makers and government agencies to ensure proper consultation before making these decisions. Hence, it is suggested that government agencies should consult relevant department and scholars in Nigerian universities for support and calculated and professional advice before decision-making.

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Adoption of Transformable Furniture for Space Utilization in Residential Spaces in Lagos, Nigeria

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ABSTRACT

An Average income earner living in Ikeja experiences basic shelter issues that includes high accommodation cost, insufficient space to build, and high cost of buildable land among many others. Most of them could not afford adequate space required of their family size. The present housing situation in Ikeja is therefore investigated and space utilization method is induced as supportive option in mitigating the problem of interior space congestion with the use of transformable interior furniture in residential spaces.Three hundred 300 questionnaires were administered in the study area and Simple table, percentages and explanatory paragraph were used to analyze the results. A comparative study was also carried out on cost implication of the use of transformable furniture to the habitually used interior furniture in the area. The results shows a promising outcome as room congestion and cost constraint could be annulled with the use of transformable interior furniture design in the study area. The study concludes that the use of the transformable interior furniture should be encouraged as increase in demand of the transformable furniture will increase the number of manufacturers thereby reducing the product cost through market competitiveness.

Keywords: Housing, Nigeria, residential spaces, space utilization, transformable furniture

INTRODUCTION

Housing remains in a deplorable state over time mostly in the urban environment of less developed countries as a result of an ever rising population caused primarily by rural-urban drift. The situation is even worse in places like Lagos, Nigeria that is short of buildable land spaces. Housing the "surplus population" of the city has long been an acute problem and a competitive exercise of multi-dimensional implication manifested in the political, socio-economic and environmental processes (Olayiwola, Adeleye and Ogunsakin, 2005). The urban poor constitute the vast majority of urban dwellers and they are in a disadvantaged economic position to build for themselves and are generally unable to make effective demand of existing housing (Olotuah and Taiwo, 2013).

An Average income earner living in urban cities like Lagos, Port-Harcourt, and Abuja experiences basic shelter issues that includes high accommodation cost, insufficient space to build, high cost of buildable land among many others (Olotuah and Aiyetan, 2006). Many effort had been made to improve the level of housing provision for the urban poor from government policies for a goal of achieving adequate housing to extensive mass housing development employing indigenous materials and methods, and involving the target population from policy making through programme execution. These methods of approach involved the participation of the grassroots user population to ensure the sustainability of the housing development in Nigerian cities, yet little of the effort have been felt so far. Despite the fact that they were mainly low income earners, they have household size of four persons and above, and most of them live in one bedroom apartments (Aduwo, Ibem and Opoko, 2013). They have improvised by altering their houses arrangement because they needed to

Onanuga, O. A.; Folorunso, C. O. & Adeyanju, A. (2016). Adoption of Transformable Furniture for Space Utilization in Residential Spaces in Lagos, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 988-996

provide more and better spaces to accommodate their growing families. This has resulted into interior overcrowding and spread of diseases.

Several studies that have been done on resident's satisfaction, quality and adequacy of housing, have reported that the quality is generally poor and level of satisfaction is very low (Ukoha and Beamish, 1997; Olatubara and Fatoye, 2007; Fatoye and Odusami, 2009; Jiboye, 2009; Ilesanmi, 2010; Clement and Kayode, 2012; Ibem and Amole, 2011; Ibem and Amole, 2012). Meanwhile, to improvise, over 89% of the open space around each of the buildings have been used up in the course of transforming the dwelling units. This has invariably reduced the available open space needed for adequate circulation of air and human traffic as well as outdoor activities (Aduwo et al, 2013). Despite this, it has been observed that there are still some space that are not well utilized even in the course of transformation.

Most researchers have concentrated on design specification that avoids excessive space provision, while much work have also been done as regards proficient land-use for more housing provision. However, research as regards the effective optimal use of provided space round the clock is still grossly scarce. This can be explained better considering the living room serving as a space to accommodate visitors, but its' effective use is limited to daytime therefore remain unutilized at night. This study therefore aims to investigate how the provided spaces in the interior can be adequately utilized to provide the required space that will accommodate the household size without altering the design of the space, a move to mitigate overcrowding of a part while some other parts of the interior are underutilized. The subsequent discussion shall focus on the result of housing delivery achieved so far by different strategy employed to solve housing matters in Lagos, Nigeria.

LITERATURE REVIEW

Housing Situation and Effective Responses in Lagos, Nigeria

Lagos is the smallest state in Nigeria in terms of land area with only 0.4 percent of the Nigeria total land space, but remains the most populace city in Nigeria (UN-Habitat, 2004). The state accounts for about 9.7 percent of national population and stretches 180km along the Atlantic Coastline having 17% of its total land area made up of Lagoon and water. At the Northern and Eastern sides lies Ogun State and the Western side is bordered by Republic of Benin. The increasing rate of population growth of over 9% per annum, resulting to additional 1.4 million persons annually (Bamgbose, 2009; Lagos State Government, 2004) and about 4,000 people per day with population density of one person per square kilometer is about 16 times the national average (Ibrahim, 2014).

The population explosion in Lagos is attributable to significant economic, commercial and political changes that made Lagos the fastest growing city in Nigeria as it accounts for nearly 50% of the total value added by the manufacturing sector of Nigeria and increasing capital intensive than other parts of the country. The large population which accounted for more of urban poor engage in irregular, low-income employment making them poor that they cannot afford conventional housing that will accommodate their family size (Ibrahim, 2014).

Since the late 1960s, the intervention of government in housing in Nigeria has covered provision of staff quarters, staff housing loans to government workers, direct house construction in public schemes, and site-and-services schemes (Olotuah et al, 2013). Government have responded in their own way to solve the problem of housing right from the military era to date. Government efforts in providing public housing during the first and second policy plan period (1962-68, 1970-74) were concentrated in Lagos. From 1973 to 1979, 10,000 housing units were constructed in Lagos and about 24,000 units in the rest of

the states. The civilian administration, before the 1983 military coup executed 20% of its housing programme (about 30,000 housing units) (Olayiwola et al, 2005).

The Lagos State civilian government constructed 10,428 units out of the planned 50.000 units whereas it completed about 70% of the housing units meant for the high-income groups (Alaka, Opebi, and Alapere estates). The 1984 military administration of Lagos State completed 200 housing units out of the programmed 8000 housing unit proposed to be built between 1983-1986 (Olayiwola et al, 2005; Olotuah et al, 2013). Many other strategies have been put in place by different government bodies between 1986 to date, and Federal Government involvement in housing within the last six years shows that government has a significant contribution (olayiwola et al, 2005).

The National Housing Fund, another government policy, which is supposed to be the source of housing finance is itself, faced with the difficulty of mobilizing contributions from the informal sector compromising self-employed workers. The formal sector has not been forthcoming, either, in its contribution to the Fund as the financial institutions (notably the Commercial Banks and Insurance Companies) and have not been participating in the scheme. The private sector, been essentially profit-oriented, cannot as well ensure an equitable distribution of housing resources. This is inevitable in a country with high unequal income distribution. The poor majority are thus subjected to unending housing poverty in the absence of decisive intervention with respect to direct construction of low-cost houses; meanwhile, the quantitative housing needs of the populace, though staggering, have to be met for all Nigerians to have access to adequate housing.

Space Planning and Its Limitation

Space planning involves optimum utilization of available buildable space in an efficient and effective manner that meet the users' needs and requirements. Space planning gives an effective total use of an available buildable space, a method that has involves vertical development at areas where horizontal development are impossible. Space planning strategy have been an alternative sought by governmental organization in other countries to tackle the issue of housing inadequacy, and in developing countries like Nigeria, vertical development of high rise buildings and condominiums has been fully harnessed. Nigeria, been one of the developing country, her building practice is still grappling with a lot of challenges, ranging from inadequate technical and managerial know-how to insufficient financial, material and equipment capital base (Oluwakiyesi, 2011). This is made evident by the threats it imposed on the building practice in Nigeria that varies from importation of costly building materials and professionals from foreign countries, to diminishing opportunities for indigenous professionals cum low local contractors' growth due to competition from their more capitalized and better equipped foreign counterparts. The cost of imported building materials (Onibokun, 1985) and construction techniques involved usually make acquiring accommodation more cost unbearable. However, increasing household size imposed a limit to space planning methods as space requirement keeps increasing to accommodate the household size, hence, changing the original form and spatial configuration of a dwelling unit by the occupants in order to meet current space need arises. In lieu of this, a guideline for space utilization strategic approach was developed (SMG, 2006).

Space Utilization Scheme

Space utilization is a measure of whether and how space is being used. The utilization rate is a function of a frequency and occupancy rate. The frequency rate measures the proportion of time that space is used compared to its availability, and the occupancy rate measures how full the space is compared to its capacity (SMG, 2006). The household size of an average family keeps increasing once a marital relationship starts, and the size of a family determines the

space required to accommodate them. Meanwhile, increasing the space in a home lead to higher prices for the end purchaser (Luke, 2014). The inability to afford new houses or expand the existing one resulted in overcrowding thus, aggravating what is originally a convoluted situation. Most families resolve to a confined space they can possibly get due to financial constrain, therefore keeps transforming the interior partitions and overloading existing spaces. Meanwhile, it has been observed that it is only a part of the space that is been overloaded while some other part are limited in use (Freeman, 2004). In other to achieve balance in the use of interior space for the household need is the target of space utilization approach.

Reviews on issue of residential management approach, the German Bauhaus movement produced an analysis entitled; 'Existenzminimum' (McGrath, 2011). The project focused on setting minimum standards for elements such as floor space, density and fresh air amongst other items in response to the then German postwar housing crisis (McGrath 2011; Luke, 2014). The rooms were designed to be multifunctional; to easily change between uses throughout the day. Research has affirmed that a rented apartment allows dwellers to act only on partition wall level and utensil level and that the tenants cannot operate beyond the furniture level according to the context (Khan, 2014). Since most of the tenure category affected by housing issues are the tenants, the design of multipurpose furniture becomes necessary as movement of different furniture for different interior use can also be wearisome.

Furniture, an essential companion of human lives and work, and an important/inevitable constituent of the indoor environment is a basic component in achieving a compact, yet functional and comfortable interior spaces. Space saving concept with the use of multifunctional furniture has been in existence for decades. However, it was not until recently that its importance and convenience was recognized, particularly in this time of increase urban population growth which is associated with limited living surface area (Kilmer et al, 1992). The space management technique through the use of multifunctional furniture involves either the use of a dual function furniture that can serve two purposes (like a sofa can be converted to a bed in figure 2) or furniture design that relate with space (that is a bed can be hid into a wall or ground or raise to the ceiling as part of design - figure 3). It is assumed that space saving furniture, multifunctional design and tiny transforming spaces are a new idea, however people have been looking for ways to make their homes more space efficient and products more versatile (Ching & Binggeli, 2012).

Figure 1: Showing a sofa convertible to bed.
Source: Adapted from: www.motherlandnigeria.com/geography.html

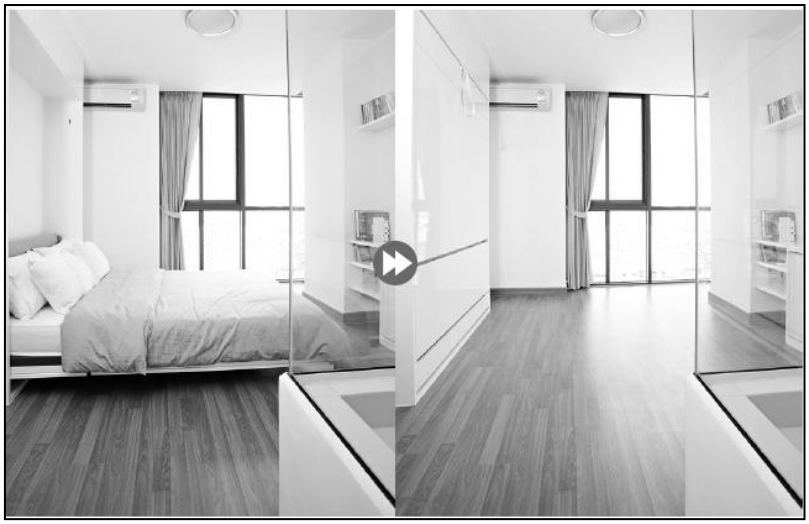

Figure 2: Showing a map of Lagos State.
Source: Adapted from: www.motherlandnigeria.com/geography.html

METHODOLOGY

The study utilized both secondary and primary sources of data. The secondary data sourced for relevant information from journals, articles, and research reports from government agencies, and parastatals. Primary information was collected from both personal observations and questionnaire. The area concentrated on in Ikeja are the Ikeja G.R.A, Allen Avenue, Awolowo way, and Alausa. A total of 300 questionnaires were administered to the government workers residing in the study areas. These areas have a large concentration of government workers in Lagos. Seventy five (75) apartments were randomly chosen from each area and the questionnaires was administered to the head of the family of one household in each apartments. The comparative study of cost difference in the use of transformable furniture in a one bedroom apartment against the regular furniture setting in a two bedroom apartment was also analyzed.

Study Area

Lagos State is the economic nerve center of Nigeria. It would be the fifth largest economy in Africa if it were a country. At the inception of Lagos state in 1967, Lagos Island was both the state capital as well as the seat of the Federal Government. However, when Nigeria's federation was restructured into 19 state in 1976, the capital of the state was moved to Ikeja. Lagos state is also made up of five administrative divisions in which Ikeja was one, the administrative division were further divided into local governments. Ikeja division consist of six local government authorities namely: Agege, Mushin, Alimosho, Oshodi/Isolo, Somolu and Ikeja. Ikeja serves as the seat of government and also as the division's headquarters. Prior to the emergence of military rule, Ikeja was a well-planned, clean and quiet residential environment with shopping malls, pharmacies and government reservation areas. It now boasts of a large shopping mall "Ikeja City Mall" which is the biggest mall in the Lagos mainland and also has a cinema. The investigated areas for the purpose of this research cut-across G.R.A., Allen Avenue, Awolowo way, and Alausa.

Ikeja is one of the many parts of Lagos mainland constrained by space consisting of many residential apartments, government offices, commercial centers, and industries among others. The research examines the impact that transformable furniture will make on dwellers in disadvantage economic position who cannot afford to rent adequate space required of their family size.

Plate 3: *Showing a map of Lagos State and the study area.*
Source: Adapted from: www.motherlandnigeria.com/geography.html

RESULTS AND DISCUSSIONS

Effect of Income on Choice of Accommodation

The income of the residents living around the Ikeja areas is presumed to be a predominant factor that determines the types of apartment that they live in. To justify this, the income classification in relation to the type of dwelling of the respondents was analyzed. In the questionnaire, the income was classified into low income earners (range between those of no regular income to lowest rank government worker collecting #280,000 per annum), middle income (income class range between #280,000 to #700,000 per annum), and high income (class earning above #700,000 per annum) earners. The study showed that about 56% (168) of the respondents were of low income classification, 36% (108) are of middle income and 8% (24) are in high income class. The result of the dwelling units tallies with expectation. About 22% out of the total 56% in low income class lives in rooming apartments, 24% lived in one bedroom apartments, while only 10% in low income category lives in two bedroom apartment. The table gives a summary of all responses by the respondents for all the classes of income, and percentages shaded for clarity.

The result therefore proves that the urban poor were limited to the confined spaces due to their disadvantaged economic position. This situation can be attended to if the available space that they can afford are been properly utilized and strategically managed. The concept of transformable furniture bring about the achievement of a reduced square area required to accommodate a unit family in an urban environment. This will create more space to accommodate more urban dwellers thereby reducing the crowdedness in the provided spaces and housing need of the people.

Table 1: showing the relationship between the apartment type and the income classification

Apartment		Income classification			Total
		Low income No regular – 280,000	Middle income 280,000-700,000	High income Above 700,000	
Rooming apartment	count	66	6	0	72
	percentage	22	2	0	24
1 bedroom apartment	count	72	18	0	90
	percentage	24	6	0	16
2 bedroom apartment	count	30	30	0	60
	percentage	10	10	0	20
3 bedroom apartment	count	0	30	18	48
	percentage	0	10	6	30
4 bedroom apartment	count	0	24	6	30
	percentage	0	8	2	10
total	count	168	108	24	300
	percentage	56	36	8	100

Source: Researcher's Field Survey.

A Comparative Analysis of Two Dwelling Spaces

A comparative analysis was carried out of two different apartments of an average income earner in the study area. The cost of the furniture put in place in the interior space of the two bedroom was compared with cost implication using transformable furniture for a one bedroom apartment (table 2). The cost of a minimum annual lease for both one bedroom apartment and two bedroom apartment at Awolowo way was noted, and also the cost of necessary furniture the spaces could require. The one bedroom apartment contains a living room and a bedroom with other facilities such as kitchen and toilet, while the two bedroom apartment contains a living room and 2 bedrooms with other facilities such as kitchen and toilet.

Table 2: Cost comparative study using transformable furniture in a studio apartment against the orthodox furniture setting in a two bedroom apartment

	Studio apartment Transformable furniture		**2bedroom apartment orthodox furniture**	
	unit	**Price (#)**	**unit**	**Price(#)**
Minimum annual lease	1	200,000	1	300,000
Bed	1no platform bed (HDF) first room	210,000	1no platform bed (HDF) first room	210,000
			2no average size bed second room	260,000
Sofa	2no dual use sofa (convertible to queen size bed) – HDF	840,000 (at $2000 each)	1 living room caret fabric sofa set	200,000
Total cost		#1,250,000		#970,000

Source: Authors field work

Table 2 shows the details of cost incurred by the residences in both apartments. Transformable furniture was considered for use in the one bedroom apartment and the orthodox furniture was used for the two bedroom apartment. With the use of the transformable furniture, the dual sofa is convertible to two numbers queen size bed, thereby providing additional two bed spaces for comfortable night rest for a household that could only afford one bedroom apartment. Therefore, it can be said that the bedroom is copiously utilized round the clock. It can also be deduced that the tenant occupying the two bedroom will be paying more as cost difference will take effect after the first year as the dweller in the two bedroom will annually be paying #100,000 more, yet harnessing same comfort level as the other dweller.

The implication of using a transformable furniture is that a great deal of space is saved and the use of a space can be multi-functional. The sample above show a one bedroom apartment that employs the strict use of transformable space saving product. The one bedroom apartment eventually provide a satisfactory two bedroom apartment accommodating a double bed for the converted living room space.

CONCLUSION

Most of the respondents prefer the transformable furniture to the local furniture, although large percentage of them have neither the idea nor have seen the product. It is affirmed through comparison that a one bedroom apartment can serve the function of a two bedroom in a situation where a transformable type of furniture is used. A transformable sofa can be converted to a bed and changes the use of the lounge space during the day to bedroom at night. With this scheme put to use, it can be assured that problems associated with overcrowding of space and indecent housing condition can be averted. The implication is that those that can only afford one bedroom apartments, with the use of the transformable

furniture, could have a satisfaction that can be compared to those dwellers in 2 bedroom/3bedroom spaces using the common furniture.

The transformable furniture is an imported product which significantly affect the cost of purchase as none of the company producing is established in Africa. The cost of this transformable furniture varies according to material and what it is to be converted to. The price range of a queen sized transformable bed with a bookshelf according to Resource Furniture (a leading brand of this type of furniture) is from #800,000 to #3,000,000 ($4000 - $21000 CAD) when converted to the local currency, and a simple transformable sofa bed costs only around #200,000 (Shiyao Wang 2013). The government can therefore help in this regard to put a strategy in place in attracting the product companies into Nigeria. Doing this will merit in two ways; it will bring about job opportunities and also reduce the cost of purchase of the product. The supply for a commodity has an inverse effect on the price because the higher the supply the lower the price and this will give enough purchasing power especially to the low income earners.

The main reason why the ordinary furniture may be cheaper is because it is locally available in the market, therefore if the transformable furniture is made available in local market in large quantity, its price will become reasonable as the locally available ones. However, as much as this paper was able to expose this products existence taking into consideration the people that the questionnaire was administered to, the preference of peoples' changed and a larger percentage opted for the transformable space saving furniture. Therefore, government could focus on the production of housing type having more of one bedroom apartment as this will increase the number of housing unit in the study area thereby greatly impacting housing need of the people, hence, the housing challenges in the urban environment is reduced, enough space is created out of existing space and shelter provision is adequate enough for the city dwellers.

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A Critique of the Implementation of Abuja Tourism Development Master Plan

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ABSTRACT

The objective of the preparation of any tourism development master plan is to provide a guide for a short, medium and long term development framework of the sector. Hence the viability of the plan is explained by the success of the implementation programme and by extension, describes the performance of the industry. In this study, a critique of the implementation of the Abuja tourism development master plan was carried out. Observations have indicated that, important components of the plan have not been implemented. This was explained by the outcome of the assessment which shows that, physical development and upgrading has scored 0.23, marketing and promotion has scored 0.19 and events products has scored 0.20, while the overall score of the implementation programme was 0.62 points and this indicates failure of the plan implementation. Several factors were identified explaining the reasons for the failure of the plan implementation; these include: poor identification of potentials, lack of private sector involvement, inadequate funding, technical shortcomings, shortcomings associated with planning and implementation strategies, institutional constraints of policy and laws, inadequate publicity and poor advertisement. The study concluded with recommendations which include: the need to review the tourism master plan, provision of adequate funding, formulation of Abuja tourism policy and enactment of tourism laws; these would further enable tourism planners, policy makers and private sector contribute immensely to the improvement of the planning and development of tourism sector in the F.C.T.

Keywords: Assessment, Implementation, Master planning, Tourism development, Programmes

INTRODUCTION

Tourism is defined as the short term movement of people from their usual place of residence (origin) to other places (destination) for the purpose of leisure and recreational activities without any intention of securing a permanent resident or job at the destination; Christopher Cooper and Brain Boniface (2006). In 2007, the European commission on tourism and travels (ECTT) adopted a definition that included among others; persons traveling for pleasure, for family reasons or in a representative capacity of any kind and persons traveling for business reasons (ECTT, 2005).

It is also seen as the science, art and business of attracting and transporting visitors, accommodating them and graciously catering for their needs and wants; Mentosh and Gupta (2008). Since the early 70s, tourism has grown to become one of the fastest growing economic sectors in the world, ranking only after petroleum and auto trades (UNWTO, 2010). Tourism today plays a significant role in the balance of payment of many countries both in the developed and developing worlds. Tourism therefore, brings huge economic and social benefits to many nations, especially those that carefully plan and manage their potential attractions or resources (UNTWO, 2010). It has become the world's largest growing industry, statistics by the world Tourism organizations shows that there are no signs of this growth slowing down in the next Millennium. To benefit from this global trend, tourism is been adopted by governments as a vehicle for poverty alleviation, employment generation and wealth creation. It is also seen as a veritable tool for the realization of the Millennium Development Goals (MDGs).

Iliyasu, I. I. (2016). A Critique of the Implementation of Abuja Tourism Development Master Plan. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 997-1005

In recognition of these prospects of tourism, the defunct Ministry of Federal Capital Territory (FCT), Abuja prepared a comprehensive tourism development master plan in 2000. The tourism master plan is a strategic document, report or plan prepared to serve as a blue print or guide in harnessing the varied potentials i.e. National and Cultural attractions of the FCT for tourism development. The plan intends to provide a plat form through which tourism potentials could be develop in the territory. The ten (10) year plan was with the mandate of establishing short, medium and long term development programmes, such as high quality leisure and recreation facilities, accommodation and transportation within the framework of the Abuja city (F.C.T) master plan for attracting domestic and international tourists and visitors. The implementation of the plan was observed to be poor and unsuccessful in meeting the designed goals and objectives; therefore, this paper carried out a critique of the plan implementation programmes with the view of establishing the factors responsible for the poor implementation outcome of the plan.

Method and Materials for the study

The data used in the study were sourced from opinion surveys. The review of secondary data which includes; the master plan document, legal documents and policy reports that were meant to guide the implementation of the programme, were also carried out. Purposive sampling method was adopted for the selection of respondents for the opinion survey to ensure a wide coverage of all agencies responsible for the implementation of the projects and programmes of the master plan in the FCT, Abuja for the actualization of the objectives of the study. In conducting assessment that would be free from ambiguity, subjectivity and biasness, the Kergs scoring criteria (expressed levels of project or programme implementation achievements in percentages (%) and to a defined score values ranging from 0% to 100% and a score values of 0 point to 3.0 points) was used. The overall scores is acquired by summing up of all the points of the implementation projects or programmes divided by the score points; this is mathematically expressed as:

$$\boldsymbol{K} = \frac{\sum \boldsymbol{x}}{\boldsymbol{n}}_{\boldsymbol{t=1}} - - - - - - - - - - - - (\mathbf{1})$$

Where: K = constant value meaning the mean of the Kergs points

$\sum x$ *= Summation of all points of individuals projects scores*

n = total number of scores in Kergs index

The relationship between outcomes is also expressed mathematically as: $\boldsymbol{0 \leq \emptyset \geq 3.0}$**----------** ***(2).***

The Study Area

Abuja, the Federal Capital Territory is located in the geographical Centre of Nigeria, occupying an area of about 8,000sq.km. It is bounded to the north by Kaduna State, to the west by Niger State to the east and south by the new Nassarawa State (formerly part of Plateau State) and to the south-west by the new Kogi State (formerly part of Kwara State). On the world map, FCT lies between latitude 80' 25°, north of the equator, and longitude 60' 46°, and 739, east of the Greenwich meridian. The central geographical location of Abuja makes it easily accessible from all parts of the country, especially by road. The administrative composition of Abuja is made up of six area councils and eleven districts.

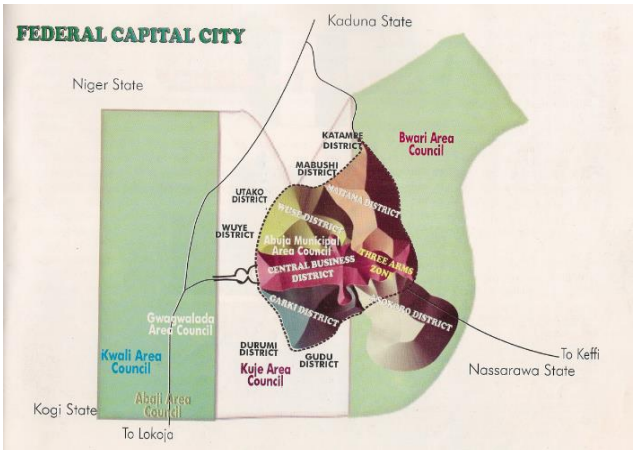

Figure 1: Administrative Districts in the F.C.T Abuja

The main occupation of F.C.T's local communities is farming. Manufacturing sector has also grown quite substantially especially in respond to the demands of the building and food industry. Local handicrafts especially; poetry, blacksmithing, basketry and leather work. The population of F.C.T is about 8.0 million. The major indigenous groups in the territory are the Gwaris followed by Koros, the Ganas, the Gwandaras, the Bassa and the Egbiras. Most of them live in the rural areas of the FCT and are somewhat related in their culture, language and tradition. Presently, the main city of Abuja, administratively called Abuja Municipal Council Area is inhabited predominately by the Hausas, Igbos and Yorubas and a minority of the indigenous tribes.

THE TOURISM MASTER PLAN OF THE F.C.T ABUJA

The master plan proposals for the development of the sector are anchored around three issues. These are the development potentials which include:

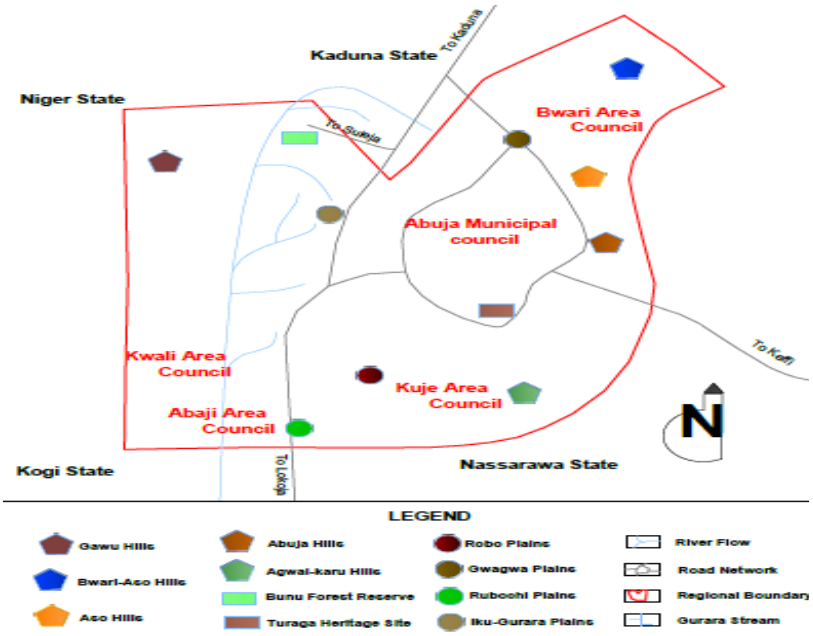

Figure 2: Proposed Physical Development Potentials

The Natural Elements

These involve the natural features or bounties of Abuja such as Hills and Rock outcrops, the geomorphology and topography, climate and hydrograph of areas. For the purpose of the

master plan; the following natural potentials of the areas are considered for the development of tourism sector of the F.C.T; Aso or Asokoro Rock, Strabag Hill (or the National Center), The Zuma Rock, The Twin Mountains of Abuja City Gate, Gurara Falls, Jabi Dam Resort, Lower Usuma Dam, The Republic Garden/Abuja Garden, Abuja Plant Nursery, Julie Useni Park, Abuja Zoo, FCT Game Reserve and The National Arboretum.

The Cultural Elements

The cultural elements refer to historical and traditional artifacts of areas. For the purpose of the master plan the following existing tourist cultural potentials of the F.C.T were adopted or development of a robust tourism destination in Abuja. These include; handcrafts, music, traditional buildings or settlements, signature architectures, cuisines, religious places, palaces, theatre and performing arts, festivals, events and fairs, museums and monuments, traditional games and sports, fashion and textiles as well as traditional medicine (curatorial services).

The supporting facilities

Tourism largely depends on the numerous existing supporting or complementary facilities to thrive. For the purpose of the master plan the following existing tourist attractions and facilities have been integrated into the master plan for the development of tourism in the F.C.T; Hotels, Restaurants, Conference Facilities, Transport Facilities, Sports and Recreational Facilities, Shopping Facilities, Tourism Information Posts, Tour Operators and Travel Agencies.

FINDINGS AND DISCUSSION

Assessment of the plan Implementation

In the assessment, out of 22 physical development projects proposed, only 2 were fully implemented representing 9.1%, about 9 projects were partially implemented representing 40.9% of the projects. Also out of 8 physical upgrading projects proposed, only 1 was fully implemented representing 12.5%, while 2 projects were partially implemented representing 25% of the proposed projects.

The assessment of marketing and promotion programmes, indicate that out of 6 programmes proposed, only 2 were partially implemented representing 33.3% of the programmes.

The events product assessment also, shows that only 2 events products were partially implemented out of 5 products proposed, representing 40% of the proposed products.

Overall Assessment of Plan Implementation:

The sectoral assessment carried out above was further examined. First was to enable comparative assessment of the implementation levels of the sectors; and second to enable appreciation of implementation at the aggregate plan level. In the study, the aggregate scores of the plan components obtained indicates that, Physical development and Upgrading projects has the highest aggregate score of 90 points, marketing and promotion has the moderate score of 18 points, while event products have the least score of 15 points. Outcome of the overall assessment shows that, the implementation of Physical development and Upgrading projects did better than the other components obtaining the best aggregate score of 20.95 points, while implementation of events product was poor with the score of 3.0.

Inference form the study established that, the total implementation scores indicates poor implementation of the master plan. This has been established by the results of the overall assessment scores outcome of the plan implementation which shows an overall score points of less than 1.0 (0.62), this indicates failure of the implementation of the master plan. This implies that the critical components of the tourism master plan have not been implemented as established in the assessment of the various components of the plan. Therefore, it has become

necessary for the study to further provide explanation on the factors that are responsible for the failure of the plan implementation towards actualizing the F.C.T Tourism development mandates. Table 1 shows the detail of the overall assessment scoring.

Table 1: Scores of the overall assessment of the plan implementation

S/No	Variables	Maximum scores	∑x	n t = 1
1.	Physical development and Upgrading	90	20.95	0.23
3.	Marketing & promotion	18	3.5	0.19
4.	Events Product	15	3.0	0.2
	Total			**0.62**

Note: 0-1=Failure, 1=Poor, 2=Moderate, 3=High,

FACTORS EXPLAINING THE POOR LEVEL OF PLAN IMPLEMENTATION

Poor Identification of Tourism Potentials

The results obtained from the study have shown that poor implementation is partly accounted for by wrong choices of tourism potentials made by the Master Planners. The proof of this comes by comparison of chosen potentials in the plan and the perceptions of the public, determined based on an opinion surveys. Table 2 shows the various user perceptions.

Table 2: User Perception on Tourism Potentials in Abuja

S/No	Users / stakeholders	Tourism Potentials in the F.C.T						Total
		Architectural elements & monuments	Hotels	Catering services	Conference centers	Parks, Recreation & Resorts	Cultural elements	
1.	Domestic tourism	20%	22%	12%	11%	30%	5%	100
2.	International tourists	12%	25%	2%	53%	6%	4%	100
3.	Day visitors	28%	20%	15%	21%	13%	3%	100
4.	CATA	36%	12%	11%	20%	6%	15%	100

Poor Private Sector Involvement

The analysis established that, the various projects and programmes that were ear marked for implementation, over 70% of the project tasks implementation was made the responsibility of the government which are yet to be implemented. Government were supposed to create enabling environment for the private sector participation such as economic incentives (tax holiday, free registration and accessibility to serviced land), but such environment does not exist in the F.C.T. However, this explains the poor outcome of private sector involvement in tourism industry of the F.C.T, and further explains the non-implementation of the three basic components of the master plan.

Inadequate Funding

At the F.C.T level, the study has established the lack of effective private sector involvement in the tourism sector. Problems of funding were found to be one of the major reason for the unsuccessful implementation of the tourism master plan. Table 3 shows the various outlays of funds proposed for the implementation of the master plan.

Table 3: Funds allocated between 2000-2010 for Tourism development in the F.C.T

SN	Agency	Phase I (2001–2004)		Phase II (2005-2007)		Phase III (2008 – 2010)	
		Spent (#)	Budgeted (#)	Spent (#)	Budgeted (#)	Spent (#)	Budged (#)
1.	Public sector	12.2m	1.5b	14.6m	2.2b	120.5m	2.56b
2.	Private Sector	120m	1.8b	240.34m	2.6b	406.84	3.52b
	total	132.2m	3.3b	254.94m	4.8b	527.34m	6.08b

Source: Abuja Tourism Master Plan, (2000), NTDC (2011) and FCT, Tourism Development Department. (2013)

Technical Shortcomings

In the context of Abuja tourism sector, the analysis on table 4 has established that, the organizations responsible for the implementation of the master plan were poorly staffed.

Table 4: Manpower for Tourism Development in the F.C.T.

S/No	Bodies	Senior cadre		Middle cadre		Junior cadre	
		Available	required	Available	Required	Available	Required
1.	NTDC	4	8	6	10	8	16
2.	Abuja Tourism Development Department	2	6	3	15	7	18
3.	Abuja Art and Culture Bureau	3	8	4	12	6	16
4.	Tourism Area Councils	-	4	-	6	-	12
	Total	9	28	13	43	21	62

Sources: Abuja Tourism Development department, 2011 & Field Survey, 2013.

Poor Implementation Strategies

The study has established that poorly articulated strategies existed for implementation of the tourism master plan. Table 5a and figure 5b examined the various views and opinions of stakeholders who directly or indirectly influenced the implementation of the plan. Stakeholders opinions were sorted out and their views and opinions indicated that, implementation of tourism development programmes in the F.C.T is poor.

Table 5a: Stakeholders Perception on the implementation of the Tourism Master Plan

Respondents	Responses				Total
	High	Moderate	Low	Poor	
Nigerian Tourism Development Corporation (NTDC)			√		
Abuja Tourism Development Board (ATDB)				√	
Abuja Council for Arts and Culture (ACAC)			√		
National Commission for Museums and Movements, Abuja				√	
Federal Capital Development Authority (FCDA)				√	
Parks and Recreation Department (AMMC)			√		
Private Tour Operators		√			
Hoteliers		√			
UNESCO (Head Office, Abuja)			√		
World-Wild Life Foundation, Abuja	√			√	
ASOFEST					
Center for Advancement of Tourism in Africa, Abuja Project Office			√		
Total scores	1	1	4	6	12
Percentages	8.3	8.3	33.3	50	100

Table 5b: Stakeholders Involvement in the plan implementation Process

S/NO.	Respondents	Involved	Partially involved	Not involved
1.	Residents of Area Councils	*	*	√
2.	Villages	*	*	√
3.	F.C.C. Residents	*	√	*
4.	Tour operators	*	√	*
5.	Financial institutions (Banks, Insurance Companies)	*	*	√

Lack of Tourism Development Policy

The provision of adequate and functional policies, laws and administrative structures is key to the effective implementation of development programmes including programmes for tourism development. At the F.C.T, such policy was established from the study to be non-existent,

and its absence has constituted a major hindrance to the effective implementation of the plan. In its absence, the National Tourism Development Policy of 1990 (reviewed in 2004) appears to be the only guiding instrument for tourism development in the F.C.T and without reference to the tourism needs of the F.C.T this policy in effect has been of limited value. Table 6 shows the conflicting roles among different agencies responsible for Tourism development in the FCT as a result of absence of the policy.

Table 6: Conflicting roles of Tourism Development Agencies in the FCT

S/No	Agencies/Bodies	Responsibilities / Functions				
		Planning & monitoring	License/ permit	Collection of revenue	Collection of data	Marketing/ promotion
1	Nigerian Tourism Development Corporation	√	√	√	√	√
2	FCT-Tourism Development Department	√	√	√	√	√
3	Abuja Art and Culture Bureau	√	√	√	√	√
4	Area Councils Tourism Committees	√	√	√	*	*

Source: Abuja Tourism Master Plan (2000), NTDC (2010), AA&CB (2010)

RECOMMENDATIONS

Based on the outcomes of the assessment; the study made the following recommendations with the purpose of improving on the implementation of both the tourism master plan and the tourism activities towards delivering the mandates of the Abuja tourism development visions and goals. Thereby, help in improving on the general performance of the tourism sector.

Review of the Tourism Master Plan of the F.C.T

In view of the outcome of the assessment, the tourism master plan should be reviewed with emphasis on revising assumptions, selection of viable potential resources, evaluating methodologies of tourism elements, explore the city significant architecture, culture and landscape elements as well as adoption of an appropriate tourism circuit for strategic development of the sector.

Provide improved funding

A system of exploring the appropriate models of Public-Private Partnership (PPP) should be designed and implemented, so as to augment government efforts towards actualizing the tourism mandate. Public sector should be more proactive towards creation of enabling environment in the provision of basic infrastructures for tourism, while the private sector is to provide funds for developing the industry.

Strengthening of the existing institutional framework

The Abuja tourism development policy should be gazette, and laws related to tourism development should also be enacted. Also, synergy should be created among the various agencies of tourism in the FCT for effective implementation of development programmes and projects, as well as re-strengthen them towards actualizing the FCT tourism master plan.

Strengthen the technical component of the Tourism Development Board

The sole implementing agency of the Abuja strategic tourism plan and development to be re-strengthen to reflect the ideals for effective tourism development in the territory. This includes the provisioning of adequate staffing, office equipments, communication gadgets, vehicles for monitoring, improved salaries, wages and welfare packages for the staff and conducive office space for operations.

Establish the Abuja Tourism Development Board (ATDB)

The national assembly should be solicited to pass the Abuja tourism development policy and law bill, this is to enable the establishment of the board, which would serve as the state apex for coordinating and monitoring of tourism development.

Create Adequate Publicity

the Abuja tourism programmes should be given popular publicity and awareness drive such as TV Jingles, Newspaper Advertisement and participation in tourism Events and Fairs, and also should be made available on the internet and also an effective web site for the board should be created to enable contributions in form of suggestions and opinions to be expressed in meeting the designed goals of the tourism development of the F.C.T.

Develop Political will for tourism

Government should commit effectively towards actualization of the Abuja tourism mandate. This should take the form of provision of supporting infrastructures such as; water, electricity, roads and public transport systems, etc, economic incentives such as tax holiday, free investment portfolio from the C.B.N, insurance companies, development and commercial banks, investment houses and other financial institutions in the country; policy regulations such as visa holiday, immigration lifts, trade tariffs and improved security system.

CONCLUSION

It has become clear from the assessment that Abuja is rich in tourism attractions and potentials but the implementation of the programmes have been unsuccessful, constrained by the identified factors. This hindered the effective development of the tourism sector of the F.C.T as established by the study. The outcome established that the basic components of the tourism master plan were not adequately implemented, while others are yet to be carried out. These were attributed to the identified factors that resulted to the outcome. Recommendations were made for transforming the Abuja tourism sector to a more viable sector and also for future tourism planning process and programmes for the actualization of the National Tourism Development Master Plan and the National Tourism Development Policy with regards to Abuja and the country at large.

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Mapping For Community Development: A Case Study of Apatapiti Community North East, Akure-Nigeria

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ABSTRACT

This project aimed at carrying out the detail surveys of North Eastern part of Apatapiti community. The 2-D geospatial data of the features existing on the study area were acquired using the Total Station instrument to determine their planimetric positions in space. The planimetric positions were plotted using the AutoCAD 2007 software on a scale of 1:1500 to obtain the layout plan. Charts were produced from the analysis made to the variation in the sizes of plots and blocks, road lengths and the land use activity characterised with the layout, using Microsoft Excel software. Findings revealed poorly constructed temporal and permanent features in the community for appropriate attention. Results obtained from the analysis of the land use showed that the layout is 61% residential with commercial (29%), agricultural (7%), social (2%) and educational (1%) sharing the remaining space. The proof of Geomatics method as a tool for effective mapping, the achievement of the aim based on the results obtained and the plan produced was the conclusion of the project work. The sufficiency of the project work for Land Information System (LIS) applications and database creation, further work on the project area, archival in the department for record and research purposes were recommended.

Keywords: Detail Survey, Geomatics, Planimetric positions, land use activity, geospatial data

INTRODUCTION

Mapping survey are made to determine the locations of natural and cultural features on the Earth's surface. Once located, these features can be represented on maps (Ghilani & Wolf 2012). The results are used for planning, policy making and quality decisions for development. Detail mapping helps in the production of a plan (to scale) of an area of land showing all detail, natural and man-made. It helps to provide a record (in coordinate form) of detail within an area. It also aids in taking measurements to allow earthwork areas and volumes to be calculated.

Problem of the Study

Apatapiti, is a community characterized by various dilapidations and poor living infrastructural conditions. It lacks adequate information on what type of natural and artificial features exists therein. There is no record of comprehensive detail mapping (in large scale maps or geospatial data) available for decision or policy making for the development of the community. the North Eastern part of the community is seen as the fulcrum of the community with the lion share of the problem. Hence, the pursuit of this project to help in solving these problems.

Purpose of the Study

Considering detail mapping as being essential to the study area, the study aims at carrying out the detail mapping surveys of the North Eastern part of the community through the following objectives:

i. Locate existing property boundaries.
ii. To fix all the existing details within the project site.
iii. To provide the geospatial data.
iv. To produce corresponding plan and charts

Ogunlade, S. & Tijani, S. (2016). Mapping For Community Development: A Case Study of Apatapiti Community North East, Akure-Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1006-1010

v. To proffer various recommendations to help the authorities concerned.

STUDY AREA

North Eastern part of Apatapiti community is located at Akure South Local government area, Akure, Ondo State, Nigeria. It is bounded by Min. [050 08' 45''E, 070 17' 21''N] Max.[050 09' 03''E, 070 17' 29''N] geographic coordinates, and has FUTA south gate area to the North, FUTA main campus to the West, Aule community to the South and Alaba layout to the East. (Figure 1).

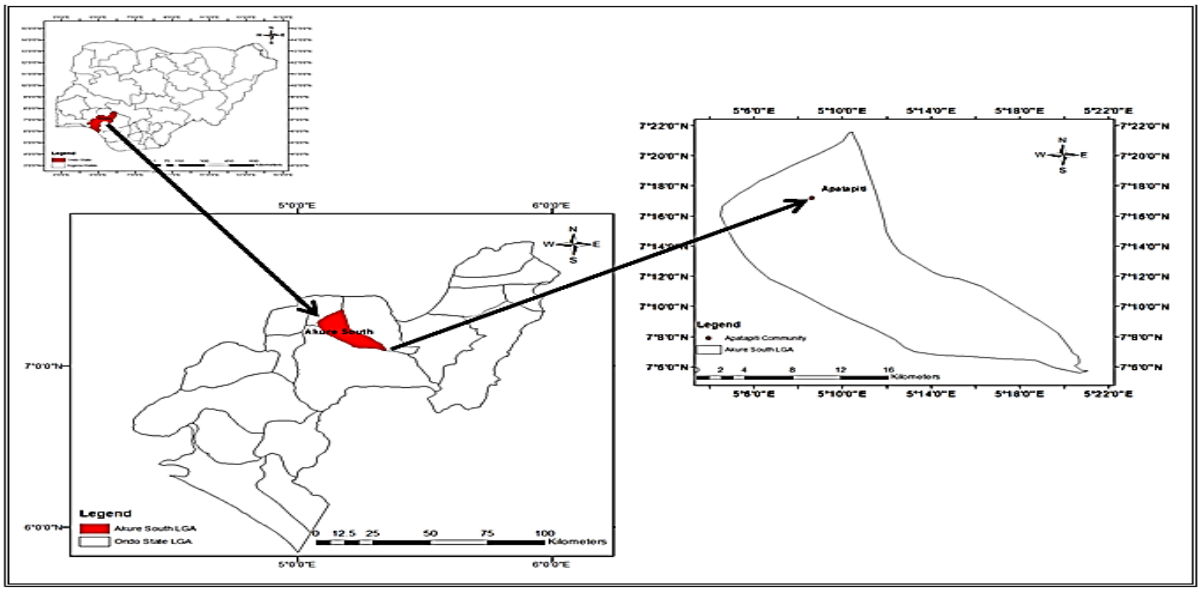

Fig. 1 Map of the study area

METHODOLOGY

Data

i. Downloaded coordinates from Leica (TCR 307) Total Station.

Software

i. AutoCAD 2007 software
ii. Leica Downloading Office Software
iii. Microsoft Excel.

Hardward

i. Laptop computer (Intel PIV DualCore, 500GB HDD,4GB RAM)
ii. Hewlett Packard Deskjet 9600 series and Laserjet 1120w
iii. Leica (TCR 307) Total Station and its accessories.

Data Acquisition

The data acquisition was achieved by carrying out the survey of the perimeter (boundary) of the study area, and the survey of the included details. These were performed sequentially using a Leica (TCR 307) total station instrument. The Total station instrument is equipped with a combination of Electronic Distance Measurement (EDM) and Digital Theodolite making it capable to combine angular measurements with distance measurement simultaneously.

The pillars used as control for the survey were checked and confirmed to be in correct angular and linear positions. A total of fourteen boundary stations were selected and a closed traverse was carried out on the stations to determine their planimetric coordinates.

All the details within the study area were fixed using the radiation method. Using the boundary pillars as reference, the edges/corner points of the objects/features in the study area were coordinated.

Data Processing

The 2-D geospatial data of the boundary points and the features existing in the study area were acquired to determine their planimetric positions in space. The planimetric positions were downloaded from the Total Station instrument using Leica downloading office software and these data were exported into AutoCAD 2007 software. These data were plotted on a scale of 1:1500 to obtain the layout plan, and thus the area of the study area was determined

Result Presentation

The results were presented in Tables (Table 1-3), Charts (Charts 1- 2) to explain the land use analysis of the community, and a large scale map (Figure 2).

Table 1: Features that were detailed

S/N	FEATURES	NUMBERS
1	Residential Buildings	126
2	Temporary Structures	8
3	Uncompleted Buildings	13
4	Existing Buildings	141
5	Shops	51
6	Transformer	2
7	Water Tanks	5
8	Well Water	12
9	Fish Ponds	2
10	Electric Poles	64
11	Farm Land	4
12	Tree	6
13	Mast	1
14	Refuse Dumping site	2
15	Existing survey beacons	5

Table 2: Sample Field Record

S/No.	DETAILED FEATURES	EASTING(M)	NORTHING(M)
1.	Residential buildings	736110.448	807287.495
2.	Shops	737462.658	806580.545
3.	Temporary structure	737461.640	806582.233
4.	Uncompleted buildings	737403.128	806607.760
5.	Roads	737439.911	806539.404
6.	Farm land	737332.107	806561.879
7.	Electric poles	737394.641	806555.806
8.	Wells	737270.018	806568.703
9.	Water tanks	737268.593	806484.648
10	Trees	737297.502	806490.701
11	Fish ponds	737279.897	806490.366
12	Refuge dumping sites	737278.868	806490.625

Table 3: Land Use Activity Level

ACTIVITY	AREA	%AGE
EDUCATIONAL	0.116	1%
INDUSTRIAL	0	0%
COMMERCIAL	3.360	29%
RECREATIONAL	0	0%
RESIDENTIAL	7.068	61%
AGRICULTURAL	0.811	7%
SOCIAL	0.232	2%
TOTAL	11.587	100%

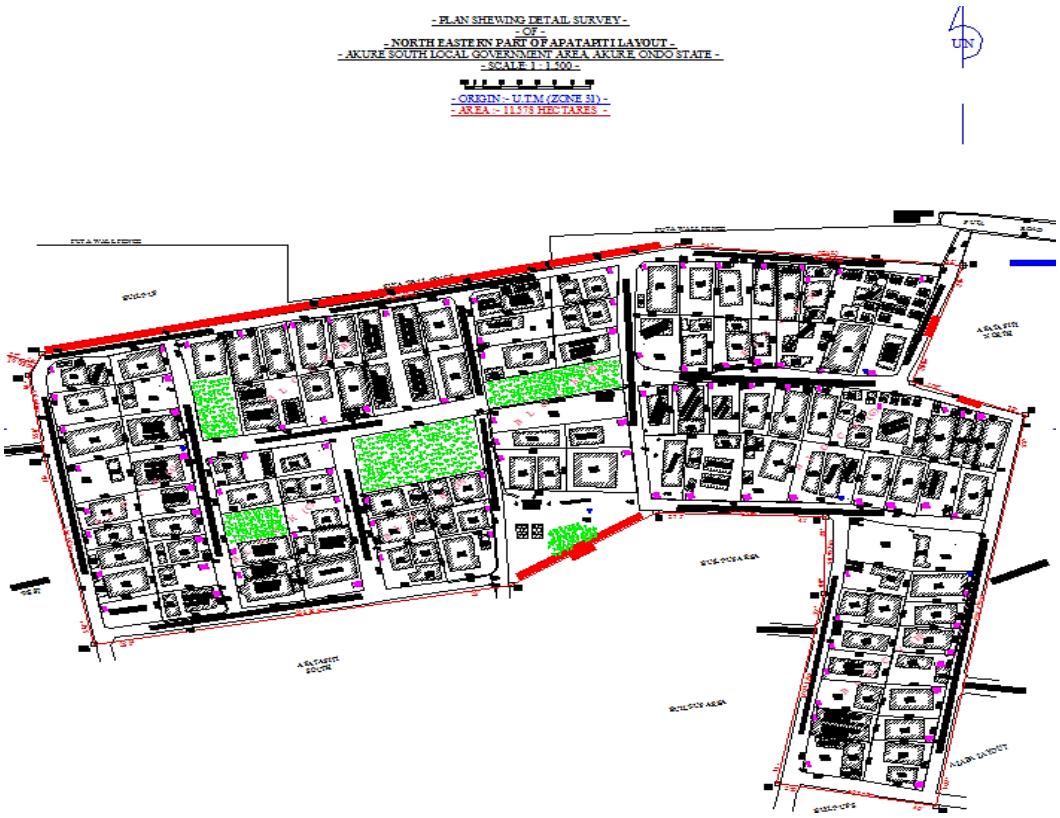

Figure 2: Produced Plan of the Community (Source: Authors' Work, 2015)

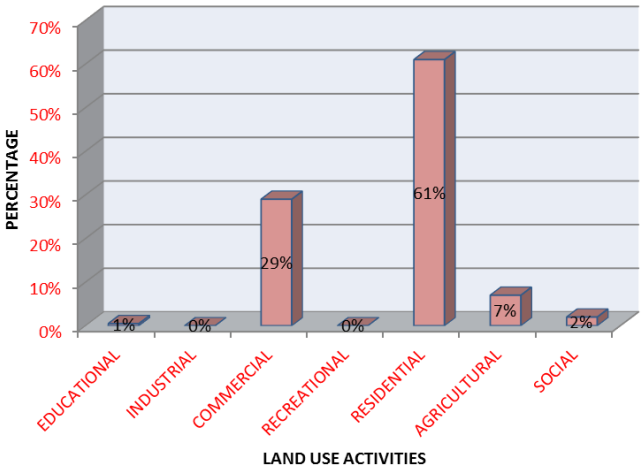

Chart 1: Land Use Analysis of the Community

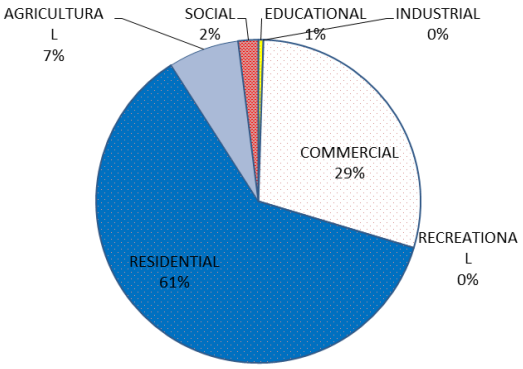

Chart 2: Land Use Analysis of the Community

Analysis of the Results

The result obtained from the study (Table 3, Chart 1 and Chart 2) showed that the total area covered in the study was 11.587 Hectares, the community is characterized with Residential (61%) as the major land use activity, Commercial, Agricultural, Social and Educational takes 29%, 7%, 2% , and 1% of the entire land use activities respectively, while the community has no Industrial (0%) and Recreational (0%) land use activity.

FINDINGS

The community is occupied by civil servants, students and commoners in descending order

i. Fish farming is common in the households
ii. There is incessant refuse dumping especially at the fish farming area which is a threat to health, fish farming and flooding/erosion.
iii. The community is full of poor conditioned roads and insufficient drainage system which can aid accidents, flooding and erosion.
iv. There is the absence of Street lights, which threatens the security of lives and properties of the community.
v. There is the absence of recreational activities in the community which is not too good for the health of the people and productivity.
vi. The absence of industries in the community is commendable due hazards to health which the presence can threaten.

CONCLUSION

Geomatics has proven to play an important role in the mapping of the study area mapping of the of the study area to reveal the prevalent condition therein and aid quality decision making for its development. From the findings, it is clear that the community is not in good infrastructural conditions, hence the need for serious and urgent attentions. From the analysis of result it is shown that the study area is majorly residential. The absence of industries in the community is adjudged to be commendable while the absence of recreational activities is not a welcome idea to the good living and productivity of the people.

RECOMMENDATION

The study has revealed the condition of the study area. It is recommended that the study be adopted as sufficient for a Land Information System (LIS) applications and database creation for the community.

Being a community mostly residential, provision of social amenities such as good roads, drainage system, street light, recreational activities etc., are very germane and need serious attention as a matter of urgency. Concerned authorities and agencies in various sectors: the Environment, Health, Town planning, Security etc. should through mapping survey (and various Geomatics methods) look into the conditions/problem of the community and other communities to proffer lasting solution for better living. The resultant Map is a tool to achieve this purpose

The study is also recommended for further research on communities for further development. The resultant geospatial data be archived for record and research purposes.

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Socio-Economic Impacts of Architecture on Sustainable Tourism Development in Nigeria: Case Study of Idanre Hills, Ondo State

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ABSTRACT

Nigeria has vast tourism components that could make her the leading tourism provider and compete with other tourist destinations globally. Numerous tourists' attractions spread across the length and breadth of Nigeria, ranging from places of natural attraction to historical heritage. In this paper, the research on the socio-economic impact of architecture on tourism development was conducted using Idanre Hills as a case study. Furthermore, the paper evaluates the socio-economic contribution of architecture on Idanre Hills and critically analysed the potentials of Idanre Hills; focusing on the impacts of architecture on the host community. The study adopted the quantitative approach of data collection, using questionnaires. Data collected were analysed using the Statistical Packages for Social Sciences tool. Results revealed that architecture and tourism are related and can contribute significantly to the host community by creating unique spaces using traditional materials and styles that preserve the cultural, social and environmental values.This in turn will help attract tourists and on the long run improve the economy of Idanre. The paper concludes that architecture will improve the economy as well as the life style of the people by attracting more tourists, as well as create a sense of place for the host community.

Keywords: Architecture, Nigeria, Tourism Development, Socio-Economic

INTRODUCTION

Tourism is identified as a fast growing activity all over the globe (Basu, 2003, Jennie, 2012) and widely acknowledged as a key driver of socio-economic progress. Over the years, tourism has become one of the largest and fastest growing economic sector of the world (UNTWO, 2015) with the assertion supported by the statistical data from regional, national and international tourism of United Nations World Tourism Organisation. Tourism, as defined by World Tourism Organisation, is an activity of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes. Also, tourism is the study of people away from their usual habitat of the establishment that responds to the requirement of travellers and of the impacts that they have on the economic, physical and social well-being of their host (Wall and Mathieson, 2006).

The impact of tourism fall into three categories that include the economic, social and environmental impacts and these categories could be positive or negative (Mason, 2003, Cook, Yale, Marqua, 2006). Socio-economic impact is designed to assist communities in making decisions that promote long-term sustainability including a healthy community and social wellbeing (Chadwick, 1995).

Architecture comprises one of the unique opportunities that have affected major economic development in cities across the world, Olanusi (2015) opines that the impact of architecture in tourism is to create a friendly environment that attracts and appeals to the sensory-emotional instinct in man to want to see, appreciate and belong. Thus, this process will

Ola, O. A. & Ayeni, D. A. (2016). Socio-Economic Impacts of Architecture on Sustainable Tourism Development in Nigeria: Case Study of Idanre Hills, Ondo State. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1011-1018

generate and monumentally contribute to the social and economic development of man and the society.

Nigeria as a nation is endowed with both natural, historical monuments that can be tapped to aid the economic development of the country but according to Ayeni, Ebohon, and Taki (2009), the Nigeria tourism industry is" beset with numerous problems", which include lack of tourism supporting and enhancing infrastructures. Saheed (2012) argued that, the provision of tourism infrastructure is important to ensure proper tourism development and Nigeria need to consider quickly this to create a commitment to sustainable tourism developmentAs often said and to be effective, it needs the attention of all- the architect, planners and the society. However, Long (2012) pointed out that tourism development without proper planning and integration with local values and environment can lead to socio-cultural, environmental and economic damage. A more complete point of view can be provided by the concept of architecture and sustainability because it can help to ensure the development of the tourism sector and determine that the quality of life of future generation is not at risk.

Hence, the study explores the impact of architecture potentials in tourism development of the socio-economic base of Ondo State using Idanre hills as a case study.

LITERATURE REVIEW

Relevance of Architecture to Tourism Development

Architecture is defined as the practice of building design and its resulting products. Amole (2004) refers to architecture as being concerned with planning, design and production of buildings either existing or new and its role in which the Nigerian state seeks her rightful position in emerging 21st global economy cannot be overemphasized. Architectural elements are one of the categories demanded by tourists. However, care must be taken to protect the architectural and historical monuments of the region. Tourism is widely acknowledged as an effective tool for socio-economic development, because of the possible backward and forward linkages with the rest sectors of the economy, which allows it to facilitate employment opportunities, income, local economic development, and enhance the quality of life (Hall, 2007). Architecture and tourism are closely related activities that can be said to depend on each other. However, architecture regarding tourism is an integral element of the planning of any region, whether it is of cultural heritage or contemporary architecture. For the development of any destination, adequate and efficient infrastructure and access to tourist destination are of great importance.

As noted by Bullen et al(2011)), tourism development deals with infrastructural investment stimulation and as such, social amenities like road, airports, communication network, electricity, portable water and other social facilities should be improved in some of the communities where the tourist attraction facilities are situated. Since architecture is concerned with planning, Itayemi (2012) views that both the public and private sectors involved in tourism should depend on planning to achieve a tourism development that respects the host community, maintains the natural environment and delivers a quality tourist experience.

Planning is necessary for tourism to develop in a way that is beneficiary to the host community. The destination regions must have many values ranging from cultural, historical and even environmental in which it is necessary to be maintained to attract tourists. The majority of tourists are concerned about the destination in which they will spend their holiday. So, the natural environment of the host regions, their buildings and tourist institutions, their people, culture and history and other forms of tourist elements are what the tourists want to experience in the destination, (George, Mair and Reid, 2009).

Architecture and Sustainable Tourism development

The term sustainable development has been used by various individuals, researchers, organisations, forums and conferences and it all attempts to contribute to the quality of life and services, as well as, economic and social welfare for the future generations. The platform of Architecture in Tourism (2007) stated that high-quality architecture stands for sustainability and if well planned can be easily adapted to changing demands over time. Architecture has the talent of defining spaces and, therefore, has a powerful influence on the human behaviour and understanding, and this is exactly what is always taken into account in sustainability, maximizing economic benefit and preserving the ecosystem. Architecture acts through its qualities to achieve function and well-being Orientation, functionality and quality of space are hygienic factors indispensable for guest satisfaction Sustainable architecture with respect to indigenous cultural traditions and minimizing the negative impacts on the environment can unite the natural and built spaces and create a sense of place for the tourists. Also providing aesthetics, culture and special attractions can seriously save the technological and cultural aspects of indigenous environment. The idea of sustainable architecture is to cover tourism development and economic activities.

The World Commission on Environment and Development (WECD) defined sustainable development as ‘‘development that meets the needs of the present without compromising the ability of the future generations to meet their needs’’ (WECD, 1987). Hunter (2002) and Veneeva (2006) noted that although the concept of sustainable tourism is derived from the sustainable development, it is one of the pre-requisites of achieving sustainable development. According to the UNWTO (The World Tourism Organization), sustainable tourism can be defined as: "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities Also, London School of Economics and Political Science (2009) defines sustainable tourism as tourism development that avoids damage to the environment and cultures of the locations where it takes place. Sustainability principles refer to the environmental, economic and socio-cultural aspects of tourism development, and a suitable balance must be achieved.

Mowforth and Munt (2002) has argued and challenged the notion of sustainability and its relationship in the developing world that the growth of tourism offers a means for third world countries to escape the confines of underdevelopment. Sustainable tourism development meets the need of the present tourist and host regions while protecting and enhancing the opportunity for the future. It was envisaged by WTO (2002) as the management of all resources in such a way that economic, social and aesthetics needs can be fulfilled while maintaining cultural integrity essential processes, biological diversity and life support systems. Planning to promote human welfare, derived in part from the stock of economic, human and social capital and to maintain and enhance ecosystem services (Buckley, 2009).

Johnpaul (2013) has identified certain factors that need to be considered in order to achieve a successful tourism planning and sustainable development, and includes integrated planning by involving the stakeholders; Community Participation of the host community by bringing in their social, cultural values and economic problems; Proper funding by the federal or state government in order to improve the standard of living of the host community; Provision of tourism infrastructures such as electricity, pipe borne water, good road, good communication systems and accommodation, that enhance the sustainability of life, and sustainability in resource usage making sure tourism does not increase pressure on local resources. Idanre hills have great tourism potentials that can attract local and foreign tourists. Tourism in Idanre hills, Ondo state according to Itayemi (2012) is undergoing a total revamping and

transformation and this will contribute to the socio-economic development of the community, state and the country at large if well and properly developed.

STUDY AREA

The study was carried in Idanre hills in Ondo State. Ondo State generally referred to as the sunshine state is located in the south-western zone of Nigeria and was one of the seven States created on 3rd February 1976 by the then Federal Military Government of Nigeria. The state lies between latitudes 5°45′ and 7 °52′N and longitude 4 °20′ and 6 °5′E. The state is made up of 18 Local Government Areas, and is bounded in the north by Ekiti and Kogi States, in the east by Edo State, on the west by Osun and Ogun States and in the south by the Atlantic Ocean (Ogunbodede 2007, Francis 2012).

Background of the Study Area

Idanre hills (Oke Idanre) which is about 24 kilometres away from Akure the capital city of Ondo state has been the home of the Idanre community for almost 100 years. Idanre hill is one of the awesome and beautiful natural landscapes in Ondo State and Nigeria (Itayemi, 2012). According to UNESCO (2007) Idanre hill consists of high plain with spectacular valleys interspersed with inselbergs of about 3000 feet above sea level and the vegetation has diverse and variegated ecosystems of flora and fauna. Its physical attributes include the great 660 steps, guest chalets, Omi Apaara (thunder water), Aghagha hill (Orosun peak), old court, burial mounds and ground, Owa's palace, shrines, belfry, Agboogun foot print on the rock, strange inscriptions on one of the gigantic rocks, Arun river, and Ark of Noah. As narrated by Adisa (2010); Itayemi (2012); Adeniran (2012) and Oluwole (2013) the great 660 steps laid in concrete along the sides of the hills lead to a pleasurable adventure to the intriguing wonders of the hill, the ancient king's palace is believed to have been built in the seventieth century. The palace commands unique features, which possesses architectural value. Within the palace are the ancient clangs and designs of various types which symbolize customs and culture of ldanre people and the Yoruba at large.

The footprint of a great ruler of ldanre (Oba Agboogun) is also on the top of the hill. The Oba then invoked his power into the foot on soft eruption (Lava flow). This left behind a footprint on the rock. It is widely believed that any size of foot, either big or small is bound to be accommodated by the print. It is believed that the footprint changes invisibly in shape and size but anyone whose foot could not be accommodated in the footprint are either a witch or wizard. The position of this print on the hills is not easy to locate. The writing on the rock is strange and clumsy that no one has ever understood it's meaning, even when it is conspicuous. In the recent time, those letters are becoming invisible to the naked eye. It was also gathered that Archaeologist believed that the writing must have taken place before the eruption. This is a symbol widely believed by the people of Idanre to be the famous Ark of Noah in the Bible. History is yet to ascertain or denies the authenticity of this believe. However, the awe inspiring object is fascinating enough to attract first time visitors for a second visit to the tourist centres. The traditional Idanre people have a rich cultural heritage.

Till present day, the Idanre people in their different ages still go up to the hill to celebrate some traditional festival where traditional intercessions are rendered for the peace and progress of the community. One of the notable festivals include the Orosun festival which is the remembrance of one of the heroines or historical figures in Idanre and is one of the major factors for Idanre's consideration as a UNESCO Heritage Site and the Mare festival which is a recent creation of the Ondo State Government that involves mountain climbing annually. According to Okong-Ekong (2015) and Obinna (2015), the newly built hills resort at the foot of the hill is an eco-friendly blend that amplifies the heritage of Idanre. Amongst the facilities built at the foot of the hill are the resorts traditional welcome (Ekaabo), tree houses, houses

on the rock (Ile oriota), food sheds, children's playground, wadii(for plaiting hair), swimming pool, office complex and fully serviced apartments (three and two bedrooms ensuite). The hills resort has hosted a number of guests during the 2014 Mare festival and has continued to attract patronage from the town's residents and tourist.

METHODOLOGY

The study adopted the quantitative method of data collection and used the survey research design. Copies of the questionnaire designed for this study were administered by the researchers between the months of May to July 2015. They were duly completed and collected from the respondents.

Close ended questionnaires divided into five sections A, B, C, D, E were used for the study. Respondents were chosen by random sampling from the study area and some parts of Akure and were required to respond to a four-point scale ranging from 4 strongly agree to 1 strongly disagree. A total number of one hundred and fifty (150) copies of the questionnaire were distributed to randomly selected respondents comprising of tourists, the staff of Idanre Resort Hill, the residents of the case study area and other respondents in some parts of Akure. This method enabled each of the respondents to have an equal chance of being selected as a representative of the total population. The one hundred and fifty (150) questionnaires were duly completed and returned. These responses, however, constituted the source of data used for this study and data analysed using the Statistical Packages for Social Sciences (SPSS) and results expressed in simple percentages and standard deviation.

FINDINGS AND DISCUSSION

Respondents Characteristics

Analysis of data using the SPSSx shows that 59.3 percent of the respondents were male while 40.7 percent were female and implied that majority of the respondents were male. The majority of the respondents were within the age bracket of 18 to 50 years accounting for 85.3 percent of the total sample size while those above the age bracket of 50 years accounted for 14.7 percent. Furthermore, 36.7 percent of the respondents were single, while 59.3 percent were married, 3.3 percent were widowed and 0.7 percent of the sample size did not respond.

Also, the educational status of the respondents showed that 2.0 percent of the respondents had no formal education and needed assistance with the questionnaire, 5.3 percent were primary school holders, 22.0 percent were secondary school holders, and 64.0 percent were well educated to be tertiary holders, while 6.7 percent of the respondents held other professional qualifications. A total of 44.0 percent of the respondents were government workers; 28.0 percent were private workers while 19.3 percent were students and 8.7 percent were farmers and artisans. The range of income accounted that 52.6 percent of the respondents earned between N18,000 and N100,000, 42.7 percent earned between N100,000 and N250,000, and 4.7 percent did not respond to the questionnaire. The respondent's characteristics revealed that all stakeholders are represented in the sample.

The role of Architectural Facilities within Idanre Hills

Respondents were asked on their perception generally on architectural facilities. This was asked to find out if they were adequate and whether or not improvements are needed. From the literature review, according to Bullen et al (2011) provision of adequate or improvement in the architectural facilities is important in a tourist attraction. As revealed in Table 1, about 16.0 percent (24) of respondents strongly agree that architectural facilities of Idanre Hills are not well developed and if improved will make the attraction unique and attract more tourists. Also, 52.0 percent (78) agree. Also, 2.0 percent (3) strongly disagree while 4.7 percent (7)

disagrees and 25.3 percent (38) did not respond. It implies that 68.0 percent agree that architectural facilities are of great importance in a tourist destination.

Creating a lasting impression on tourists

The respondents' view in line with the above was asked to know if the building types and recreational facilities would create memories for them to visit the tourist destination again. Ascertaining the findings from the literature review, the host regions buildings and facilities are the important elements tourists want to enjoy and experience. From the analysis in Table 2, 12.0 percent (18) strongly agree that type and quality of the building and recreational facilities will create a lasting impression on tourists, also, 60.0 percent (90) agree. Also, 2.0 percent (3) strongly disagree while 1.3 percent (2) strongly disagrees and 24.7 percent (37) did not respond. The total respondents that agree to this notion, therefore, are 72.0 percent, and this reveals that tourist wants to appreciate what attracts their sensory emotions to visit any tourist destinations.

Table 1: Showing the Role of Architectural Facilities within Idanre Hills

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly agree	24	16.0	16.0	16.0
Agree	78	52.0	52.0	68.0
Disagree	7	4.7	4.7	72.7
Strongly disagree	3	2.0	2.0	74.7
No response	38	25.3	25.3	100.0
Total	150	100.0	100.0	

Table 2: Showing Creating a Lasting Impression on Tourists

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly agree	18	12.0	12.0	12.0
Agree	90	60.0	60.0	72.0
Disagree	2	1.3	1.3	73.3
Strongly disagree	3	2.0	2.0	75.0
No response	37	24.7	24.7	100.0
Total	150	100.0	100.0	

Socio-economic Impact of Architecture on the Host Community

Again respondents were asked to know whether architecture impacts on their socio-economic wellbeing or vice versa. Table 3 revealed that 36.0 percent (54) strongly agree that architecture is a strategy for socio-economic impact on the host community and 32.0 percent (48) agree. Also, 2.7 percent (4) strongly disagree while 4.0 percent disagrees and 25.3 percent (38) did not respond. It therefore implies that a total of 68.0 percent of respondent agree that architecture development in Idanre Hills will contribute immensely to the Idanre community. The findings from the respondents revealed that the presence of accommodation and catering facilities within the Idanre Hills will impact greatly on the socio-economic activities within the community.

Table 3: Showing Socio-economic Impact of Architecture on the Host Community

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly agree	54	36.0	36.0	36.0
Agree	48	32.0	32.0	68.0
Disagree	6	4.0	4.0	72.0
Strongly disagree	4	2.7	2.7	74.7
No response	38	25.3	25.3	100.0
Total	150	100.0	100.0	

Tourist Centres Should Be Maintained To Ensure Sustainability and Continuity

Also, questions were posed to the respondents to know if the use of sustainable local resources and proper planning or maintenance of infrastructure would enhance tourism continuity and development. Table 4 revealed that 41.3 percent (62) strongly agree that

tourist centres should be maintained to ensure sustainability and 58.7 percent (88) agree. It, therefore, implies that a total of 100.0 percent of respondents agrees to the data in the table that sustainability and continuity of the tourist centres will be ensured through maintenance. Also, the views of the respondents validate the fact that tourism and sustainability deal with adapting to change over time and it also requires constant maintenance to ensure its growth.

Table 4 Showing: Maintaining of Tourists' Centres to Ensure Sustainability and Continuity

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly agree	62	41.3	41.3	41.3
Agree	88	58.7	58.7	100.0
Total	150	100.0	100.0	

Based on the analysis, findings shows that sustainable tourism can be achieved through architecture if there is proper planning, maintenance, enhancement and provision of tourism infrastructure to improve the social, economic and cultural well-being of the community in which historical monuments is sited.

The Findings generally revealed that there should be more provision, rehabilitation and maintenance of tourist chalets, and other infrastructural facilities on the Oke Idanre to make it habitable to tourist and develop tourism within the host community. Furthermore, the government should ensure provision and maintenance of these infrastructural facilities to allow for full exploration of the touristic value of Idanre Hills. This corroborates the findings from the literature review that provision of accommodation and other tourism facilities is a key factor that impacts on the economic, environmental and social development of the host community.

As also observed from the analysis, the type of buildings and recreational facilities create an overwhelming impact the tourist wants to experience and share. It creates repeated memories the tourists would like to experience. As noted in the literature review, tourists love to explore and experience the destination tourism environment, monuments, culture, and other elements found within the tourism sites. However, there should be proper maintenance of recreational and building elements to ensure sustainability and promote tourism and improve on the tourist's visits within the host community

Furthermore, tourism has conserved the local cultural heritage, architectural traditions and ancestral heritage of the host community and allows cultural interaction with the tourists. Also, the development of tourism has provided employment opportunities such as tour guides, restaurants, transportation, since tourism is known to be a labour intensive industry and to improve the living conditions of the people of the community and also generate revenue to the government. This was revealed from the literature review that tourism development is seen as an important aspect in regards to the improvement in the quality of life. Therefore, the government should encourage and contribute immensely to tourism development in the community.

Findings from the literature review, reveals the use of sustainable local resources, planning and maintenance of these facilities would be of great benefit as it acts to meet the needs of the present and future generation. Therefore, sustainable tourism and promotion of tourism development through management and maintenance of the tourism infrastructure and sector should be encouraged. As further discussed in the literature, architecture through the efficient planning of resources and spaces, provision of adequate infrastructural facilities will minimize the negative impacts of tourism in the environment and ensure sustainable tourism development to meet the needs of the host community and future generations. Thus, sustainable architecture acts to preserve the tourist environment by influencing the use of

available resources to improve the socio-cultural heritage and economic values to promote and facilitate tourism development.

CONCLUSION

Based on the discussions in this study, it could be deduced that architecture can be considered as an effective means of connecting sustainable tourism through strategic planning, provision of infrastructure and local use of local sustainable materials since design and planning of spaces in the tourism industry are built by architects. Architecture will impact positively through the creation of skilled and unskilled jobs in areas of accommodation and catering facilities. As such will be a valuable source of employment and will serve as additional source of revenue and foreign exchange for the state and community in general. Furthermore, the relationship between sustainable tourism and architecture attempts to create unique spaces using traditional materials and styles, and it preserves the cultural, social and environmental values. The government needs to support and develop the tourism sector to achieve a fulfilling future of sustainable tourism.With this in mind, it would be highly essential to consider the effects of architecture in creating opportunities in the tourism industry to attract more tourists and create a sense of place for the host community.

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City Aesthetics and Sustainable Recreational Open Spaces in Planned Residential Estates: Focus on LSDPC Estate, Lekki, Lagos, Nigeria

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ABSTRACT

Major damages and gradual annihilation of the natural landscape have resulted from continuous human settlement and interaction with the natural environment. This has also had an enormous catastrophic effect on the existence of both the built environment and the natural landscape. This paper examines the use of recreational open spaces either publicly or privately owned through questionnaire administration in LSDPC Estate, Lekki in Lagos Nigeria. It affirms that the use of these spaces in planned residential estates is fast becoming an increasingly important part of people's lives thus demanding more free time and greater prosperity to enable them extend their free time activities. It further explores the awareness of respondents' to the effects of the existence of these spaces on city aesthetics. It opines that if well managed, these recreational open spaces will go a long way in improving the general aesthetics of the city and will prove sustainable where various policies are put in place. Expected outcomes of these policies implementation would include the encouragement of relaxation activities, communal interaction and organization, encouragement of active and healthy lifestyles, preservation and use of leftover land which otherwise would have developed blight. It asserts that the need for an improvement in the built environment can be reasonably achieved through effective collaboration between stakeholders in the building construction industry, the citizens and government agencies, and proffers ways in which recreational open spaces can be made an integral part of a sustainable, aesthetically pleasing and healthy environments in Nigeria.

Keywords: City Aesthetics, Blight, Open Spaces, Stakeholders and Sustainable

INTRODUCTION

A number of the low-cost housing estates built by the Lagos State Government in the 1980s have gradually deteriorated to the extent of becoming nightmares to their occupants and people who toured the estates. Varied findings have shown that lack of maintenance and failed infrastructures have eroded the foundation of many of the buildings which should be awaiting demolition but are still being occupied. The Government of Alhaji Lateef Jakande in Lagos State initiated the low-cost housing scheme in 1980 to cater for housing needs of the populace especially workers in the state. As a result, many people grabbed the opportunity to become home owners at a take away price of N3, 000 with repayment plan of 15 years, not knowing the houses would become a source of headache to them many years after. Not left out of this deterioration are the recreational open spaces within them.

Goudie (2000) articulates that; "*Open space is a tribute to the commitment of residents and professionals to an excellent environment and the natural legacy of increasing value."* Recreation activities are those carried out with leisure, usually chosen voluntarily by the participant either to derive satisfaction or pleasure. It can also be a creative enrichment based on the perception of one's personal or social values. Recreation deals with important matters of many and varied leisure- time activities, including development of skill in recreation activities, participation in competitive and non-competitive games, free play, improvement in health and social interaction, to name a few (Ulrich, R. (1983); Riley, (1992); Malakoff, (1995). These phenomena have resulted in several situations that will be subsequently discussed in this paper.

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LITERATURE REVIEW

Recreational Open Spaces in Planned Housing in Lagos state, Nigeria

With a very diverse and fast-growing population of 13,427,000 (2000 census estimate) and as a result of unending migration from the rest of Nigeria and neighbouring countries, Lagos, is characterized by its mostly unfettered and fast growth. However, Obia 2010 states that Lagos is already a megalopolis (Urban Planet: Collective Identities, Governance and Empowerment in Megacities, 2010) with a projected population of 24 million persons by 2015. Metropolitan Lagos became the pre-eminent city in Nigerian system, functioning as the political and administrative capital of Nigeria following the amalgamation of the Northern and Southern provinces of Nigeria in 1914 through political independence in 1960, until the federal capital officially moved to Abuja in 1990. This change in seat of power notwithstanding, the continued astronomical population growth lent credence to the decision of several past governments to make housing provision for the citizenry priority of sorts (lagosstate.gov.ng 2009).

The use of recreational and communal spaces either publicly or privately owned is fast becoming an increasingly important part of people's lives both locally and globally thus demanding more free time and greater prosperity that has enabled them extend their free time activities. However, a challenge in creating and maintaining successful public spaces is how to achieve an integrated approach, which includes design and management set within the broader context of urban policy (Shaftoe, 2008).

Going by the aforementioned, one can decipher that the terms green space, open space, open public space and recreation space all refer to spaces that are left for the purpose of leisure, relaxation and or recreation which have environmental benefits for the public wellbeing of the citizenry. In this study, these terms will be used interchangeably throughout this thesis and they refer to those reasonable larger open spaces not limited to children's play spaces, public open areas and green areas within residential neighbourhoods. The implementation and subsequent sustainability of the environmental benefits and their management of these spaces in the future is the focus of this research.

The Human Desire to Enhance the Living Environment

It is very significant that for over 11 centuries, humans have chosen to devote time and resources, including water to establish and maintain turf grasses in landscapes for a better quality of life. While this desire to enhance the living environment may exist worldwide, it has not been attainable in those regions where people must spend all of their waking hours in pursuit of food, fibre and housing to survive.

Countries that have industrial as well as agricultural employment can generate sufficient financial resources, enabling individuals to afford to improve their living environment with landscape plants. Studies around the world have consistently observed that countries with extensive urban landscapes, including lawns, trees and shrubs, also have associated with them a dominant population with a relatively high productivity rate. In addition, people in these places interact more harmoniously than people who live in areas that are seriously deficient in using landscapes to improve the quality of life.

Unlike the prevailing circumstances in advanced countries, the urbanization process as studied by Aluko (2011); Jiboye (2011) resulted from rapid industrialization which consequently altered the physical makeup of the cities, while in Nigeria, it is consequent upon the rural – urban migration between the village and the city. These have inadvertently posed the challenge of different socio-economic, cultural and environmental problems which have necessitated efficient and superior governance in a bid to surmount the problems. Daramola and Ibem, (2010) opine that, several factors have been traced to the pitiable condition of the Nigerian environment, prominent among them is poor environmental management practice

which have led to poor quality of the environment in urban areas. However, Arigbola (2008) maintains that adequate planning and control is needed to ensure harmonious development considering the rapid rate of urbanization and constant demand for land for different purposes.

City Aesthetics and Urban Blight

In the absence of any significant affordable housing strategy by the State government, citizens have continued to explore different approaches to accommodate themselves. The urban poor, who are dominant in Lagos, are transforming the city to meet their needs, often in conflict with official laws and plans. They reside in the slums and squatter settlements scattered around the city and are predominantly engaged in informal economic activities which encompass a wide range of small-scale, largely self-employment activities. 60% of residents are tenants and have to pay rent as high as 50-70% of their monthly income since most of the existing accommodations are provided by private landlords (Aluko, 2011). Most housing decay and deterioration comes in various forms and their existence is more evident in densely populated parts of the city. Some of the characteristics of slum include inadequate and deficient facilities obsolete buildings, filthy environment, etc. Much concern has been shown about the problems of the slum areas particularly on the level of decay exhibited by such areas and the plight of the low income households which dwell in them, this put lives and health of the residents in danger.

METHODOLOGY

Data and information collected from both primary and secondary sources were adopted for the study. Primary data were collected through physical investigation of the estate. The intention of this study is to assess the existing situation in the selected areas of Lagos and produce a model for future research on the use of sustainable urban open spaces. For this study on city aesthetics and sustainable recreational open spaces in the planned residential estate, questions were drawn up to appraise the aesthetic impact of these spaces on the estate while the general information on the study area was collected from literature.

The Study Area

The study area, Lagos, is in the South-Western Geo-political zone of Nigeria (Fig. 1). It is known for the sub-equatorial climate and receives a high annual rainfall of over 1,520mm (Adelekan, 2010). Lagos State is located approximately between longitude 2^0 42`E and latidudes 60 22`N and 60 52`N.

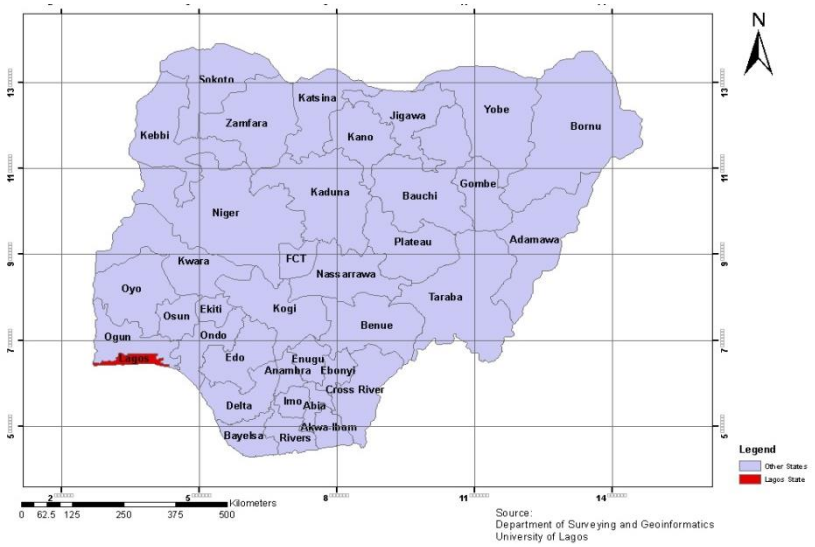

Fig 1.0: Nigeria highlighting Lagos State
Source: Department of Surveying and Geoinformatics, University of Lagos.

Though the smallest in the country, the state has an annual population growth rate of about 13.6% (about 5 times as fast as the national growth rate of 2.8%) (Adelekan, 2010). It is Africa's second fastest growing urban centre after Cairo, being a focal point for regional, national and international trade and served by significant and often overloaded road, rail, ocean and air transport facilities (Aluko, 2011).

Secondary data relied heavily from the LSDPC office as well as relevant information from related studies that had been carried out previously on the estate. The data were presented in tables on the state of the recreation spaces within the estate, their aesthetic properties as well as their impact on property value of the estate. Implications of blight, slum development among others were addressed in this section.

The low-cost housing estates built by the Lagos State Government in the 1980s have become nightmares to their occupants and people who toured the estates, reports that lack of maintenance and failed infrastructure have eroded the foundation of many of the buildings which should be awaiting demolition but are still being occupied. One of these, the LSDPC, Lekki Estate is the focus of this study.

FINDINGS AND DISCUSSIONS

Population and Structure: Settlement at the LSDPC low cost housing estate scheme Lekki is nucleated. The buildings are divided into various sections, each of which has the buildings in clusters. The estate consists of 125 blocks of 6 units all housing 4080 people on the average. The building types in all other sections are all similar except the ones in the Q-block which are of a different type. No single recreational open space could be found to still exist in its original form.

Social Economic Characteristics: After several visits to the site, the study found that the community has become an eye-sore and above all, the dangers posed by the delicate appearance of these buildings, recreational open spaces and the general estate atmosphere is better imagined. However, if information that the government is planning relocation for residents of the estate is anything to go by, the Lekki Jakande Estate might just be one of Alhaji Lateef Jakande's legacies of low cost housing to fall.

Plate 1.0: Showing state of road and conversion of recreational open space to other use.

The study reveals that residents of the estate comprises of construction workers that work on the Lekki-Epe Expressway, several members of staff of the Lagos State Government among others. However, over 70% of respondents are not the owner occupiers and could not provide some questions pertinent to the study. Majority of the womenfolk are petty traders who run small scale businesses within and outside the estate. Other trades such as barbing, shoe making are common in the estate. These small businesses form the hub of activities within this estate.

Table 1: Recreation participation level of LSDPC, Lekki residents based on a 5-point scale (Most frequent, Frequent, Indifferent, Infrequent, Never)

Socio-economic Activity	Cumulative Mean	Valid Percentage (%)
Outdoor		
Gardening	28.2	13.252
Walking	67.1	31.537
Driving for pleasure	16.2	7.614
Jogging	19.4	9.118
Bicycling	16.7	7.849
Ball games (football, handball, volleyball)	24.6	11.562
Resource Based		
Picnicking	12.2	5.734
Swimming	20.0	9.400
Community School Programs	14.1	6.768
Going to Movies	1.90	0.893
Indoor		
Reading for Pleasure	59.2	27.824
Watching Television	46.2	21.714
Visiting Friends	**35.2**	**16.344**

The above data in Table 1 clearly shows that indoor activities have the highest rating for recreation and this is closely followed by walking, the outdoor activity chosen by 31.537% of the respondent population. This indicates that level of participation in resource based activities is not as high as both outdoor and indoor activities. During the interview, respondents were asked the reason for this and they all cited the non-existence of such recreational open spaces in the whole of the estate. They further stated that the efforts of the resident association to appeal to the estate authorities had proved abortive.

Plate 2.0: Showing conversion of recreational open space to other uses.

However, a gross mismanagement of the estate roads, infrastructure and facilities are evident and as attested to by respondents and the site visits see plate 3.0 and 4.0 below. Refusal to comment by officers of the LSDPC as at the time of questionnaire administration contributed to a dirge in information retrieval.

Plate 3.0: Showing indiscriminate waste disposal along perimeter wall of a commercial facility

The above plate 3.0 shows how the environment is being defaced by indiscriminate and unlawful dumping of refuse. The residents further substantiated that the most of their efforts at sanitation had proved abortive especially without the backing of the estate management.
During the interviews that were conducted, respondents identified several causes of slum and blight in the estate. They are the following:

i. Overcrowding
ii. Neglect
iii. Unplanned development
iv. Lack of infrastructural facilities
v. Improper disposal of waste

Plate 4.0: State of open space being used as refuse dump disfiguring the aesthetics of the landscape

Commercial activities are the main hub of the estate. They provide much needed income for the residents and give support to the community's development by paying their levies to the Community Development Association (CDA) albeit unwilling but they and a few residents are the only people keeping the estate from total degradation. However, the presence of many dump sites defeats the input of commercial activities. In addition to this is the conversion of the open and recreational spaces within the estate into shoddy accommodation for the very low income earners in the estate.

Plate 5.0: High congestion of poor building structures (shanties) on undeveloped estate land

The estate has a variety of commercial activities that take place as well as petty trading. The popular Lekki beach in Lagos which draws tourists from far and near and is one of the symbolic sites in Lagos is located right behind the estate; it thus doubles as a recreation resource for the people of the area.

The state in which the estate is in prompts one to ask questions about the activities, efficiency and relevance of the Lagos State Property Development Corporation (LSPDC), the developer of the Jakande estates. Interestingly, it is gathered that rents in the estate are not too far from

the Lekki standard. A Landlord in the estate, who chose anonymity revealed that, depending on location, rents still dangle between N100, 000 and N150,000. According to him, areas that are not prone to flood rent rooms as high as N200, 000.

Table 2: Effect of age and Number of Children at Home on Average Participation Level in Recreation. (1-Never, 2-Sometimes, 3-Often)

Number of Children at Home	Below 25	Age group(years)		
		26-45	46-65	65 +
0	0.90	31.70	8.20	3.25
1	13.9	57.40	16.10	2.20
2	7.53	75.70	18.30	1.15
3	3.90	91.80	31.70	1.00
4	**9.60**	**12.20**	**19.60**	**0.83**

Table 3: *Effect of Educational status or Attainment on overall recreation participation (1-Never, 2-Sometimes, 3-Often)*

Education Attainment	Number of respondent	Average Participation	Valid (%)
Primary School	21	0.140	14.00
Secondary School	36	0.255	25.50
BS.c /H.N.D	45	0.319	31.90
Higher Degree	15	0.106	10.60
Other-Trade, Skill.	**24**	**0.170**	**17.00**

Table 2 showed clearly that presence of children could affect recreation patterns in families. The family with the lowest and highest number of children had a higher participation level. Table 3, show that most respondents are averagely educated and belong to the middle age, who actively participate in outdoor recreational activities such as walking, playing organized sports and the likes, although facilities for these outdoor recreation activities are not available in the area yet people still found means of recreating themselves.

The "rereation orientation" analysed in this study represents a mid point between the analysis of specific activities and that of overall participation, for LSDPC Lekki Estate residents. The study found that indoor recreation activities generally was the second most popular, no doubt becuse they can be practiced through out life and without regard for seasons. Participation in recreation can be heightened by increasing the educational status of people, creating their awareness to the importance of recreation and its health benefits on the human body.

CONCLUSION

This report describes the existing situation at the LSDPC Low Cost Housing Estate, Lekki. It has highlighted the absence of recreational open spaces within the estate. It describes how to go about selecting and protecting recreation space areas. It suggests employing a variety of tools and resources to fully accomplish the job. It also notes that there are issues that local communities will face as they struggle to build a recreation system.

To be effective, the report emphasizes that recreation spaces must be an integral part of the overall planning effort. Equally important is the concept of linking together a variety of recreation space types into a coherent system of open space. Such a system of open space takes on a greater value than just the sum of its individual parts. The recreation space system will succeed in meeting the needs of community residents when it is based on a vision that they helped to shape.

Acquiring or protecting open space areas and constructing facilities represent only the first step in the conservation and protection of land and resources. It is a community's ongoing commitment to land stewardship that ensures its continued enjoyment of recreation space benefits.

Sequel to the foregoing, the government, individual property owners, and the town planning authorities should play their individual and constitution role under to eradicate their slum development in the study area, hence put a stop to nuisance and environmental degradation and other circumstance associated with it, so that the area can develop into an environment free from dirt and blight and that brings rise to the saying "A healthy environment, a wealthy people".

RECOMMENDATION

For any housing estate to have sustainable recreational open spaces that would improve city aesthetics, several facilities and management strategies need to be put in place. The use of development plans have tended in the past to emphasize detailed quantitative standards, but there is now an increasing focus on the quality of public open space, which ensures that the reasonable expectations of users are more likely to be fulfilled. Qualitative standards include:

• Design: The layout and facilities should be designed to meet a range of user needs, including both active and passive recreation, as identified in the planning principles above. Users should feel safe at all times within parks; adequate supervision, passive surveillance, boundary treatment and public lighting contribute to creating a sense of security. Public open spaces should be suitably proportioned; narrow tracts or 'left over spaces' which are difficult to manage should not be acceptable. Materials should be chosen for their durability.

• Accessibility: Estate recreational areas should be located to be within not more than 10 minutes' walk of the majority of homes in the area; the parks should be on public transport routes as well as pedestrian/cycle paths. Playgrounds should be carefully sited within residential areas so that they are both easily accessible and overlooked by dwellings, while not causing a nuisance to nearby residents.

• Variety: A range of open space types should be considered having regard to existing facilities in the area and the functions the new spaces are intended to provide. A balance will be required between the provision of active and passive recreational facilities.

• Shared use: The potential for maximising the use of open space facilities (such as all-weather pitches) should be explored, for example, by sharing them with nearby schools.

• Sustainable Urban Drainage Systems are often used to reduce the impact of urban runoff on the aquatic environment.

Most planning authorities include quantitative standards for public open space in their development plans, generally in the range of 2 -2.5 hectares per 1,000 population, and allocated according to a hierarchy of spaces. Assessing open space requirements on a population basis can be difficult due to the unpredictability of occupancy rates where often larger houses and apartments are occupied by fewer persons than the number of bed spaces would indicate.

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A GIS Approach in Spatial Distribution of Water Pipeline through Primary and Secondary Network in Lagos State

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ABSTRACT

Access to a secure, safe and sufficient source of fresh water is a fundamental requirement for the survival, wellbeing and socio-economic development for all humanity. The challenges face by the Lagos State Water Cooperation (LSWC) is to ensure continuous water supply for her citizen. In spite of this effort to rescue the situation, a substantial proportion of the city's population are yet to be served with water from the main source. One of the major challenges in water supply is the provision and management of the pipe network and the associated assets. Effective functioning of these assets is necessary for distributing water continuously and efficiently. The methodology for this research work was data acquisition, geo-referencing and digitizing, data integration, data analysis and manipulation, data display as maps, charts and tables. Analysis and result for this research works shows that LSWC is made up of 22 Project Control Units (PCUs), from which analysis shows that population is higher than water supply in Lagos West, Owode, OluteKirikiri, Ajegunle, Victoria Island, Itire among other. Water supply as regard to population ranges between 0 – 0.94 g/c/d whereas on the other hand, water supply is higher in Iseri Oke, Isolo, Shomolu, Surulere, Yaba and Lagos/Ikoyi ranging from 1.09 – 8.71 g/c/d. The study shows that water is in short supply and with the use of a GIS software has showed the expected water supply within Lagos Metropolis. Some of the factors that have been identified as important controls on water demands in the study area include increase in population, increase standard of living and purchasing power, changes in social tastes and policy decisions. Unfortunately, LSWC is unable to meet the growing water demand of the people due to: inadequate water facilities such as network distribution, water works (reservoirs), inadequate power supply, poor state of some of the equipment, reckless over-consumption and misuse of water amongst others.

Keywords: GIS, Water Pipeline and Primary and Secondary Network

INTRODUCTION

A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations. GIS is a broad term that can refer to a number of different technologies, processes, and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insurance, telecommunications, and business. For that reason, GIS and location intelligence applications can be the foundation for many location-enabled services that rely on analysis and visualization.

Water is very important to the world, is a precious natural resource, vital for life, development and the environment. It can be a matter of life and death, depending on how it occurs and how it is managed. When it is too much or too little, it can bring destruction, misery or death. Irrespective of how it occurs, if properly managed, it can be an instrument for economic survival and growth (Niyi and Felix, 2007).

According to Kofi Annan (former United Nations Secretary General), "access to a secure, safe and sufficient source of fresh water is a fundamental requirement for the survival, wellbeing and socio-economic development for all humanity" (Awake, 2009). For more than 30 years there has been remarkable growth in the need for quality water purification by all

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categories of users - municipal, industrial, institutional, medical, commercial and residential. The increasingly broad range of requirements for water quality has motivated the water treatment industry to refine existing techniques, combine methods and explore new water purification technologies (Pure Water Handbook by Osmonics).

Water covers 71% of the Earth's surface, and is vital for all known forms of life. On Earth, 96.5% of the planet's water is found in oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps of Antarctica and Greenland, a small fraction in other large water bodies, and 0.001% in the air as vapour, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Indeed only four million cubic kilometer of water is obtainable for man's use. From this inventory, it is clear that water though appear abundant in nature only a small fraction can be exploited for man's use (Linsley and Franzini, 1972).

Earth's water is always in movement, and the natural water cycle, also known as the hydrologic cycle, describes the continuous movement of water on, above, and below the surface of the Earth. Water is always changing states between liquid, vapor, and ice, with these processes happening in the blink of an eye and over millions of years (According U.S Geological Survey, 2013). Today, access to safe drinking water has improved over the last decades in almost every part of the world. Water distribution systems have existed since the Minoans constructed the first piped water conveyance system (Michael S. A., Saviour M. and Naa D. T. 2011).

Currently, water distribution systems effectively serve municipalities of all sizes worldwide. A water supply network consists of engineered hydrologic, hydraulic mechanisms. It also includes water resources, pumps, treatment plants, reservoirs, pipes and their accessories (Babovic et al., 2002; Chin, 2006) and other equipment for operation and management. One of the major challenges in water supply is the provision and management of the pipe network and the associated assets. Effective functioning of these assets is necessary for distributing water continuously and efficiently.

According to United Nation's projections, by 2050 almost half of the world's population will be experiencing either water scarcity (<1,000m^3 of renewable water per capita per year) or water stress (between 1,000m^3 and 1,700m^3 per capita per year). It is estimated that 1 billion people in developing countries do not have access to portable water and unsafe water is implicated in the deaths of more than 3 million people annually and causes 2.4 billion episodes of illness from water-borne diseases each year.

The world urban population was projected to increase from 6.7billion in 2007 to 9.2billion in 2050 (United Nations, 2008). 90% of this global entire population growth will take place in urban areas of developing economies (Lunqvist et al, 2003, United Nations, 2004). The forces identified for this explosive growth include industrialization, mass transportation and the telecommunications revolution (Hall & Pfeiffer, 2000).The management challenges posed by the growth on a mega scale are substantial (Jones & Visaria, 1997) coupled with rapid urbanization (Paddison, 2001).

The location of water supply assets is vital to its effective management. Geographical Information Systems (GIS), with extensive spatial analytical capabilities have become widely applied in the infrastructure sector since its introduction in the 1960s. GIS is applied in four sections of the water infrastructure sector: asset management, distribution management, customer and outage management (Brussels, 2005). It is ideal to manage infrastructure by integrating all the information systems within these sections. However, lack of data is often a serious limitation. Consequently, a GIS application in the operations and maintenance section

of water utilities is a first stage approach to integration and optimization of all sections of water supply systems.

The Significance of Global Water Crisis

Lagos, for example, the commercial centre of Africa's most populous country, is a city with a current population of almost 14 million, about half that of Kenya and larger than most African countries. It is the most populous city in Africa and Europe, the sixth in the world, and could jump to number three in the world in another 20 years. This would require expanding water access and provision of other basic services and infrastructure to several more million inhabitants. As in many other African countries, Lagos is a city on the verge of a water crisis (Omogunloye&Ayeni 2012).

In spite of huge fund being expended on water related projects in Lagos in the last few years, very little success has been achieved in eradicating water crisis in the city. Financial & Operating Statistics of Lagos State Water Corporation shows that Investment expenditure on water projects in Lagos state in the year 2000 was put at ₦24,458,000, about ₦10,358,000 was expended on water production and treatment, ₦3,000,000 was spent on water distribution while ₦11,100,000 was spent on operational support. In spite of this investment the impact of water shortage is still stronger in Lagos metropolis. Thus this implies that a multidisciplinary approach from planning stand point would be required for the problem to abate. In view of this, this research intends to use Geographic Information Systems (GIS) as a planning tool for evaluating the impact of water crisis in Lagos metropolis with the view to identify area of needed attention.

THE STUDY AREA

Lagos State is located on the south-western part of Nigeria on the narrow coastal flood plain of Bight of Benin, to the South. It lies approximately on longitude 20 42'E and 30 22'E respectively and between latitude 60 22'N and 60 52'N. The Lagos Lagoon is to the East, Ogun State to the North and North-West and the Ologe Lagoon to South-West.It is situated on an area characterized by creeks, lagoons and tributaries of major rivers, such as River Ogun and Owo with large catchment areas which present difficulty in drainage due to high water table and near flat marshy terrain. The water area and marshland represent about 40% of the total area of the Metropolis. However, territorially, Lagos State encompasses an area of 358,862 hectares or 3,577sq.km, see Figure 1

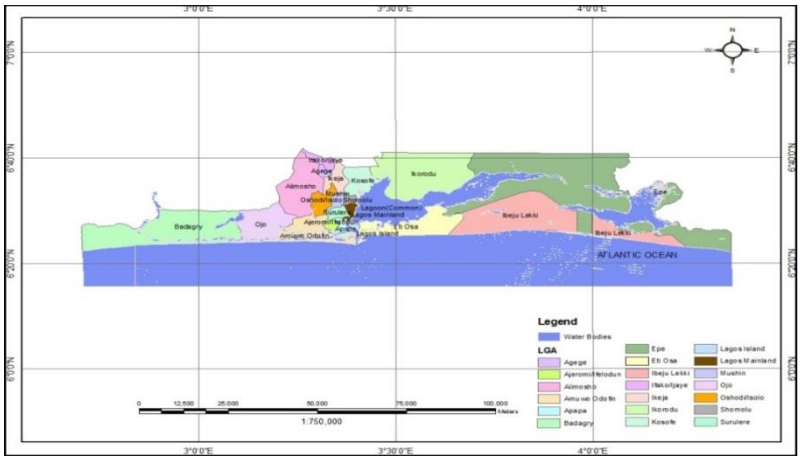


Figure 1: Administrative Map of Lagos State

Population

Although Lagos state is the smallest state in Nigeria, with an area of 356,862 hectares of which 75,755 hectares are wetlands, yet it has the highest population, which is over five per

cent of the national estimate.The state has a population of 17 million out of a national estimate of 150 million. The UN estimates that at its present growth rate, Lagos State will be third largest mega city in the world by year 2015 after Tokyo in Japan and Bombay in India.

Of this population, Metropolitan Lagos, an area covering 37% of the land area of Lagos State is home to over 85% of the State population.The rate of population growth is about 600,000 per annum with a population density of about 4,193 persons per sq. km. In the built-up areas of Metropolitan Lagos, the average density is over 20,000 persons per square km.

Current demographic trend analysis revealed that the State population growth rate of 8% has resulted in its capturing of 36.8% of Nigerian urban population (World Bank, 1996) estimate at 49.8 million people of the nation million populations. The implication is that whereas country population growth is 4/5% and global 2%, Lagos population is growing ten times faster than New York and Los Angeles with grave implication for urban sustainability.

Water Distribution in Lagos Metropolis

Due to the fact that Lagos is surrounded by water, many people assumed that it would be easy to provide the people with the required water; however the present situation is far from this. The water in the lagoon and ocean surrounding Lagos are not fit for human consumption. The large expanse of water around Lagos is not potable and does not meet World Health Organization standard. Hence, the public authorities in Lagos had to search far and wide to get water for the people of Lagos to drink and for other domestic use.

Lagos State comprises of capacity of three Primary Trunk Mains "A", "B" and "C" which cater for the transmission of water about 159,000m³/d (35mgd) since 1973, (Lagos State Water Corporation facts data, 2002). Since 1910 to date, the main concern of the authorities managing water supply to Lagos has always been how to increase the supply of water due to the ever increasing population of Lagos as a commercial nerve centre of the nation's economy.

At present, Lagos has a population of about 15 million. Over the years, therefore, the supply from Iju was no longer enough to meet the demands of Lagosians and a second waterworks had to be constructed at Ishasi, deriving its source from River Owo having a capacity of 18,000m³/d (4mgd).

Mini Waterworks are waterworks that can provide water supply up to 3 million gallons daily, (Agenda 21, 1992; Barth, 1993; Black, 1990; East Bay municipal Utilities district, 1991; Engelmann and LeRoy, 1993; Bulletin 160-93, Sacramento, CA, U.S.A., 1994; Brooks and Peters, 1988). Seven of the mini waterworks in Lagos metropolitan; had a combined design output of 82,000m³/d (18 mgd) while the remaining three in the semi-urban areas have a combined capacity of 38,000m³/d (8.4 mgd).

The Mini Waterworks were designed to feed directly into the networks laid in their various locations, to give immediate effect in these areas. Along with the installations of the Mini Waterworks, additional tertiary distribution networks have been laid on a continuing basis, to improve access to consumers (Lagos State Water Corporation facts data, 2002).

METHODOLOGY AND RESULT

Data Collection

Data used for this research work were gotten from Lagos State Water Corporation (LSWC) Ijora, Google earth and various Internet wide searches. The various methods that were used in acquiring data can be seen in the flowchart of research design below Figure 3.1. The initial steps taken before the adopted method was to acquire data used for the research work which were not limited to the following:

i. Administrative Map of Lagos State.
ii. Water facility Map.
iii. Population Data
iv. Water Demand
v. Production Analysis

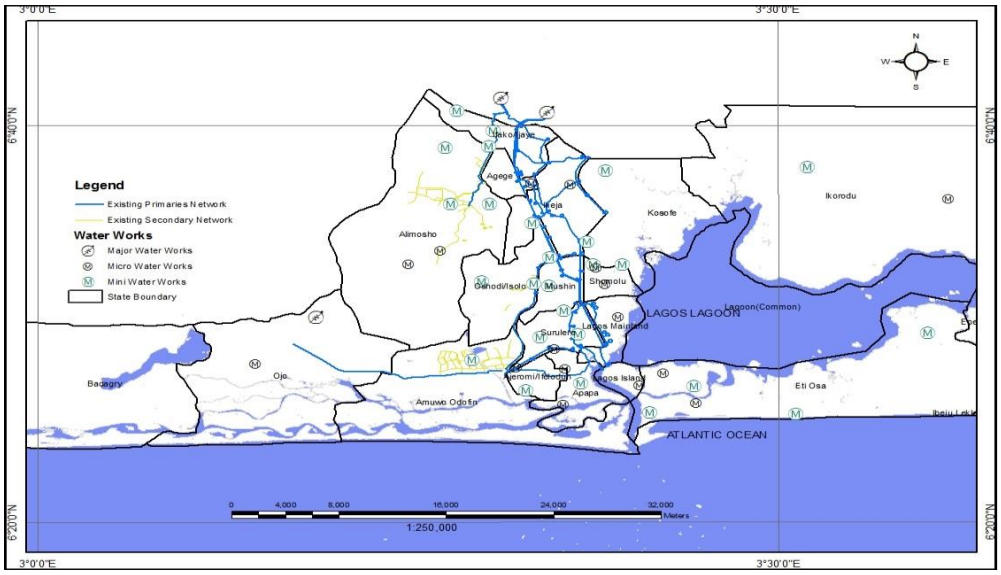


Figure 2: Water Facilities Map in Lagos State (source: Lagos State Water Corporation)

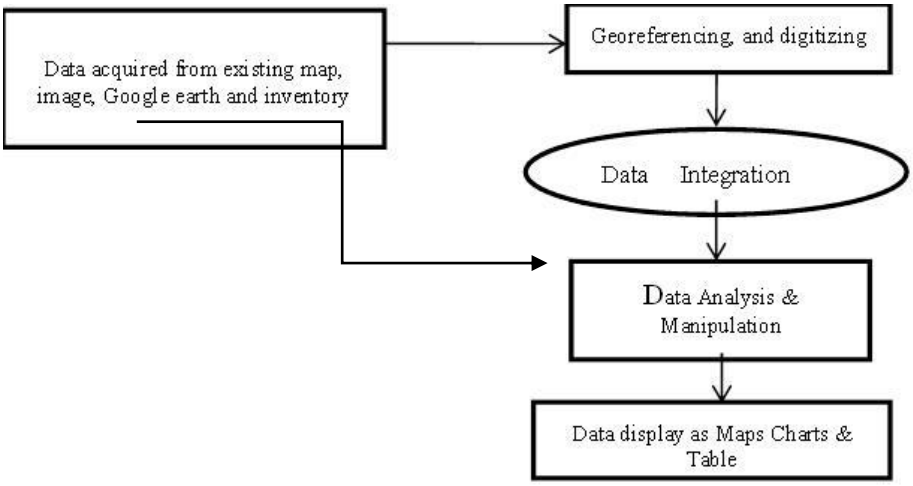


Figure 3: Flow chart Research Design

Chart and figures

Result generated from Chart and Figure are shown from Figure 4 – 6 below.

Figure 4 – Figure 6 gives a further analysis of water supply in the state. However, Figure 4 shows analysis of water production with the design capacity (mgd) of water work against average production (mgd) for year 2012. From this, it is observed that Adiyan has the highest

design capacity of 70 (mgd) with an average production of about 48.61 (mgd). It also observed that the likes of Mosan-Okunola and AbuleEgba water works are currently not producing.

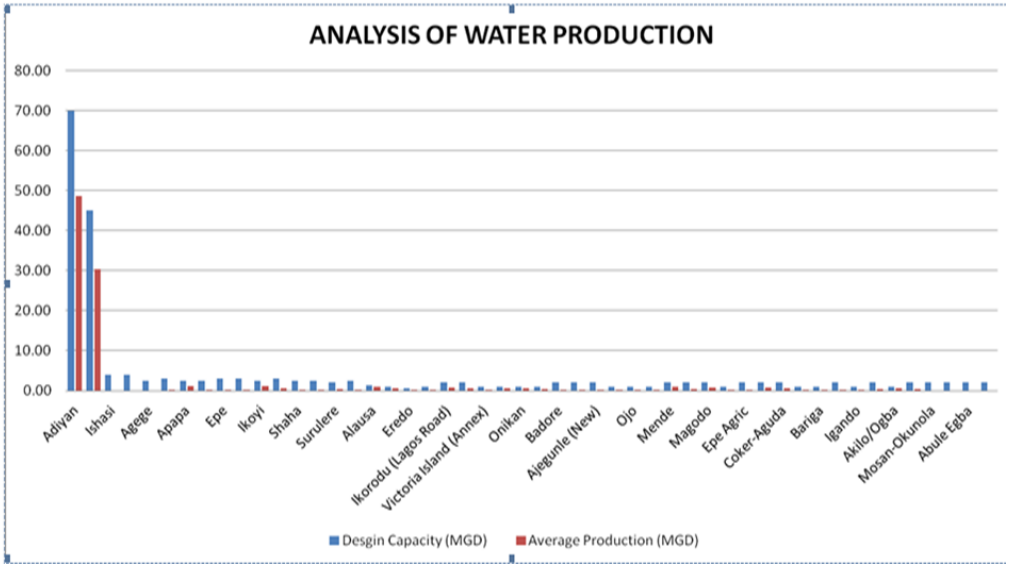


Figure: 3 Analysis of Water Production Chart (Lagos State Water Corporation Water Works Design Capacity and Average Projection)

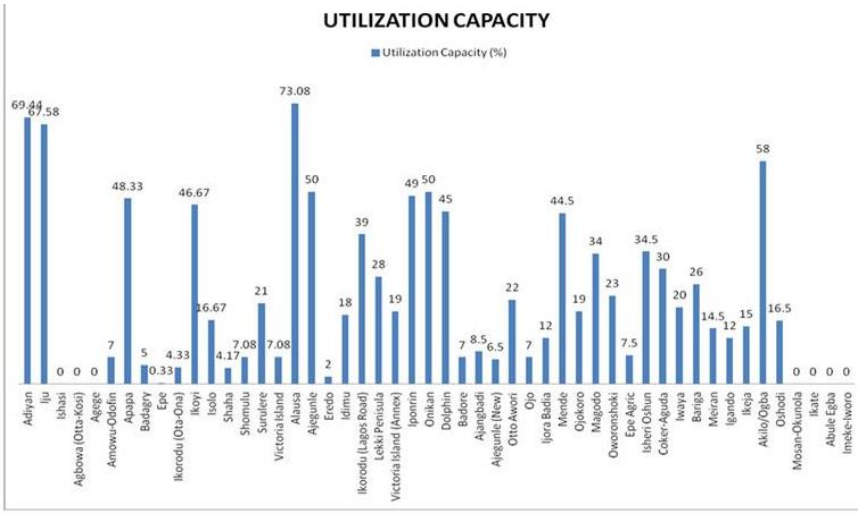


Figure 4: Utilization Capacity Chart (Lagos State Water Works)

Figure 4 depicts utilization capacity of water works in the state, with Adiyan, Iju and Alausa water works having the highest percentage based on performance, while Epe, Eredo, Shaha Badagry among others shows very low performance.

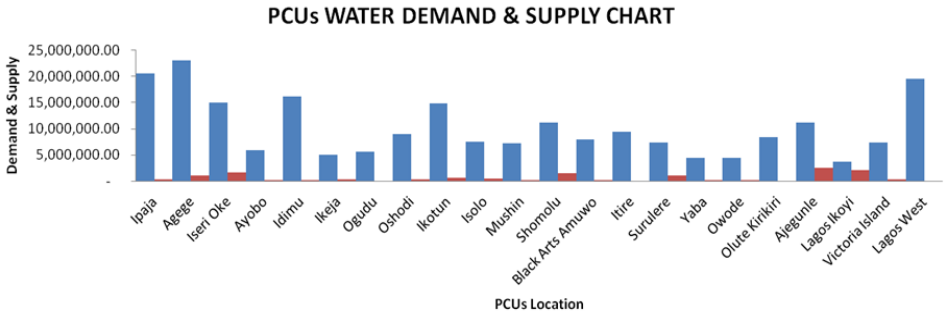
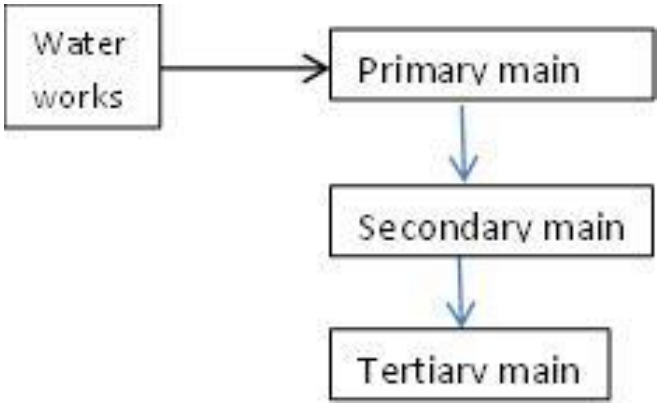


***Figure 5**: Project Control Units Water Demand and Supply Chart, Lagos State Metropolis*

Figure 5 above shows analysis of water demand and supply within Metropolitan Lagos in the 22 Project Controlling Units. From the chart it is evident that water demand is far above water supply. Hence, the chart highlights shortage of water supply within PCUs. The Chart equally shows that there are no supply within Ogudu, Itire, OluteKirikiri and Lagos West PCUs. Lagos West PCU lack of water supply could be as a result of the rehabilitation work that was currently ongoing while the factor identified for lack of supply at Itire PCU, is that water work is currently under construction. No water work identified with Ogudu and OluteKirikire.

Water Distribution Network

Figure 6 and Figure 7, shows the spread of primary and secondary pipeline as well as water works in Lagos Metropolis. However, the spread of pipelines within the metropolis are not evenly distributed. The primary pipeline is characterised running from north (Ogun State) to south- Olute Ikirikiri PCU (Amuwo Odofin LGA) without any considerable extension to the east and west of the state. The secondary pipeline can be observed to have its spread along Ipaja, Idimu, Isolo, Agege,Ikeja, Mushin and Black Arts Amouwo PCU and took to a more central position base on the spread of the primary pipeline.



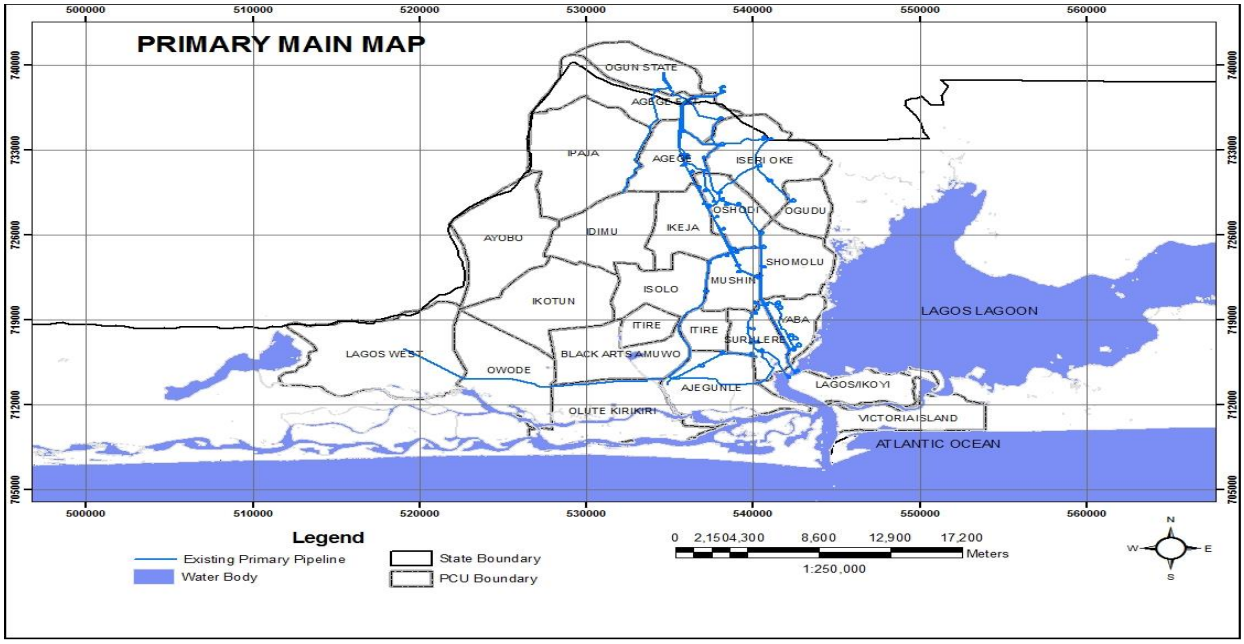


Figure 6: *Map showing primary main across Project Control Units in Lagos Metropolis*

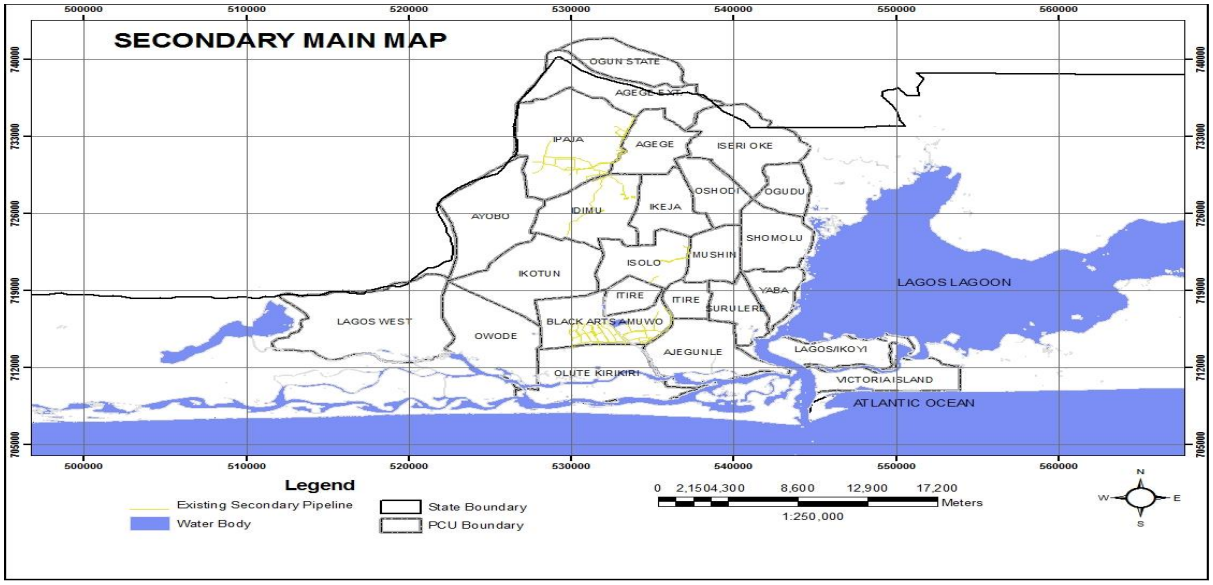


Figure 7: Map showing secondary main across Project Control Units in Lagos Metropolis

CONCLUSION

The role of portable water in modern society such as the Lagos Metropolis cannot be over-emphasized. People depend on its good quality-and quantity-for drinking as well as maintaining personnel hygiene. This research work has highlighted the following:

i. The spatial distribution of water pipeline through primary and secondary network in Lagos State. Despite the considerable attention paid to water supply in the study area over the years, inadequate water supply remains one of the major problems. Findings revealed that most of the water works are performing below average while in some cases there was no water supply/production as the case maybe.

ii. There are situation where people that have the network connected to their houses are left unsatisfied with the supply; and whenever the water is pumped, it does not last more than 2 hours in a day and as such the people within the metropolis are left with no choice than to find alternative sources of water to meet their daily consumption.

iii. Proper delineation of PCUs was not done, there were few discrepancies between PCUs and LGAs boundaries. However, reason for these discrepancies could be that the delineation was not done by geographers or surveyors. And as such, assumption was used in some cases in merging PCUs population for each LGA population.

iv. Some of the factors that have been identified as important controls on water demands in the study area include increase in population, increase standard of living and purchasing power, changes in social tastes and policy decisions.

v. Unfortunately, Lagos State Water Corporation is unable to meet the growing water demand of the people due to: inadequate water facilities such as network distribution, water works (reservoirs), inadequate power supply, poor state of some of the equipment, reckless over-consumption and misuse of water amongst others.

vi. Finally, the use of GIS should be employed for effective management, since overtime it has been proven to be very useful for effective planning and cost efficient.

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Mapping and Spatial Distribution of Petroleum Products by Marketers in Nigeria

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ABSTRACT

Nigeria is endowed with abundant natural resources of which petroleum resources play a dominant role in the economy. These resources can be effectively harnessed and managed for the benefit of all Nigerians. Unfortunately, the distribution of petroleum products in the Nigerian economy is fraught with complex problems resulting sometimes in petroleum products outages, inflated prices of products and contentions on the pump price of products. The aim of this paper is not only to evaluate the distribution of petroleum products in the country but to apply Geographical Information System (GIS) to highlight distribution weakness in the country. The research work was carried out using data acquired from NNPC, PPPRA and NEITI. These data was processed using GIS. The findings from the study show that the distribution system of petroleum products in Nigeria is ineffective and inefficient due to a number of factors which have been identified. To meet all this demand for these products without provoking market imbalances, the right supply levels are needed. Measuring this is always a challenge for the experts who work in the oil industry. Thus, the use of GIS should be employed in the downstream sector of oil industry.

Keywords: GIS, NNPC, Petroleum Consumption and Distribution

INTRODUCTION

Nigeria's economy is dominated by the oil and gas sector. In 2004, this sector accounted for about 80% of all government revenue, 90-95% of export revenues, and over 90% of foreign exchange earnings (Aluko, 2004). The country is Africa's leading oil producer and at a global level, ranks among the top 10 oil producers (Olokesusi, 2005). Most of the oil and gas is produced in the Niger Delta Region, presently defined by the political boundary of nine states: Abia, Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo and Rivers.

The Nigerian oil and gas operations comprises of assets and infrastructure including 5,284 oil wells, 10 gas plants, 275 flow stations and 10 export terminals (Joab, 2004). All of these are connected by a network of pipelines that crises-cross the country. These developments often require a large chunk of the wetland to be reclaimed/ dredged. Oil and gas production has come at a great environmental cost to about 1,500 communities in the Niger Delta where the Nigerian National Petroleum Corporation (NNPC) oil venture partners operate.

However, marketing of these petroleum products in Nigeria could be traced back to 1907, when kerosene was imported with an agency agreement believed to be the first was concluded by Secony Vacuum Oil Company (now Mobile) to market its ''sunflower'' kerosene. Thus, kerosene was the first petroleum product marketed in Nigeria and Mobil had the privileged of being the pioneer in this business (Nigerian National Petroleum Corporation, 1985).

Distribution problem in general, is not a recent problem. The extractive/mining sector in Nigeria have, for the past decades shown comparatively slow rate of growth and have been, in the main, predominantly foreign-dominated. This reflects a fact that the sector is both

Tata, H., Ariyo, T. O. & Omogunloye, O. G. (2016). Mapping and spatial distribution of petroleum products by marketers in Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1037-1044

technology and capital intensive, requiring a high level of sophisticated, expensive equipment and expertise, which are in short supply in Nigeria.

Consequently, business features, irrespective of all glamours, gains and aspiration have their attendant problems as well. These problems associated with the business come in varied ways and takes different dimensions. The attendant problems may arise from logistics activities, inefficiency and mismanagement of the marketing mix. These problems plague the Nigeria oil sector in its effort to market petroleum products.

These products are marketed by the multinational oil companies like Exxon Mobile, Total Finas etc. Despite the effort of government aimed at efficient distribution of petroleum products; the problems of inadequate and uneven distribution among others still threaten the marketing of petroleum products today in the country.

As a result, these problems gave birth to independent marketers that served as panacea to the prevalent economic situation occasioned by inadequacy in petroleum products distribution in the country

Independent marketers therefore were granted right to be involved in the industry as to bridge the gap created by distributors logistics, to ameliorate the suffering of Nigerians. Entry of independent marketers became welcomed and justified, in the oil industry. Prior to the birth of the independent marketers, petroleum product distribution was epileptic and unreliable.

The Nigerian Petroleum Industry

The petroleum industry can be classified by type of actors or by sector. The actors in the Nigerian industry consist of both private and public organizations. The public actors are the government agents and functionaries such as the Nigerian National Petroleum Corporation (NNPC) and its subsidiaries, the Department of Petroleum Resources pricing regulatory authority (PPPRA), among others. The private segment consists of both indigenous and foreign actors.

The indigenous sector consists of private independent marketers. As far back as 1978, the concept of independent petroleum products marketing was introduced with a view to bringing indigenous independent marketers to that sector of the industry. According to Edoreh (1997), in 1979 a year after the scheme of independent marketers was introduced, there were not more than 20 (twenty) "independent marketers". By 1993, the number had risen to 1,000. Today, the indigenous independent marketers are well over 7,948 (Petroleum Product Pricing Regulatory Agency, PPPRA, 2010). As a measure of the growing involvement of the indigenous petroleum products marketers in the economic development process of Nigeria, it is interesting that in 1981, they accounted for less than half – percent in terms of volume of petroleum products marketed in Nigeria. By 1998, they had captured about 25 percent of the market. Today, they account for nearly 40 percent of the volume of products marketed in country (NNPC, 2010). In terms of outlets, the major marketers have 2218 while the Independent marketers have 7948 outlets. The NNPC has 18 mega stations nationwide as at June, 2010 (Table 1.1).

These indigenous independent marketers are competing with the established big (foreign) multinational enterprises usually referred to as the major oil marketers comprising:

i. Mobil Oil Nigeria Plc
ii. MRS Nigeria Plc
iii. Total Nigeria Plc
iv. Con Oil Plc
v. Oando Nigeria Plc
vi. African Petroleum Plc

These six major oil marketers control about 60 percent of the market. There are two major classification of petroleum industry by sector. These are the "Upstream" and ''Downstream'' sectors.

Table1. 1: Nationwide retail outlets 2009 census-summary distributed by zone

Geo-Political Zone	Marketer Type Major	Marketer Type Independent	Total No of Outlets
North Central	355	1318	1673
North East	163	726	889
North West	265	1023	1288
South East	194	1227	1421
South South	224	1519	1743
South West	1017	2135	3152
Total	**2218**	**7948**	**10166**

Source: Petroleum Products Pricing Regulatory Authority Available at www.pppra-nigeria.org

In the downstream sector, activities are progressively falling within the control of private entrepreneurs, especially the indigenous independent marketers. It is the policy of the Federal Government that petroleum products be distributed by private companies. To this end, government divested a sizeable portion of its interest in oil marketing companies by selling some of its share to the public through the Technical Committee on Privatization and Commercialization (Christopher E and Adepoju A., 2012).

The study looks at the various methods employed by the various marketers in Nigeria to distribute petroleum products from the refinery to the final consumers and types of channels involved. This reveals the extent to which the shortage of petroleum products as well as their adulteration could be traced to the distribution system.

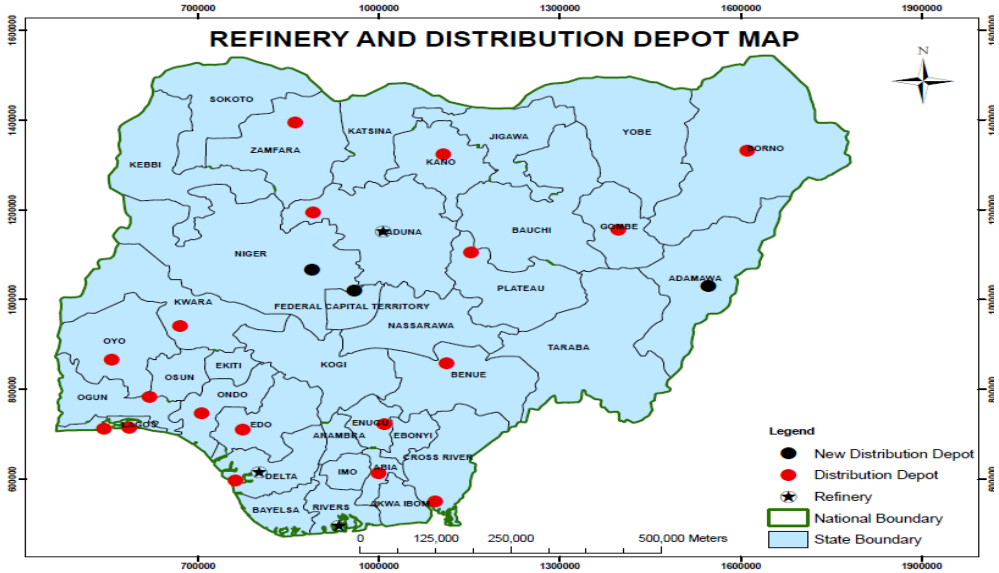

Figure1. 1: Map showing the distribution of Depot in Nigeria (source: Pipeline product marketing company of Nigeria)

METHODOLOGY

Data Collection

Data used for this research work was gotten from PPMC (Pipeline product marketing company of Nigeria), NNPC (Nigeria National Petroleum Company), PPPRA (Petroleum Products, Pricing Regulatory Agency) NEITI (Nigeria Extractive Industry Transparency Initiative) and Internet wide searches. There were various methods that can be used to acquire data; the method adopted can be seen from the flowchart below Figure 1.1.

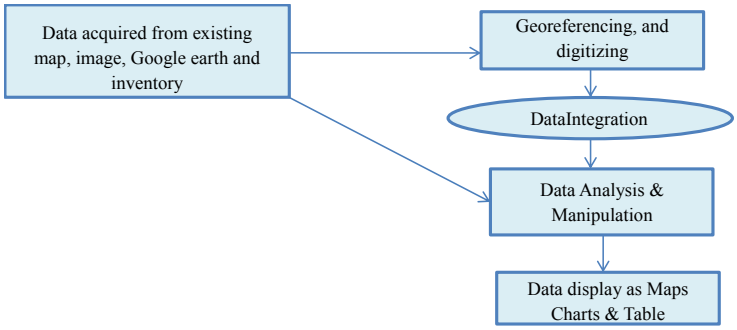

Figure 1.2: Flow chart for the research

PRESENTATION OF RESULT AND ANALYSIS

The zonal petroleum product Consumption/distribution for year 2011 as seen in Figure 4.7 shows that South West has the highest consumption with 3,520,949 million litre consumed during the year, with the lowest consumption being South East with 254,437 million. Table 4.6 and Figure 4.8a below equally buttress consumption/distribution for the year. South West been the highest consumer, thus, could be as a result of the huge industrial activities taking place in this region while Southern East having the lowest supply of product shows that the level of industrial activities could be low. It is observed that the PMS and ATK product are consumed mostly in the South Western zone which again defined the kind of activities that can be identified in this region. South South region has the highest consumption of HHK and Brake Fluid in the country while North Central has the highest consumption of special products. However, Figure 4.15b show that South West 39% of the distribution, seconded by South South with 24%, North Central 17%, North West 7%, North East and FCT 5% and South East has just 3%.

Table 1.2: Show the zones distribution of petroleum products in Nigeria (Petroleum Products Pricing Regulatory Authority Available at www.pppra-nigeria.org)

Products	South West	South East	South South	North West	North East	North Central	FCT	Total
LPG	1,079.95	0.23	3,640.69	20.40	0.08	20.00	80.30	4,841.65
PMS	2,717,300.80	174,545.96	881,619.52	465,027.75	331,233.88	781,746.67	336,975.67	5,688,450.25
HHK	199,305.44	2,127.81	465,105.96	26,638.66	30,001.95	140,122.08	18,262.08	881,563.98
ATK	135,897.27	3,793.11	26,037.60	11,803.30	3,253.86	8,448.60	39,787.67	229,021.41
AGO	18,919.29	26,099.06	432,089.45	51,220.07	-	237,060.00	18,300.92	783,688.79
LPFO	967.28	-	102,063.98	-	434.21	216,415.35	161.17	320,041.99
Lubricating Oil	4,598.43	951.77	1,788.65	957.04	1.87	2,109.48	555.93	10,963.17
Greese	45.93	0.98	8.41	1.51	-	9.14	1.80	67.77
Pet. Jelly/Waxes	-		-	-	-	-	-	-
Bitumen	-		-	0.34	0.30	64.80	-	65.44
Brake Fuid	2.43	0.25	2.63	-		2.16	0.71	8.18
Others			34,539.57	-		5,419.37		39,958.94
Total	**3,078,116.82**	**207,519.17**	**1,946,896.46**	**555,669.07**	**364,926.15**	**1,391,417.65**	**414,126.25**	**7,958,671.57**
% Distribution	**38.68**	**2.61**	**24.46**	**6.98**	**4.59**	**17.48**	**5.20**	**100.00**

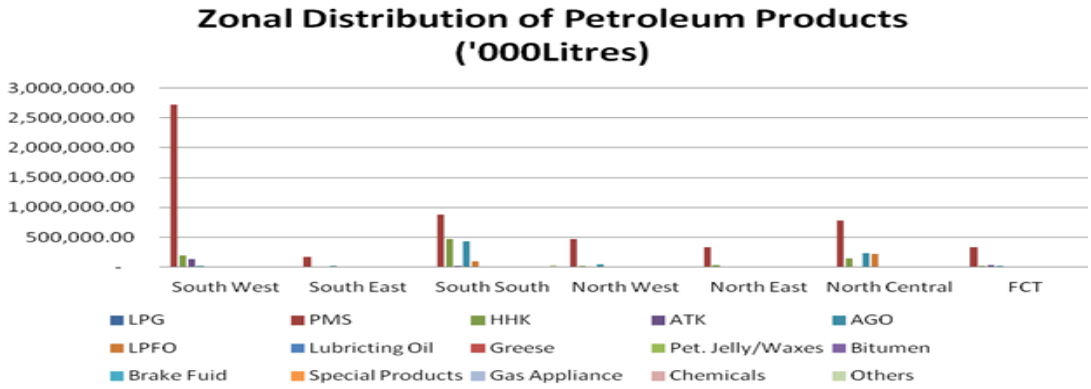

Figure 1.3: Shows distribution/consumption of Petroleum Product by zone for year 2011 in Nigeria

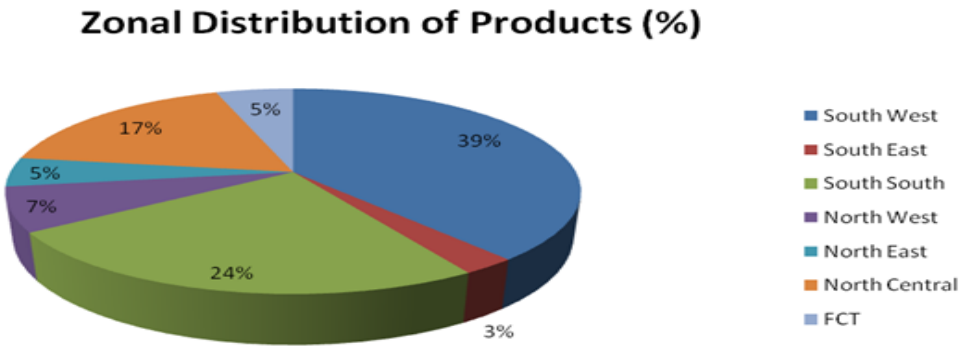

Figure 1.4: Shows percentage of distribution/consumption of Petroleum Product by zone for year 2011 in Nigeria

Table 1.3: Shows the contribution of major and independent marketers to the distribution of petroleum products distribution in Nigeria

Marketers	LPG	PMS	HHK	ATK	AGO	LFPO	Lub Oil
Forte Oil	2,584.46	652,654.93	54,075.74	59,841.20	-	-	-
Conoil	-	934,743.04	68,551.31	169,180.21	-	-	-
Mobil	-	-	-	-	-	-	-
NNPC Retail Outlet	-	1,536,286.98	192,524.15	193,924.60	-	-	-
MRS	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-
Oando	-	-	-	-	-	-	-
Independent Marketers	29,257.15	2,564,764.58	585,555.79	-	-	-	-
					-	-	-
Total	**31,841.61**	**5,688,449.53**	**900,706.99**	**422,946.01**	**-**	**-**	**-**

Table 4.7 and figure 4.10 below shows the contribution of major and independent marketer to the distribution of petroleum products in Nigeria. From the available data, both the major and independent marketer did not contribute to the distribution of AGO, LFPO and Lubricating Oil. This however, could imply insufficient supply of product to the Nigeria citizen. It also observed that independent marketers have contributed measly to the distribution of products in the country.

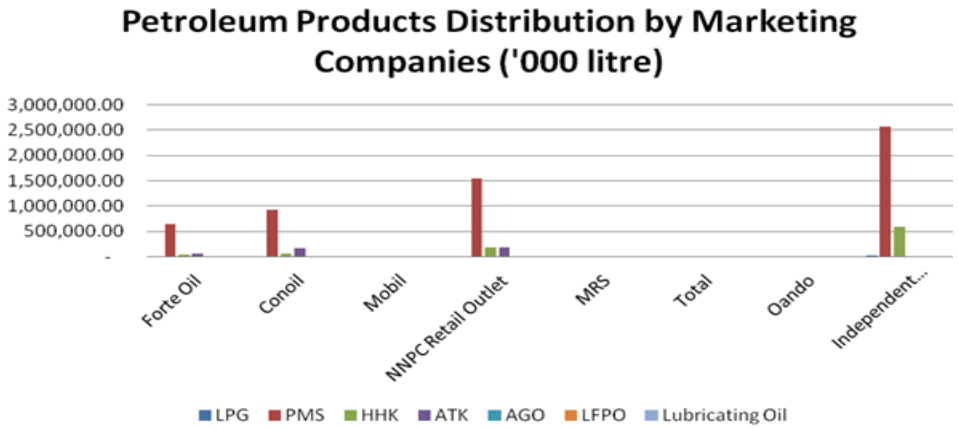

Figure 1,5: Showing petroleum products consumption/distribution by marketer in Nigeria for year 2011

Furthermore, Figure 1.6 below shows the trend movement of petroleum/consumption by state for the past 3 year from 2009 – 2011. The trend shows that the consumption of petroleum products is higher in 2009 than 2010 and 2011.From the movement it is observed that the consumption is slightly higher from Edo to Kebbi State in year 2011 than in year 2010. Many factors could be responsible for this gap in consumption. However, one of the factors that might be able to result to this gap is change in price of petroleum products which could reduce the purchasing power of the people within the states and the country at large which is in conformity to Law Demand and Supply. Supply and demand is perhaps one of the most fundamental concepts of economics and it is backbone of a market economy. Demand is how much quantity of a product or services is desired by buyers. The quantity demanded is the amount of a product people are willing to buy at a certain price; this shows the relationship between price and quantity demanded (demand relationship). Supply represents how much the market can offer. The quantity supplied refers to the amount of a certain good producers are willing to supply when receiving a certain price. The correlation between prices and how much of goods or services is supplied to the market (supply relationship). Thus supply is a reflection of supply and demand which implies that more quantity of petroleum products will be demand if the price is reduced.

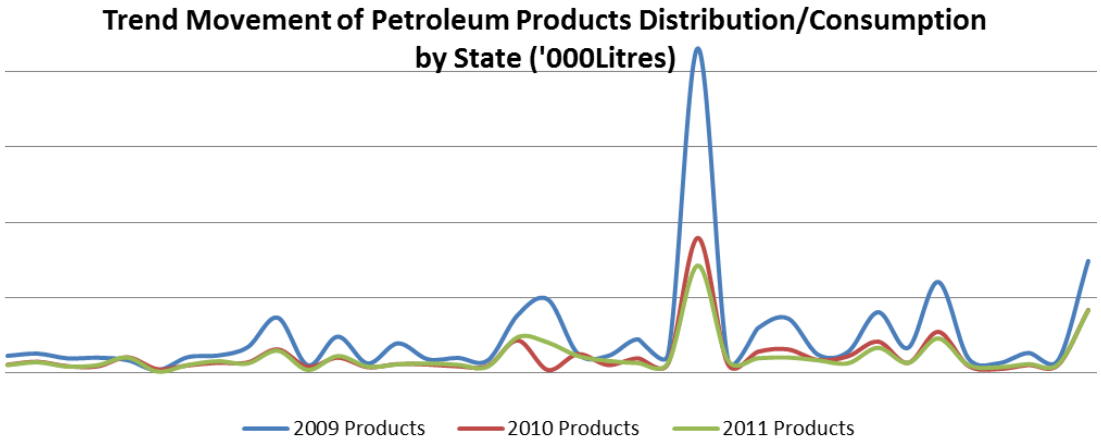

Figure 1.6 shows the trend movement of petroleum/consumption by state for the past 3 year from 2009 – 2011

DISCUSSION OF FINDINGS

From the available data, the local refineries received a total of 40,405,605 barrels (5,284,675 mt) of (dry) crude oil and condensate and processed39,408,108 barrels (5,088,208 mt) into various petroleum products. The total production output by the refineries was

5,379,854metric tons of various petroleum products. The combined average refining capacity for year 2011 was 24% as against 22% in the previous year.

PPMC evacuated 5,208,930 mt of petroleum products from the refineries and it also imported 759,681 mt of PMS,AGO and HHK for distribution. Total value of imported products was $0.802 billion. PPMC sold a total of 13.21 billion liters of various grades of petroleum products through depots and coastal lifting. During the year, 1.37 billion liters of petroleum products worth about ₦141.13 billion was exported.

A total of 8,199.02 million liters of petroleum products was distributed nationally giving an average daily consumption of 15.58million litres of PMS, 2.68 million litres of AGO and 2.47 million litres of HHK. The total petroleum products distribution of8, 199.02 million litres is about 3% lower than 2010 total volume of 8,476.99 million litres. This is due to non-availability offigures from major retail companies namely MRS, Mobil, Total and Oando. The quadruple usually account for more than 50%of total petroleum products distribution.

The distribution by zone shows the South-West with the lion share of 40% followed by the South- South with 24%, North Central with 17%, North West with 7%, FCT with 5%, North East with 5% and South East with 3%. Thus, scarcity of petrol has continued to prevail in the country, despite this significant increase in importation.

Conclusively, with government claims that the landing cost of a litre of imported petrol put at ₦152.44, making it to pay about ₦55.44 on every litre of petrol as subsidy since the control price for her citizen is put at ₦97 per litre. When the ₦55.44 per litre is multiplied by a daily consumption of 40.32 million litres, it amounts to a daily subsidy expenditure of ₦2.235bn. The figure adds up to ₦69.29bn monthly.

CONCLUSION

i. With the current trends at which Nigerian economy is growing, the Country needs more pipeline distribution network.
ii. From the analysis, trend movement of petroleum/consumption by state for the past 3 year (2009 – 2011), shows that the consumption of petroleum products is higher in 2009 than 2010 and 2011.
iii. Finding also shows that South West has the highest zonal petroleum product Consumption/distribution for 2011 with 3,520,949 million litres while South East has the lowest consumption with 254,437 million litres (Figure 1.3).
iv. Further findings from this research work, shows that depot within the country are not evenly distributed (Figure 1.3).
v. Finally, the use of GIS should be employed as planning tools for proper and effective distribution.

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Graphic Communication for Sustainable Development: Eliciting Desired Response from Target Audience

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ABSTRACT

This paper focuses on eliciting desired target audience response pivotal for sustainable development. Toward this end, it utilized the Critical-Historical-Analytical Examination, and Content Analysis methods to assess conditions and response to media. It started with the need to understand target audience perception when making graphic messages for development. Furthermore, it examined the perception process of graphic messages using the Aaker and Myers Model. And it discussed audience responses to graphic messages in Africa, based on the analyses of secondary data of the conditions pivotal for decisive response, and found that neglect of target audience conditions resulted in the production of ineffective stimulus conditions as well as communication failure. The paper recommends that communication actors should understand conditions that determine responses to development messages and integrate Target Audience during media production. This would create stimulus that elicit desired response from target audience.

Keywords: Development, Eliciting Desired Response, Graphic Communication, Perception, Stimulus/Audience Conditions

INTRODUCTION

Eliciting desired response from target audience is the primary objective of graphic communication campaigns. These campaigns often employ pictorial images and verbal signs to share messages about development in agriculture, health and education, to mention a few.

The response of target audience to these messages is largely determined by the way the graphic messages are created and distributed. A positive or negative response largely depends on the reactions elicited by the typographic and graphic elements selected to produce graphic messages. This is because both form and content attributes produce emotional reactions that affect behaviour (Ebigbagha, 2010, citing Garland, 2005; and Watt, 1979). For this reason, the media is the message (Baran, 2009). So, both graphic form and content immensely impact on target audience perception.

In order to produce graphic media with salutary effect, it is necessary to understand target audience perception. Media generated without necessary and sufficient consideration of audience conditions usually is ineffective, and with grave consequences. An example is the 'Dress Code Campaign' in Ahmadu Bello University, Zaria, Nigeria by the Dress Code Action Committee, in 2005. The media produced were rejected and destroyed by the target audience. This would have been prevented had adequate consideration been given to target audience conditions during production of the stimulus conditions (the billboard posters). For instance, had the draft of the posters been pre-tested with the target audience and recoded based on the pre-test result, a suitable, likeable and modest dress code, which reflected the interest of the target audience would have been depicted and the time, money, energy and resources wasted saved.

A thorough consideration of target audience conditions is indispensable to creating

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appropriate, accurate and vivid stimulus. It helps the graphic encoder to satisfactorily resolve uncertainties, which are bound to occur as development ideas are encoded into graphic messages. These uncertainties (Technical, Semantic, Syntactic, Arousal/Aesthetic and Response) are ruinous and could pose formidable barriers to effective communication of stimulus conditions.

A diligent consideration of the conditions that determine target audience perception of graphic messages is essential to effective graphic media production. Towards this end, the Aaker and Myers model of the perception process, which lends itself as a veritable guide, is examined. Also, discussed are variables for generating graphic messages with particular focus on target audience conditions. And audience responses to graphic communication campaigns, which considered or neglected target audience perception during media production process, are adequately highlighted.

THE PERCEPTION PROCESS OF GRAPHIC MESSAGES

The way target audience perceive graphic messages is lucidly described in the Aaker and Myers(1981) model of the perception process (figure 1).The model shows how stimulus flow through attention and interpretation to cognition. It also suggests how this flow of stimulus is determined by stimulus and audience conditions.

The model identifies four elements in the perception process, these are: (i) Stimulus - the content of the message the audience is exposed to in a given environment. (ii)Attention - the careful notice focussed on a given stimulus, which essentially controls the amount of information the audience processes at any given time, whether he/she engages in Active search, Passive search, or Passive attention. (iii) Interpretation - the explanation or meaning the target audience makes of the content of any given stimulus, which he/she could Simplify, Distort, or Organise; and (iv), Cognition - how target audience see, recognise and understand a given stimulus.

In addition, the model also identifies two principal types of variables that determine the attention and interpretation of a given stimulus, these are: (i) Stimulus conditions, which are all the things that could affect or make up the stimulus itself, these include: Intensity, Size, Message, Novelty, Position, and Context. (ii) Audience conditions are all the things that could affect the state of being of the target audience, these include: Information needs, Attitude, Values, Interests, Confidence, Social context, and Cognitive style.

The model shows the information seeking pattern of target audience. It holds that information provided by a given stimulus are first screened at the attention stage, whereby attention, which acts as a filter, controls the amount of information the receiver processes; whether he/she is involved in active search, passive search or passive attention. This screened amount of information is then organised into explanations/meanings the receiver could make out of it, which conforms to his/her image of reality. At this stage, the target audience could simplify, distort or organise the content of the stimulus into a suitable cognition. All these activities are influenced by stimulus conditions and audience conditions.

The stimulus and audience conditions that determine attention and interpretation target audience give to graphic messages are of prime importance in communication development process. This is particularly salient in our society today, where mass production and distribution of information have flooded the environment and create problems for the individual who desires to sort out or seek for relevant information to meet his or her needs.

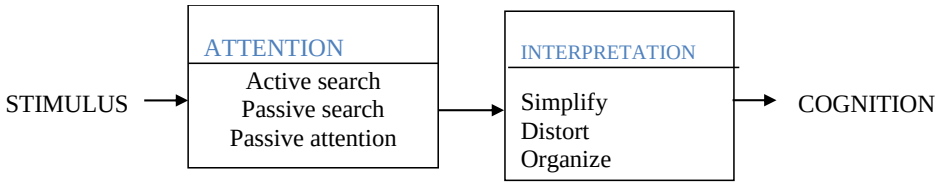
More importantly is the awareness and necessary application of these stimulus conditions in the creation of graphic messages, bearing in mind target audience perception. It is important

to know that there are attention filters, which determine the amount of information processed, and affect the attention given to a particular message when target audience are exposed to it. So, unnecessary information/content in the stimulus must be eliminated to avoid 'noise' that repels.

In addition to the above, the element of interpretation is essential. It shows that target audience match information to their image of reality. As a result, when encoding graphic messages, all that concern the audience should be considered. Otherwise the message would often not achieve the desired response.

Therefore, when determining messages and making media production plans, it is important to consider: the intensity of colours of the graphic and typographic elements, the size of design elements in relation with one another within the picture plane and the overall size of the media itself in comparison with similar ones in the same vicinity. In addition, what portion of the message need be emphasised, the syntax/arrangement order, and the novelty, uniqueness or unusual presentation should be planned. Also, the position where the graphic message would be mounted in relation with other messages displayed, and the context should be taken into serious account.

Finally, the information needs, attitude, values, interests, the socio-cultural environment and the cognitive style of the target audience should be considered because they greatly impact on target audience response.



Some Suggestive Determinants of the Perception Process

Stimulus Conditions	Audience Conditions
Intensity, Size, Message,	Information needs, Attitudes
Novelty, Position and Context	Values, Interests, Confidence and
	Cognitive style

Figure 1: A model of the Perception Process, influenced by two principal types of variables: stimulus and audience conditions (Aaker and Myers, 1981)

TARGET AUDIENCE RESPONSES TO GRAPHIC MESSAGES

Target audience responses to graphic messages in development communication are immensely determined by the conditions of the stimulus presented. A diligent consideration or careless neglect of target audience conditions during communication development process would either produce stimulus conditions that afford or hinder desired response respectively. This is evident in the graphic media produced for three nationwide campaigns (The ORT Campaign in Egypt, The Delayed Sexual Debut Campaign in Nigeria, and The Use Condom Campaign in Nigeria) on health issues.

The ORT Campaign in Egypt

The ORT Campaign in Egypt (Ebigbagha, 2010; citing World Health Organisation, 1987) is an example of effective media production that elicited desired response. It emphasises the need for draft of graphic communication to be pre-tested with audience before final production for campaign. This is salient to avoid rash decision-making and the production of ineffective media.

The first Executive Director of the Egypt ORT Project was to decide on and adopt a logo for the project. Having examined many logo ideas submitted by different artists/designers, he liked one more than the others (see Plate I). The director was tempted to adopt the logo he

liked without further deliberation. However, he withheld his opinion until all logos had been tested.

Plate I: Logos Pre-tested for the ORT Campaign in Egypt,

The logos were tested with a sample of the target audience, mothers, and the result shows that, the logo the director preferred was the one least favoured by the pre-test respondents. It also shows that the logo chosen needed be modified to be more effective. A large number of the respondents opined that the colour be modified and the mother pictured in the logo should put on a wedding ring.

The logo selected by the pre-test respondents was adopted for the ORT campaign. The experience so impressed the first Executive Director that he often recounted the story, to emphasise the need to pre-test draft with target audience for successful communication in development programme.

Had the director not involved the target audience in the development process through pre-test, the necessary improvements made on the logo would have been missed. The introduction of a wedding ring on the hand of the pictured mother in the logo is very significant and instructive. It is a staple on the socio-cultural influence on the interpretation of graphic language. Significantly, it points to the socio-cultural interpretation of motherhood as a product of legality in marriage. Also, it points to the fact that very crucial idea could be omitted when making initial draft of the stimulus, which can be corrected during pre-test/evaluation process. The omissions, if not corrected could significantly thwart the realisation of desired target audience response.

The Delayed Sexual Debut Campaign in Nigeria

The Delayed Sexual Debut Campaign is another rare example of the production of target audience-based stimulus that produced desired target audience responses in Nigeria (SFH Corporate Presentation 2006, Ebigbagha 2010, 2012).Stimulus produced include posters, pamphlets and stickers, to mention a few. The examination of the media production process showed that there were series of collaborative efforts and integrated planning between the source, graphic encoder, and the target audience during the media production process. Of these stimulus materials that were produced, two billboard posters: "Sex is worth waiting for ZIP UP…" and "Yana Da Daraja KU KAMA KANKU (it is respectful to hold yourself) (Plate IIa and Plate IIb) respectively, would suffice to relate how the quality of the graphic media produced elicited desired target audience response.

a b

Plate IIa and IIb: (a) A billboard poster on Sex is worth waiting for'ZIP UP'(b) Hausa Version: Yana DaDaraja KU KAMA KANKU (it is respectful to hold yourself). By the Society for Family Health.

The two billboard posters carried the same prime messages and supporting information in Pidgin/English, and Hausa but with different configuration based on diligent cultural considerations, knowledge, aptitude and practice of target audience. Using the English version (Plate IIa) "Sex is worth waiting for ZIP UP…" for analysis, which equally holds for the Hausa version; the prime message is 'Sex is worth waiting for'. It is executed in white lettering on high intensity blue background. This makes it legible when juxtaposed with 'ZIP UP' that is emphasized in size and depicted in gold/yellow ochre hue. The letter 'l' in the 'ZIP' is the iconic sign of a zip that is done up - a ploy that visually re-emphasized the main idea of the ZIP UP campaign. The supporting information 'Delay sex now, unwanted belle or HIV/AIDS fit spoil your life' also, appears in white but smaller in size in comparison with sex is worth waiting for', and italicized, which makes it an important warning slogan but not in formal terms as the prime message.

The pictorial element consists of four youths (two males and two females), a female and a male, a male and a female alternate juxtaposition. The youths are in trendy cloths, with captivating smiles that attract attention and arrest interest in the poster.

The relation in size and space between the typographic and graphic elements are well thought of and excellently articulated. The colours in the poster in terms of hue, value and intensity are superb, and the colour of the lettering 'ZIP UP' was balanced by similar colour of clothes worn by a male and a female in the group following the organisational principle of Harmony, involving rhythm repetition. Also, the pose of the two youths not wearing yellow-based cloth produced a diagonal movement that is countered by the other two. This creates dynamic forces that enlivened the stable typographic elements.

In addition to the above, the whole design consists of colours that have symbolic connotations. The red and black colour symbolise danger and death respectively, which could result from HIV/AIDS, other sexually transmitted diseases and unwanted pregnancy. Attention then moves from the grey colour to the yellow, which depicts the burning passion of youthful exuberance. The blue background and the white lettering is symbolic of peace, and purity respectively, which seem to suggest that if the target audience adopts the development message, peace is guaranteed in relation with sex.

The spatial relationship in terms of surface division followed the established principle of the 'golden mean'. This is suggested by visually extending an imaginary line from the hand of the female in red shirt to the bottom of the billboard poster, which produces a ratio of three to five (3:5) that as well conforms to the Fibonacci theory of harmonious surface division. Furthermore, the background is free of any distraction. The edges of the blue background colour into the figure created a vignette at the bottom of the poster that allows for gradual and peaceful transition of view into the picture, which a hardedge demarcation would have destroyed, and permits the eye to seamlessly move within the picture frame.

The Delayed Sexual Debut Campaign produced and employed suitable stimulus conditions that effectively elicited the desired responses from target audience. As a result, the campaign was a colossal success (Ebigbagha, 2010, 2012; citing the Nigerbus Research Group evaluation in 2004; and the National HIV/AIDS Reproductive Health Survey - NARHS evaluation in 2005; as cited in SFH Corporate Presentation, 2006).

The Use Condom Campaign in Nigeria

The Use Condom Campaign is an example of the prevalent production of ineffective graphic messages for development in Nigeria. Its goal was to sensitize audience to use condom as a preventive measure against HIV/AIDS. Stimulus produced includes posters, pamphlets and stickers, to mention a few. An examination of the media production process showed that there

was extremely low level of collaboration between the source, graphic encoder, and the target audience during the several stages in the media production process (Ebigbagha, 2010). Of these stimulus materials produced, a poster: "No Condom No Sex" and a Sticker "Female Condom Does Not Promote Promiscuity Use It" (Plate IIIa and Plate IIIb) respectively, would suffice to be examined in order to relate whether or not the quality of the graphic media produced elicited desired target audience response.

Plate IIIa and IIIb: (a) A poster on "No Condom, No Sex" and (b)A sticker on "Female Condom Does Not Promote Promiscuity Use It" by Society For Women and Aids in Africa

The poster "No Condom, No Sex" (Plate IIIa), warns against unprotected sex as a measure to stem the HIV/AIDS epidemic. The emphasis is on the use of condom. It depicts a man approaching three ladies in front of a building (brothel). The man is in attire commonly worn by Western and Northern Nigerians. The three ladies, each in front of a door to a room wore seductive attires and seem to communicate with the man. The illustration in the poster is fair but contains elements that could destroy the essence of the campaign because of semantic uncertainty. Some interpretations that could be inferred from it include the following: (i) only those who go to the brothel are at risk to contracting HIV/AIDS and need use condom. (ii) Only those who patronize prostitutes are at risk to contracting HIV/AIDS and need use condom. (iii) Only those who are from the Western and Northern Nigeria are at risk to contracting HIV/AIDS and need use condom; and (iv) Only those who want to prevent HIV/AIDS need use condom.

A consideration of these misleading interpretations would have been made at the draft stage, and proper decisions taken had the media draft been properly pre-tested with target audience. The attire of the man would have been revised because of the socio-cultural implication. Also the attention to brothels and prostitutes would have been revised because the most liable group to HIV/AIDS who are in the age group of fifteen to twenty-five years (SFH Corporate Presentation, 2006) are predominantly in the school and out-of-school environment, particularly on the street rather than in the brothel. Today, prostitution along the street is common and fashionable than the brothels.

The Sticker, 'Female Condom Does Not Promote Promiscuity Use It' (Plate IIIb), is a potent example of a stimulus that woefully failed to elicit the desired response from target audience (Ebigbagha, 2010).

The stimulus condition is a misleading misrepresentation of the message purported. The word 'Promiscuity' is emphasised with red colour and boldly written in capital letters. The prime message 'Female Condom' is de-emphasised with green colour though boldly written in capital and low letters. The supporting information 'Does not promote' and 'use it' are written in slim italics and further de-emphasised with black colour. The iconic image of the condom and the container are placed on both sides separately and further de-emphasised with

green colour in half tone. Each set of words are expressed in a different typeface and in all, there are four typefaces, which are too many for the given space.

On the whole, the haphazard placement of both the graphic and typographic elements defies any existing described/prescribed layout for the production of effective graphic language. At a distance, one is confronted with these three words 'Female Condom Promiscuity' The IEC materials seem to encourage promiscuity, which is against its real communication goal.

Besides, it is unattractive, uninteresting and loaded with uncertainties. The iconic image was paled to the point that it was insignificant and target audience asked for real representation for the purpose of clarity because they could neither understand it nor identify what it was.

From the foregoing, the campaign was a huge failure. It was found that proper evaluation (pre-testing, and summative evaluation) with target audience was neglected; and as a result, the stimulus produced was unable to elicit the desired response from target audience (Ebigbagha, 2010, 2013).

FINDINGS

Eliciting desired responses from target audience requires generating graphic messages that are target audience-based. A key way to achieving this is pre-testing media draft with target audience, as exemplified by The ORT Campaign in Egypt and The Delayed Sexual Debut Campaign in Nigeria. This provides needed knowledge of the two major determinants (Stimulus and Audience Conditions) of audience perception and response to graphic messages.

The pre-testing of media draft provides panacea for technical, semantic, syntactic, arousal/aesthetic, and response uncertainties that characterize most graphic communication campaigns in Nigeria, as shown in the Use Condom Campaign. Its neglect during the communication development process, usually result in the production of ineffective stimulus conditions that often leads to communication failure and create formidable barriers to effective graphic communication that is counterproductive.

The foregoing findings are hinged on a triangulation of methods (the Critical-Historical-Analytic Examination, and Content Analysis). The Content Analysis was employed to examine the graphic and typographic elements in the campaign media. This is in order to assess the stimulus conditions described/ prescribed in the Akar and Myers model of the perception process, which is salient for eliciting desired target audience response.

Furthermore, the Critical, Historical and Analytic Examination approach was utilised. This was to evaluate the consideration of audience conditions during the media production process and target audience response to the graphic media produced for campaign. These were achieved by critical and analytic examination of existing secondary data (related literatures, models and reports, to mention a few).

CONCLUSION

Making graphic messages based on target audience conditions is a key to eliciting desired target audience response in development communication. So, a diligent consideration of the knowledge, aptitude and practice (KAP) of target audience is indispensable to generating stimulus that attracts attention, stimulates interest, correctly interpreted and easily committed to memory and recall.

A prerequisite of effective target audience-based stimulus is pre-test of the media/stimulus

draft; which requires integrated planning and the collaboration of all communication actors including the target audience in the communication development process. This facilitates the understanding for the proper use of the element of design according to the principles of organisation within the context of the target audience KAP. In addition, satisfactory resolutions of uncertainties that usually occur in the graphic encoding process that are potent hindrances to achieving desired response are occasioned.

RECOMMENDATION

From the forgoing:

i. The graphic encoder, other communication actors, and the target audience need be embedded in the communication development process.

ii. The media team should be conversant with target audience conditions by thorough consideration of receivers' knowledge, aptitude and practices; and

iii. The Source should adopt strategies of evaluation, particularly pretesting media draft with target audience.

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The Economic Impact of Ikogosi Warm Spring on Its Immediate Environment

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ABSTRACT

Ikogosi warm spring is an important tourism resort in Ekiti State, Nigeria for which little has been known of its contributions to the development of its immediate environment. This study thus attempts to provide synthesized information on the impact of the tourism centre. Data for the study were collected using both primary and secondary sources. Specifically, 191 households being 10% of the total households of Ikogosi settlement were randomly and systematically selected for questionnaire administration. In the same way, questionnaire was also administered on 10% of the tourists found at the tourist centre. Apart from collecting information from the staff of the tourist centre using focus group discussions the officers of the State Tourism Board, useful data were gathered from relevant National and State publications. The findings showed that the tourism centre is an important resort for which the immediate past government had invested on though, the facilities so provided are underutilized. A significant impact in terms of improvement in the social life of the population, their occupation, particularly, trading activities and transportation were identified. The tourism Centre is not without its disadvantages which include destruction of fauna and adverse social behaviour by youths. The study recommends private – government partnership for effective management and effective publicity to raise the number of visitors to the tourism centre.

Keywords: Economic Impact, Ikogosi, Immediate environment, Tourism, Warm spring

INTRODUCTION

The contributions of tourism to the economic development of the Nations are widely acknowledged. No wonder the world tourism organization (WTO) argued that exports of tourism service generated $1,093 billion in 2010 and 30% of the total world exports of service accounted for $ 2670 billion. Ogunberu (2011) pointed out that tourism is the largest and fastest growing industry in the world. According to him, tourism accounts for about 7% of world capital investment with revenue predicted to rise up to 1.550 billion dollars by the year 2015. Akintude (2011) had elucidated that international tourism has been a major source of foreign exchange earnings in countries such as Saudi Arabia, United Arab emirate, United States and Spain. The contribution of tourism to employment generation cannot be over emphasized. The international labour organization (ILO) estimated that tourism generated 253 million jobs worldwide in 2010. A study of Vella (2011) in T20 countries confirmed the high rate of employment generation in those countries. Nigerian has several capacities that have not been used. Ikogosi warm spring in Ekiti west local government area of Ekiti State Nigerian is one of those tourism resources which are known but largely unexplored. Ekiti State Nigerian is not an oil producing state but has the warm spring which is a unique tourism resort. It is well known that tourism if well-developed could generate numerous opportunities for diversification of local economy, by attracting economic resources to areas where there are few opportunities for alternative (Vella, 2011).

Ogbuewu (2003), also argued that if tourism sector is developed has potentials in addition to to generate foreign exchange, encourage even development, promote tourism based rural enterprises, generate employment, and accelerate rural and urban integration and cultural exchange**.** This study is therefore aimed at assessing the impact of warm spring in Ikogosi town on his immediate environment with a view to assess the economic impact of the tourist centres on the host population and immediate communities. The paper takes off from this

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introduction to look at relevant literature to put the whole study in properly theoretical perspective. The literature search is followed with a view of the study area and the research methodology which is followed by analysis and discussion of findings. The findings will be followed with appropriate recommendation and conclusion.

THEORETICAL FRAME WORK AND LITERATURE REVIEW

Tourism has been described as a bundle of goods and service combined together with a fixed proportion (Ardahaey, 2010). According to Zaei and Zaei (2013), tourism is not limited only to activities in the accommodation and hospitality sector, transportation sector and entertainment sector with visitor's attraction, such as theme parks amusement parks, sports facilities, museums and others. But tourism and its management are closely connected to all major functions, process and procedures that are practised in various areas related to tourism as a system. Tourism is therefore, an economic sector which can significantly affect the economic growth of a region. Economic impacts associated with tourism arise as a result of the demand and supply relationships in the industry, the associated visitor and investment expenditure patterns that they stimulate, and the structure of the economy (Ardahaey, 2010). Ardahaey (2010) further argued that the demand and supply factors influence the number of visitors, their length of stay, and their expenditure patterns.

While the economy's structural characteristics determine its propensity to re-circulate that expenditure internally, tourism influences different categories of impacts, economic, physical and social. It is however argued that the links between the different categories of impacts, economic, physical and social are close and thus interpreted and indicated complex and difficult to measure and plan (Ardahaey, 2010). Economic impacts can be categorised into direct, indirect and induced impacts. Stynes (1997) defined direct effect as production change associated with the immediate effects of change in tourism expenditure. Impacts include payment for accommodation in hotels, travel cost and food and drinks. Direct impacts are related to issues directly affecting the tourism workers and the resorts environment. Indirect effects according to Stynes are production changes resulting from various round of re-spending of the hotel industry receipts in other backward linked industries.

The benefits include industry supply products to hotels and those who benefits from the expenditure of tourism workers. On the other hand induced effects are the changes in economic activity resulting from household spending of income earned directly and indirectly by tourists, spending their income in the local and the region for housing, food, transportation, array of household products and service need (Stynes, 1997).This paper will not attempt to differentiate these categories of impacts in its assessment. There are a number of techniques to assess tourism economic impacts. The economic impacts of tourist's expenditure can be calculated by using the multiplier analysis (Ardahaey, 2011). It is argued that economic features of tourism industry are that an income earned in places of residences, is spent in places visited (Holloway & Robinson, 1995).

According to Zaei and Zaei (2013) tourism is an instrument in transferring a vast sum of money from income generating countries to income receiving countries. The money spent by tourists in Zaei and Zaei's words does tend to percolate through levels. They further said that tourism as a source of income is not easy to measure with any degree of accuracy , nevertheless , the most common method for estimating income generated is to determine the ' multiple effect' in a destination. Multipliers may be expressed as ratio of sales income or employment, or as ratio of total income or employment changes relative to direct sales, multipliers express the degree of interdependency between sectors in a region's economy and therefore vary considerably across regions and sectors (Stynes, 1997).

The flow of money generated by tourist spending multiples as it passes through various segments of the economy. Referring to Holloway (1998), Ardahaey (2011) argued that there are four ways of measuring economic impacts of tourism, that is, the effect on income, employment, the area of balance of payment and finally the effect of investment and development. As much as possible this study will cover most of these areas particularly as revealed and limited by local factors

THE STUDY AREA AND RESEARCH METHODOLOGY

Ikogosi-Ekiti in Ekiti State is located in Southwest Nigeria which is situated between lofty, steep-sided and heavily wooded, north-south trending hills of about 27.4 km east of Ilesha (Osun State), it is also located about 10.5 km southeast of Effon Alaye (Ekiti State). Ikogosi warm spring is located north of the 7^{o} 35'N latitude and slightly west of the 5^{o} 00' E longitude. The elevation of the general area is between 457.0- 487 metres above sea level. Temperature ranges between 21° and 28°C with high humidity. The south westerly wind and the northeast trade winds blow in the rainy and dry (Harmattan) seasons respectively. Tropical forest exists in the south, while savannah occupies the northern peripheries. Ikogosi Warm Spring is selected as a case study because it is one of the most popular recreational centres with the highest recreational potentials in the State (Afolabi, 2006). The 1991 national population census puts the population of Ikogosi –Ekiti at 6,984 with 3,314 male and 3,670 female. And its estimated population in 1996 was 7,863. At present using a population growth rate of 2.5 percent, the town is estimated to have over 13,386 people.

The type of research design employed in this particular study is survey design. Data was collected from both primary and secondary sources. Data were collected from tourists and the people living around the tourist centre by the use of questionnaire. Also a focus group discussion was used to gather information from staff of the tourist centre. In addition to observation photographs of the tourists and the study area were taken. Information from the secondary source includes data on the number of visitors in the previous years from records of workers and recent policy of government from Ekiti state tourism board. The total number of questionnaire administered amounted to 10% of the total population and a figure of (191) people. Also 10% of the population of tourists, the researcher came across were randomly selected for interview. In order to analyse the data that were collected in the course of the research; both descriptive and inferential statistics were used. Tables and chart were employed to present the magnitude of occurrences of the variables that were obtained.

ANALYSIS AND DISCUSSION

As earlier mentioned most of the analysis and discussion were limited to direct impact, due to constraints of appropriate data in other areas of impact measurement. The employment issue is presented in table 1. Majority of the respondents that is, over 58% agreed that the presence of the tourism centre creates employment for the residents of the town. There is no doubt that the presence of the tourism centre has created employment opportunities because most of the staff of the tourism centre are residents of Ikogosi town. It was also noted that a lot of the youths in the town were engaged in transportation business, particularly motor cycle (okada) moving from the town to the tourism centre. In addition, there is the goosy bottle water company owned by UAC, this is located very close to the warm spring, majority of the staff of the company live in the town. This section on employment went further in its analysis by enquiring if the tourism centre had provided desirable jobs in the community. As indicate in table 2, 42.4% of the resident's disagreed that the tourism centre had provided the desirable job while 15.7% strongly disagreed. In other words more than 58% were of the opinion that the centre had not provided the desirable jobs. It was argued that the jobs provided were

seasonal, unskilled and low wages by this group. While about 15% of the residents were neutral on the job creation, up to 26% agreed that the right and desirable job were created.

Table 1: Creation of employment opportunities

Employment opportunities	Frequency	Percent
Strongly disagree	20	10.5
Disagree	10	5.2
Neutral	50	26.2
Agree	91	47.6
Strongly agree	20	10.5
Total	191	100.0

Table 2: Provision desirable jobs in the community

Provision of Desirable jobs	Frequency	Percent
Strongly disagree	30	15.7
Disagree	81	42.4
Neutral	30	15.7
Agree	21	11.0
Strongly agree	29	15.2
Total	191	100.0

Authors actually varied in the argument on value of tourism as far as job creation is concerned. Zaei and Zaei argued that tourism industry is high labour intensive service industry and hence a valuable source of employment. They argued it provides employment several times more than normal manufacturing industries. Ardahaey (2011) on the other hand believed that tourism employed more people in less developed countries and people employed are at lower performance level in order to keep their salaries low. Tourism effects are often invisible or covered as tourism might employ people from other sectors or people that would not otherwise be considered to belong to the available workforce. Therefore it might be difficult to measure and see the real impacts tourism has on employment.

The Result of the survey as shown in table 3 reveals if the price of goods and services in the community has increased as a result of the resort. As much as 63.9% of the residents sampled agreed that price of goods and services in the community have increased because of tourist resort. Also 5.3% strongly disagreed, 9.4% of the respondents disagreed while 20.9% strongly disagree. This section went further in its analysis by enquiring if the local businesses have benefitted from the tourists. Table 4 shows that 41.9% of the residents sampled agreed that their local businesses have benefited from the tourist while 20.9 % of the respondents disagreed. Also 20.9% were of neutral view, 10.5% of the respondent's strongly agreed while 5.8% strongly disagree. The local businesses that thrive as a result of the tourists include the petty trading and the motor cycle riding business (okada).

The major problems of the tourist centre were also examined so as to examine the impact of the problems on the economic development of the host communities. Table 5 shows that like most Nigerians, the host community blames the government for inadequate facilities at the centre with 42.9% choosing this as one of the main challenges of this site. Everyone seems to opine that the majority of the responsibility of the site rests with the government. Next to that 22.0% of the respondents were of the opinion that the problem of the tourist centre is as a result of lack of awareness of the centre. This presupposes that the government did not do enough publicity to attract visitors to the site. In other words, there was no enough publicity concerning the existence of the tourist centre, 13.1% of the respondents confirmed that the

level of patronage is low because the resort are mostly patronised during festive period. Also 6.8% of the host community respondents confirmed that the centre lack development which leads to massive emigration of the youths that they believed are much needed for the promotion and every day running and maintenance of the centre. They ascribe the emigration movements to the State capitals around the communities such as Akure and Ado Ekiti .Other problems includes; difficult topographical terrain with 9.9 % and there was more or less no blame on the tourist themselves with just 6.8% of the respondents putting the blame on bad usage by the tourists.

Table 3 Increase in price of goods and services

Increase in price of goods and services	Frequency	Percent
Strongly disagree	40	20.9
Disagree	18	9.4
Agree	120	63.9
Strongly agree	11	5.8
Total	191	100.0

Table 4. Assessment of Business Benefit from Tourist

Business Benefit from Tourist	Frequency	Percent
Strongly disagree	11	5.8
Disagree	40	20.9
Neutral	40	20.9
Agree	80	41.9
Strongly agree	20	10.5
Total	191	100.0

Table 5. *Major problems of the tourist centre*

Major problems of the tourist centre	Frequency	Percent
Inadequate government intervention	82	42.9
Difficult terrain	25	9.9
Lack of awareness	42	22.0
bad usage by the tourist	13	5.2
emigration of youth	19	6.8
Low level of patronage	10	13.1
Total	191	100.0

CONCLUSION

This study has tried to assess economic impacts of Ikogosi tourism on its hosting environment. While there have been some significant impacts, the impact have not been enough. They are not outstanding enough because opportunities that are supposed to be available have not been fully tapped. Majority of the respondent were of the opinion that the centre had not provided the desirable jobs. It was argued that the jobs provided were seasonal, unskilled and low wages by this group. Also only 41.9% of the agreed that there business as benefited as a result of the resort the study thus recommends that some of those opportunities be fully utilized. Information from the tourists and observation show that the tourist centre has not attracted enough international tourists. This is evidence that there has not been a satisfactory level of publicity.

RECOMMENDATIONS

It is well known that tourism generate numerous opportunities for diversification of local economic by attracting economic resource to area where there are few opportunities (Vellas, 2011). Ekiti state is not an oil producing state, both the government and individual should take the advantage of the resource available with Ikogosi resorts to come up with economic enhancing opportunities. Apart from Ekiti state government provided chalets there are no hotels and standard restaurants in Ikogosi, this is among the area where private investors should come in. Government need to provide the enabling environment to attract private investors in tourism development in the region. In relation to the above is the relatively unknown of Ikogosi warm spring internationally as found in this study. This due to lack of publication, Both the Nigeria and Ekiti governments need to embark on high profile publication to make the resorts recognised nationally and internationally.

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Preference of Visual Aesthetic Architectural Features amongst Practicing Architects

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ABSTRACT

This study entails assessment of the approach façade of some selected public buildings in Akure, Nigeria for visual aesthetic quality. The study sought to find out if preference for certain aesthetic building features were common in architects or if individual divergent choices existed. Twelve buildings were assessed for visual quality and five architectural features were considered as the variables for the study. They include: entrance design, façade colour, roof design, fenestration design, and innovation in overall shape of the buildings. Previous studies have shown that there are divergent views on preferences for aesthetic features between laypersons and building professionals. Therefore, this study concentrated on building professionals in the assessments-particularly practicing architects. Preferences for visual features in buildings are based on what people like or dislike, hence a level of subjectivity is allowed in peoples' choices within the study. Digital photography was used in capturing the images of the twelve building samples and these images were used alongside questionnaires as first hand visual data so as to elicit information on preferences for aesthetic features. Some results indicated that though some of the buildings were visually appealing, they were lacking in other aesthetic appeal and other buildings that were not so visually appealing had some striking aesthetic features. Recommendations from this study will assist designers especially architects in creating buildings that are more visually appealing and more public friendly.

Keywords: architecture, architectural features, assessment, buildings' façade, visual aesthetics

INTRODUCTION

To prefer a thing to another means having more likeness for the preferred object compared to other objects. In nature generally, humans continuously process visual information either consciously or unconsciously, thereby making visual processing the most processed data in humans. Ware (2008) affirm that the visual sense is an exceptional human quality required in perception in many disciplines including art and architecture while Leone (2013), opines that scientists have confirmed that half the human brain is devoted to processing visual images, and 80 percent of learning is based on visual inputs. Visual aesthetics means the perception or appreciation of objects that are appealing to the sense of sight. The environment in which we live, work and play contains and emits features that portend and evoke stimuli in people. The built environment which architecture is a subset of contains visual features that creates an interaction with observers when visually perceived. According to Sanoff (1991), buildings have certain qualities that give them a high probability of evoking a strong image in any given observer. Characteristics like shape, colour, or arrangement enable the making of vividly identified mental images of the environment. Buildings are also objects with features that can transmit non verbal messages and can be subjected to visual experience of an observer for aesthetic judgment. Buildings can be judged based on their physical features especially along how pure the lines are, colour, texture, form, size etcetera. Goldman (2001) suggests that applying aesthetics to buildings and related architectural structures is a complex phenomenon, and aesthetics in buildings can be studied from either of two or both vital factors. These are extrinsic and intrinsic factors to visual design. Extrinsic factors comprise structural integrity, cost, nature of building materials, and functional utility of the building,

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while the intrinsic factors are elements of visual interests that are perceptible and sensory and can be evaluated in buildings.

Despite the fact that architecture can be considered as visual art, assessment of building facades for visual aesthetic quality and post occupancy evaluations especially of public buildings are rarely done in this part of the world thereby making studies around visual quality difficult. However, this creates a huge research gap by making the visual field a virgin area of research in architecture especially in the tropics where housing affordability and quality still remains a mirage for the teeming populace. Researching visual aesthetics in buildings can be a difficult task as agreed by Goldman (ibid), but this is an attempt to close the existing research gap a little and to open up channels for further studies. Onsite field observation checks reveal that low visual aesthetics exists in most of the building samples for this research. This research work aims at assessing public buildings facades to study preference for architectural features among practicing architects with a view to developing a framework towards higher visual quality standards in public buildings.

REVIEW OF LITERATURE

Previous studies have shown that visual aesthetic quality in buildings has been understudied Nasar, (1994), and (Zhang 2009). This phenomenon according to (Fuerst, McAllister and Murray, 2011), could be attributed to the high level of subjectivity involved in the assessment of visual properties. In particular, the distinction between experts and lay persons can be a crucial variable. For instance it is notable that surveys have found that there tend to be significant differences in the ratings of design quality between the public and design professionals (Brown and Gifford, 2001). Delvin and Nasar, (2004) further showed that even among professionals, significant differences still exist within and across professionals. Despite these difficulties, this should be a challenge and an avenue for further studies towards opening up more researches into the visual aesthetic field, especially among building professionals.

Ulrich and Gilpin (2003), noted that generally speaking on studies of visual environments including urban architecture and interiors as well as natural environments, there appears to be a strong preference for natural scenes compared to urban scenes for different population groups around the world._Tonio & Leder (2009), studied familiarity of simple and complex stimuli in observers and findings indicate that preference for complexity showed strong contrast effects with more familiarization. Observers familiarized with simple stimuli preferred more complex stimuli, while those familiarized with complex stimuli later preferred simpler stimuli. Bar and Neta (2006), recently found that people tend to prefer objects with curved contours to similar objects with sharp contours. This is an indication that sharp contours are more threatening and could be harmful than curved ones. Preferences for colour in gender as indicated by Chiu et al (2006) also discovered that girls within the ages of 3-12 tend to prefer pink and purple, while boys of the same age group show more preference for red and blue. Products experts especially in kids toys have taken advantage of such discoveries from the results of such studies to develop gender-specific toys that follow such colour patterns. However, these colour preferences within gender changes with age as children mature.

Other studies with features of the built environment as direct predictors of aesthetic appraisals reveal that in building interiors, unusually high ceilings, presence of windows and squares rooms as opposed to rectangular ones are associated with high preference (Kaye& Murray, 1982). Other studies about abstract variables such as cognitive constructs show greater preference for buildings that have moderate complexity, and buildings that appear more orderly or coherent (Herzog, 1992). Ghomeshi, Nikpour and Jusan (2012), found out in

a study on 'architects perspective of identifying different aesthetic quality of buildings', that building attributes have different values and meanings among architects, and while some cues are very important for architects, some were not so much important. Using an instrument called 'TACS' The Architectural Coding System, the study indicated that architects prefer glass cladding, bricks and colour uniformity among others, and had a strong dislike for circular windows. Gifford et al (2000), found out that architects preference for buildings with more railings, fewer arches and more metal cladding elicit more pleasure and buildings that had more triangular elements and more rounded edges and corners were fancier and elicit feelings of arousal within architects. The study also found that a combined feeling of pleasure and arousal was noticed within architects as it appears that metal-clad buildings excite architects. Gifford and friends attribute this perception and preference in architects to their training and experience compared to non architects. However, he concluded that it has become clearer that not all observers appraise buildings in the same way and that it is necessary to learn how appraisals within different groups vary.

The issue of taste and experience becomes key when an aesthetic experience is judged. Joshi *et al* (2012), attributes this to the highly subjective nature in aesthetic experience explaining that it is the reason why same photographs can be appreciated by some observers and not appreciated by others. Other important factors that come into play when judging an aesthetic experience include exposure by observers to previous works to be judged, cultural differences, emotional evocations and other personal attributes. Aesthetic opinions/judgments have been found to be dynamic as human observers aesthetic feelings can change over time.

METHODOLOGY

This study was carried out in Alagbaka area of Akure in Southwest Nigeria. The study employed a quantitative methods approach and a survey and observation method was adopted while a questionnaire was structured to elicit relevant quantitative information from respondents. It was necessary to measure visual aesthetic quality by quantitatively assigning values to several building features that can be visually assessed through two-dimensional graphic representations using digital images. The building features should have the characteristics that can be evaluated through direct observation of the captured building images. The views captured, as much as possible show the building features that were assessed. 50 respondents were targeted for the full scale study. On that account, 10 respondents representing 20% of participants were administered questionnaires for the pilot survey. The target group was strictly architects as only professional assessments of experts were sought within the study. The intention of the study was to get opinions of experts and not lay persons as a huge gap has been shown to exist between perceptions and preferences between architects and non-architects.

This necessitated the need to carry out the study using architects alone. This method was adopted so as to find reliable, objective and simple straight-forward means of measuring visual aesthetic quality in buildings that can also be applied to other types of buildings as well. To stimulate visual interests, 12 modern urban building images were captured using digital camera and the digital images of the buildings were included within the questionnaire so as to elicit aesthetic responses from the target group. According to Groat 1988, Nasar 1998, & Stamps 2000) a strong correlation was found between preferences expressed in 2D representations in photographic forms and preferences indicated onsite, although a negative correlation was found when original paintings and sculptures were assessed onsite than online (Joshi *et al*, 2012).

A five point Likert-like scale was used to generate numeric values within the survey questionnaire that was developed for quantitative analysis. The questionnaire was designed

around the five variables to be studied and was refined to maximize the time limit spent on responses. This type of method of enquiry is commonly used among researchers in environmental aesthetics as it is a method of qualitative interview which involves using digital camera to capture first hand visual data of the physical appearance of the building images as existing on site was adopted and corresponding questions were directed to respondents on the photographed buildings using quantitative measures. The research assistants took snapshots of the buildings from different positions, while the best snapshots that showed more visual features were chosen for the study samples. 5 research assistants were co-opted into the research team and were effectively utilized during the field study and questionnaire administration.

FINDINGS AND DISCUSSIONS

Perception of Visual Aesthetic Quality of Public Buildings among Design Professionals

Five variables were assessed in twelve building images for visual aesthetic quality among practicing professional architects, while the five building characteristics include: roof design, entrance design, fenestration design, façade colour and innovation in building shape. The calculated mean scores were very useful in making comparisons within the ordinal data provided. However stronger comparisons could be achieved using percentage scores for each variable within the 12 building images. Joshi *et al* (2012), posits that when a photographic scene is rated by observers on a merit scale on the basis of its aesthetic qualities, the average score can be thought of as an estimator for its intrinsic aesthetic quality. Descriptive summary for the twelve buildings are as presented in table 1. It shows the mean distribution of the roof design, fenestration design, façade colour, entrance design and Innovation in building shape, including the appropriate ranking for all 12 buildings.

Table 1: shows the mean values of individual buildings against the five respective variables within the study.

Building images	**Roof design**		**Fenestration des.**		**Façade color**		**Entrance des.**		**Inn. in shape**		***Overall***	
	Overall Mean	Rank	Overall Mean	Rank	Overall Mean	Rank	Overall Mean	Rank	Overall Mean	Rank	Overall Mean	Rank
Building 1	2.45	11	3.30	8	2.93	10	2.77	10	2.11	12	*2.71*	11
Building 2	4.27	1	3.79	4	3.79	3	3.13	8	3.97	2	*3.79*	3
Building 3	3.11	8	2.72	12	3.02	9	3.18	7	2.88	8	*2.98*	10
Building 4	2.59	10	3.61	7	2.88	11	3.27	6	2.61	10	*2.99*	9
Building 5	3.16	7	3.22	11	3.15	8	3.81	2	2.97	7	*3.26*	7
Building 6	3.52	4	3.72	5	3.56	4	3.75	3	3.50	4	*3.61*	4
Building 7	3.36	6	3.29	9	3.54	6	3.61	4	3.36	6	*3.43*	6
Building 8	2.72	9	3.68	6	3.27	7	2.54	11	2.77	9	*3.00*	8
Building 9	2.02	12	3.29	9	2.00	12	2.02	12	2.40	11	*2.35*	12
Building 10	3.45	5	4.04	3	3.56	4	2.97	9	3.38	5	*3.48*	5
Building 11	3.56	3	4.27	1	3.88	2	3.52	5	3.97	2	*3.84*	2
Building 12	3.77	2	4.06	2	3.93	1	4.15	1	4.52	1	*4.09*	1
Average	*3.17*		*3.58*		*3.29*		*3.23*		*3.20*		*3.29*	

From the average of the mean values shown in table 1, it can be deduced that fenestration designs for the building features ranked 1st in terms of perception among professional architects with an average of 3.58. This indicates that fenestration designs are ranked high in

public buildings. This can be attributed to a common design trend in the tropics where weather situations can be very hot amidst poor power supply. Large symmetric fenestration designs, especially for windows allow natural cross ventilation thereby reducing the effects of hot weather and thereby cooling the building interiors. Façade colour ranks 2nd-3.29. This could be an indication that architects use colours well for a sense of appeal in building facades. Entrance design ranks third with an average score of 3.23. However, innovation in building shape ranks 4th among the five variables studied with an average of 3.20. This result could be an indication that innovation in building shape in public buildings should be given more attention. Roof design ranks 5th with an average of 3.17. This is a clear indication that roof designs have least visual appeal in public buildings in Akure.

The table also shows an estimation of the average of all the five building attributes assessed for visual quality. On the overall average, building 12 was ranked 1st in terms of visual aesthetic quality with an average of 4.09. Building 11 ranked 2nd with an average of 3.84, building 2 ranked 3rd with an average of 3.79. 4th is building 6, 5th-building 10, and 6th is building 7. Others are: building 5 ranked 7th, building 8 ranked 8th, building 4 came 9th with an average of 2.99, while building 3 ranked 10th position in visual quality. Surprisingly, building 1 ranked 11th with an average of 2.71 and building 9 ranked last position with an average of 2.35.

Interestingly, some of the buildings, especially the last ranked 3 positions, were ranked relatively high in some of the building features assessed compared to their total average. For example, building 3 ranked 10th overall position, but still showed some strength in entrance design- 3.18, facade colour-3.02 and roof design-3.11. Also, building 1 ranked 11th position overall, but showed some strength in fenestration design-3.30. And building 9 too, showed some strength in fenestration design with an average of 3.29.

A closer look at table 1, show that the best 3 ranked buildings (i.e buildings 12, 11 and 3) have the highest average score in innovation in building shape, fenestration design and roof design. This could be an indication why the three buildings were ranked as the best three amongst other reasons. However, innovation in building shape and roof design ranked 4th and 5th positions in the assessments of building features, showing that less attention is given to innovation in building shapes and roof designs.

Preference for Building Features of Public Buildings among Professional Architects

Within the study, preference for five building features which include roof design, fenestration design, façade colour, entrance design and innovation in building shape was sought on the facades of the 12 building samples among professional architects. In some building facades, some features are more striking and therefore dominate other features and are therefore preferred to others. Following the most dominant score concept of Joshi *et al* (2012) as used for aesthetic emotions, the most dominant score concept was employed for preference voting for each of the five building feature within the 12 building images, and the most dominant score or single majority vote for each building feature was accepted as the true reflection of observers preference. It should also be noted that where no most dominant score exist for any building, the closest option will be to accept the one-third majority vote. Table 2 shows respondents' preferences for the five building features in percentages.

In building 1, fenestration design is most preferred with 44% compared to roof design and façade colour with 20% each. Entrance design is ranked 4th and only 2% of respondents like the shape of the building. In building 2, 44% of respondents prefer the building's roof design, while 24% believe its innovation in shape is interesting. Both façade colour and entrance design for building 2 have 12% each and its fenestration design poorly preferred with only 6%. Roof design is most preferred in building 2. For building 3, 32% of respondents prefer its

façade colour, while an average of 21% was voted for three building features, namely: roof design, fenestration design and entrance designs. Only 2% believe there is innovation in its building shape. This makes façade colour most dominant of its building features.

Table 2: Shows the percentage of respondents that chose the five building attributes under study among the 12 building images.

Building images	Roof design	Fenestr. Des.	Façade colour	Entrance Des.	Innov. In bldg shape
Building image 1	20	44	20	10	2
Building image 2	44	6	12	12	24
Building image 3	22	20	32	20	2
Building image 4	4	44	24	24	2
Building image 5	10	16	18	50	4
Building image 6	22	30	20	18	8
Building image 7	6	32	22	36	4
Building image 8	12	38	22	12	12
Building image 9	10	54	12	12	2
Building image 10	22	28	24	18	6
Building image 11	4	22	28	20	24
Building image 12	2	6	8	16	68

For building 4, fenestration design was most preferred with 44% response rate. 24% each chose façade colour and entrance design, while roof design and innovation in building shape were poorly voted with 4 and 2% each. For building 5, half the number of respondents representing 50%, prefer its entrance design. 18% prefer its façade colour, while its roof design and innovation in building shape are 10 and 4% respectively. For building 6, 30% prefer its fenestration design while its roof design, façade colour and entrance design are almost evenly preferred with 22%, 20% and 18% respectively. Innovation in building shape is least preferred with 8%.

Table 3 is a summary of table 2 showing only where most dominant feature/score occurred.

Building images	Most dominant feature	Percentage score
Building image 1	Fenestration Design	44%
Building image 2	Roof design	44%
Building image 3	Façade colour	32%
Building image 4	Fenestration Design	44%
Building image 5	Entrance Design	50%
Building image 6	Fenestration Design	30%
Building image 7	No most dominant feature	-
Building image 8	Fenestration Design	38%
Building image 9	Fenestration Design	54 %
Building image 10	No most dominant feature	-
Building image 11	No most dominant feature	-
Building image 12	Innovation In bldg shape	68%

For building 7, 32% prefer its entrance design, closely followed by fenestration design-32%, façade colour-22% and 4th and 5th place were roof design and innovation in building shape. In Building 8, 38% of respondents prefer its fenestration design. Closely followed by 22% façade colour. Roof design, entrance design and innovation in building shape were all rated 3rd with 12% each. Building 9 however has over half of respondents prefer its fenestration design with 54%. 54% is the second highest preferred score for any building feature. An average of 11% prefer three of its features, namely: roof plan, façade colour and entrance design. The least preferred building feature for building 9 is innovation of building shape with 2%. Despite building 9 ranking 12th position (table 2) it has the 2nd highest score among the five building features investigated and the highest score for fenestration design (54%).

Building 10 has an almost even distribution for four of the building features namely: roof design, fenestration design, façade colour and entrance design with 22, 28, 24 and 18% respectively. The least preferred building feature for building 10 is innovation in building shape. Building 11 has a similar distribution like building 10 except for that the choice of building features are slightly different. In building 11, the even distribution are for fenestration design, façade colour, entrance design and innovation in building shape with 22, 28, 20 and 24% respectively, except for roof design with the lowest preference of 4%. Building 12 has the highest percentage (68%) for innovation in building shape. This possibly explains why it ranks 1st in overall building features in table 1. Entrance design ranks 2nd while the other features: roof design, fenestration design and façade colour rank low- 2, 6 and 8% respectively.

In all the building images investigated, it is obvious in the percentage scores that all the building features were preferred by observers in all the buildings represented, though some features were scored very low while others very high, yet some others were moderately preferred. It appears that preference for building features is highly subjective and is relative from person to person. This statement is further corroborated with the Pearson Chi-square test below to check individual difference among the professional architects.

Pearson Chi-Square test was used to analyze quantitative data. Five building features where assessed within the 12 building samples among 50 professional architects. The results for the Chi-Square tests are presented in table 4 below:

Building images	Value count	df	Asymp. Sig. (2 sided)	min. expected
Building image 1	2.917	10	.983	.12
Building image 2	7.617	10	.666	.12
Building image 3	10.762	10	.376	.12
Building image 4	12.460	10	.255	.12
Building image 5	8.956	10	.536	.12
Building image 6	13.748	10	.185	.12
Building image 7	5.443	8	.709	.24
Building image 8	15.818	10	.105	.24
Building image 9	7.708	10	.657	.12
Building image 10	5.956	10	.819	.12
Building image 11	13.485	10	.198	.12
Building image 12	9.542	8	.299	.12

The asymptotic significance level calculated for all the building features within the 12 building samples among the professional architects were all greater than 0.05. Therefore this is a clear indication that no significant difference was found in individual architects' preferences for aesthetic building features in the 12 building samples tested.

CONCLUSION

Practicing architects are challenged to create an all-inclusive and well balanced aesthetic façade design especially for public buildings, bearing in mind that aesthetic features of buildings constitute and trigger aesthetics responses in observers. Innovations in building shape and roof design were played down in samples of public buildings façades studied, yet they play an integral and key area in making building facades worthwhile aesthetic experiences.

This study did not consider the emotional evocations of professional architects and that of other design or building professionals within its scope. It also did not study aesthetic

emotional responses of users and Clients of buildings. These are areas of further research that can throw more light into aesthetic perceptions and preferences of observers, thereby enhancing architects aesthetic appeal for public buildings and other building typologies. The policy recommendation for this paper is for architects to continue being very aware in their aesthetic appeal and to create more innovative buildings with appealing roof designs especially in public buildings.

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APPENDIX 1

Digital photographic images of some of the 12 building samples used for the study to assess visual aesthetic quality of public buildings in akure, nigeria.

Building image 1

Building image 2

Building image 4

Building image 7

Building image 9

Building image 1

Synopsis of Washed and Unwashed Eucalyptus Ash Treatments on Formulated Ceramic Glaze Properties

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ABSTRACT

Art and science share a fundamental convergence, especially in applied arts; this is the field of Ceramics. Ceramics does not stop only at the art of pottery and aesthetics but goes further into the material science of the organic and inorganic constituents of a body or glaze while their qualitative and quantitative analyses are also brought to the fore. The objective of this paper was the formulation of high quality ceramic glazes from 100% locally sourced and treated materials to solve the problem of current dependence of Nigerian potters, and the extant Ceramics Industry, on foreign glazes and materials for compounding them. Eucalyptus leaf ash, from the eucalyptus forest of Rafin Zurfi, of Bauchi LGA; Ball clay, from Gubi Dam, Bauchi LGA; and Granite, from Julius Berger Construction Company quarry, at Miri, on Jos – Bauchi Express, Bauchi LGA; were sourced, processed, chemically analyzed and used as the three main materials for ceramic glazes, in a Tri-axial blend at 1100^{o}C. The formulation batch and glazing were subjected to two separate tests. The first with washed Eucalyptus leaves ash and the second with unwashed. The research produced a variety of fused Earthenware glazes. The chemical constituents of each of the elements had particular characteristic effects on the resultant glazes, according to their percentage content in the materials used. The percentage difference in the effects of the two treatments on Eucalyptus ash on the glazes produced was 51.52% washed to 57.58% unwashed.

Keywords: Batch, Earthenware, Eucalyptus, Glaze and Tri-axial

Introduction

As the name implies, ash glaze is derived from ashes. The earliest such glazes can be traced back to the Shang period in China (1500 B.C.), and it is thought they were produced accidentally, the result of white-hot wood ash being carried through the kiln with the draft of the fire and settling onto the pots, where the searing white heat melted it to a glass. Three thousand years later, ash has remained an important and immensely popular feature of pottery glaze making, (Edmund, 2015).

Ash glaze has glasslike and pooling characteristics which puts emphasis on the surface texture of the piece being glazed, the final result is mostly from dark brown to green. Pieces with ash glaze resemble the earth in color and texture. As the ash percentage decreases, the artist has more control on the color and the final glaze color differs from light to dark shades of brown or green. (Rogers, 2003).

For the modern potter, the satisfaction of working with ash glazes comes from following an ancient tradition as well as from using materials that occur naturally. The results of different wood ashes often vary dramatically, making it possible to achieve a wide range of unique finishes. Even wood from the same species of tree garnered just miles apart can produce subtly different results, (Lombardo, 2003). Current ash glazes usually contain less than 50% wood ash compared to before when the majority of the glaze was ash. The decrease in ash percentage is to give some control over the chemical makeup and result of the glaze. Ash glazes are mostly used by artists as a decorative tool, but some still use ash glaze ware.

In Korea, the traditional ash glaze composed of only ash and water is used to make functional pottery such as bowls, cups, and teapots. To create the ash, the wood needs to burn completely in a kiln. Wood-ash is around 1% the mass of the original wood; therefore, a lot

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of wood is necessary to produce the ash. The ash is then put through a sieve to eliminate the excess clumps from the ash. At this point artists can process the ash further to create a more uniform mixture or leave it unprocessed so there are more random final results. To process the ash, water is first added to the mixture and left to settle for a couple hours. The solution is drained and dried and the result is ash containing less harmful chemicals like some soluble alkalis, (Svoboda, 2010).

LITERATURE REVIEW

Ash Glazes

The practice of incorporating ashes into glazes is a long tradition, and the qualities imparted to such glazes are appreciable. Although ash can hardly be classified with rocks, its constituent materials/minerals too derived from the earth. It has the general formular: $Al_2O_3.SiO_2.CaO.Fe_2O_3$, (Ajala, 2007). Ashes are non-combustible remains of animals (bones) and plants, it also contains or provides fluxing and other oxides. The main ores concerned are calcia, phosphorus peroxide, potash soda, alumina, silica and many trace oxides. Although the original matter is organic (that is, with carbon being the most important element and hydrogen, nitrogen and sulphur also involved) the potter is seeking the inorganic content. Thus from a large bulk or wood, the potter collects a relatively small amount of ash. Even so, the ash is only a halfway stage between the original matter and the required oxides.

Vegetable ashes contain carbon, sulphur, fluorine and chlorine. Bone ash contains carbon and fluorine. The burning of the original matter is not intended to, and in fact cannot completely, create non-volatile compounds. The burning is a preparation, controlled calcination, which removes the bulk of unwanted carbon, hydrogen, and sulphur and renders the material to a useable form. The elements involved have reached stable states for dry conditions as oxides, carbonates, sulphates, phosphates, chlorides and fluorides. Some unwanted compounds can be removed by washing the ash but most will be removed during the forming when the presence of silicates will cause decomposition of the compound oxides and volatiles, (Frank & Janet, 1991).

Chemical Constituents of Organic Ash

Wood ash is primarily made up of calcium carbonate, which is used in many glaze recipes. The ash also contains potassium carbonate, phosphates, and other metals; however, the ratio of these chemicals depend on the location, soil, and type of wood the ash came from, (Ajala, 2010). The different chemical compositions make the glaze to produce different results from batch to batch. Furthermore, two pieces with the same glaze batch can even have different results. If the ash is not cleaned or mixed thoroughly, some parts of the glaze mixture can have more of one chemical and others could have more of another making each part of the glaze to actually have varying concentrations of chemicals.

A few contain sufficient silica to fuse to a glass alone, but the majority of ashes are therefore considered as fluxes especially for glazes, (Frank & Janet, 1991). They also introduce colouring and crystallizers, which give textures. Many wood ashes contain a large proportion of monovalent oxides, which give strong fluxing action at stoneware temperature. If sufficient as is used, and it is the glaze's only flux, it creates the decorative effect known as stinging, (Marshall, 1993).

As opined by La Meridiana International School of Ceramic Art in Tuscany, (Notes on Ash Glazes, 2004), most ashes will melt to a fluid glass at around cone 10. When ash is used alone as a glaze, it will usually result in a rather thin, watery-looking glaze. Ashes vary rather widely in composition, and even the ash of a given variety of tree will vary, depending on the soil in which it grew. The use of ash in glazes depends, therefore, on testing and

experimentation with the material at hand. It may be difficult to locate a reliable source of ash which will be uniform in composition, but some potters have successfully used the ashes from the burning of waste in sawmills or fireplaces. The ashes from burned corncobs, rice hulls, or other agricultural wastes such as fruit pits offer possible sources. Volcanic ash has been successfully used as a glaze material. In small quantities, of say 10% or less, it is not a dominant ingredient and can usually be replaced with feldspar or even omitted without noticeable effect. But in amounts over about 25% it usually contributes distinct colour and texture. Recipes which simply specify 'wood ash' usually mean from a general mixture of woods. The particular qualities of ash are better exploited in reduction than in oxidation, although interesting results can be achieved in electric kilns.

Preparation of Ash for Glazes

To prepare plant ash for use, one must first ensure that it is well-burnt. For practical work the ash must also be available in sufficient quantity, at least half a bucket, and preferably more. A careful initial sieving through a garden sieve will remove the rough stuff. It is then soaked in plenty of water and passed through a 30 mesh. As the ash settles, the surface water will contain a considerable concentration of soluble alkalis and will be caustic. This liquid can be poured or siphoned away and replaced with clean water. The ash is well-stirred and again left to settle then passed through 80 mesh. Ash is caustic, it is therefore advisable to carry out these operations in a well-ventilated area with a respirator, and wear safety goggles and chemical resistant gloves. Dry wood ash, whether in the raw or prepared state, is a potentially hazardous material. It contains light particles of silica and, in the raw state, caustic material. When ash is handled in the dry state this should be with due care, avoiding the creation of airborne dust, (Lombardo, 2003).

Table 1: Standard Analysis of a Sample Ash Glaze

Ingredients	Granite	Wood Ash	Fusible Clay
SiO_2	71.9	52.0	52.7
Al_2O_3	14.6	4.0	18.2
Fe_2O_3	1.4	2.7	6.2
CaO	0.9	23.1	4.7
MgO	0.7	2.6	3.4
K_2O	5.3	6.7	3.2
Na_2O	2.9	1.0	0.5
Others	2.3	5.2	1.8
Total	**100.0**	**100.0**	**100.0**

Source: (Department of Industrial, Ceramics Section, ABU, Zaria. 2002)

The 'washing' process can be repeated two or three times, during which fluxes will be removed and the ash will become progressively more refractory. Reasonable washing is essential for ash which is to be added to tableware glazes, but for purely decorative purposes a totally unwashed ash can give entertaining results (Beth, 2015).

After the final settling and decanting, the sludge is spread out to dry. When dry it is stored and weighed like any other ingredient, care being taken not to raise too much dust. Some potters prefer to wash the ash several times by soaking it in water, then sieving the mixture through a mesh. They may repeat the procedure four or time times. The washing process removes the soluble salts from the ash and often produces a better-behaved glaze. (The Saint John's Pottery, 2015). But there are also other potters who argue that the washing removes some interesting qualities of the ash. They prefer simply of sieve, the ash, dry, through a mesh to remove all the large particles. Once prepared, the ash, if wet, should be dried. It can then be weighed out in the same way as other glaze ingredients. Tony H. (2008)

For washed ash, after burning, the procedure is to mix the ash with plenty of water in a container and to remove the charcoal and scum, which rises to the surface with a coarse sieve. Then the mixture is promptly decanted, leaving any grit or sand at the bottom of the first container. The next step is to run the liquid through a 60 – 100mesh sieve and presence what will not pass through it, together with the coarse charcoal, for drying and further burning. Finally the ash is passed through 100 – 200 mesh, according to the requirement of the glaze. After the ash has settled for a few hours the brackish surface water containing the greater part of the soluble alkalis is powered off. Fresh water is added and the decanting repeated until the water is clear and tasteless. The ash is then dried and stored or used (Ajala, 2002).

METHODOLOGY

The materials used were locally sourced from Bauchi State, Nigeria. They are eucalyptus leaves, ball clay and granite. Bauchi is one of the six states in the North-Eastern geo-political zone of Nigeria. It experiences about 6 to 7 months of rainy season in a year and about 5 to 6 months of dry season. Temperatures are generally high, where mean daily maximum temperature ranges from 29.2^{0}C in July and August to 37.6^{0}C in March and April. The mean daily minimum ranges from about 11.7^{0}C in December and January to about 24.7^0 C in April and May. The sunshine hours range from about 5.1 hours in July to about 8.9 hours in November. The monthly rainfall ranges from 0.0mm in December and January to about 343mm in July. Onset of rains is often in March while they end in October. Bauchi State has two distinct vegetation zones: the Sudan savannah in the southern part and the Sahel savannah in the northern part. It is generally characterized by undifferentiated (mixed) woodlots particularly mixed acacia. Bauchi State is also endowed with different types of mineral resources. The following minerals are found in its administrative region, they are Gold, Cassiterite (tin), Haematite, Granite, Precious Stones, Galena, Coal, Limestone, Gypsum, Wolframite Silica Mica, Corundum, Graphite, Zinc oxide, Clay, Tungsten, Wolframite and Molybdenite, (Ajala, 2010).

Sourcing of Materials

Eucalyptus leaves were used as raw material for the production of ash that was used. The eucalyptus forest in Rafin Zurfi, near Gwallameji, Bauchi L.G.A was ear-marked as the location where the leaves were sourced. The trees were planted in 1990 (25 years ago), by the one-time Director of Forest Management, Bauchi State, Abdul Leeman. The trees cover about 100 by 300meters. Bauchi L.G.A was the source of the ball clay that was used for the purpose of this study. Granite was sourced from the Julius Berger Quarry Site along Jos – Bauchi Express. Since granite is hard and may not be easily crushed, granite dust was collected from the quarry site instead.

Ball Clay Processing

After the ball clay had been collected from site, it was blunged and then passed through the ball milling machine, sieved and water milled again. The resultant product was then dried and made ready for use.

Granite Dust Processing

Owing to the hardness to crush of granite, granite dust was collected instead, from the quarry site was collected, sieved and used.

Laboratory Tests

Tests were carried out on the 3 materials used. Chemical analyses were carried out on the ash (washed and Unwashed), ball clay and granite, at the National Metallurgical Development Centre, Jos.

Table 2: Results of Chemical Analyses of Eucalyptus Leaf Ash, Ball Clay and Granite

SAMPLES	PARAMETERS (%)							
	Al_2O_3	SiO_2	Fe_2O_3	CaO	MgO	K_2O	Na_2O	Others
Eucalyptus Ash (Washed)								
	5.87	56.29	2.49	19.99	10.48	4.12	0.43	0.33
Eucalyptus Ash (Unwashed)	6.39	56.60	2.39	20.01	9.98	4.12	0.32	0.19
Granite	19.32	64.90	3.96	1.86	1.71	4.88	2.61	0.76
Ball Clay	22.09	60.80	5.32	6.22	1.92	2.47	0.36	0.82

Source: (Certificate of Analyses, NMDC-Jos, 2006)

Test Tiles

As a body on which the blends were test-glazed, test tiles were produced from ball clay. Slabs were made out of already prepared plastic ball clay. The tiles were measured ($25cm^2$) and cut out. At leather hard stage, each tile was marked with numbers behind, dried and bisque before administering batches on them for the tests.

Firing

Firing consist of heating to a temperature high enough to cause a physical and chemical changes which converts the green body into a hard, strong and chemically resistant product, without causing it to melt completely to change form. (Budworth, 1970). Firing is done in two stages; bisque (or biscuit) firing and glaze firing. The former is achieved from 900^0C and below, whereas, the later from 900^0C and above. For this test the glaze firing was done at 1100^0C.

Test Blend Methods

Riegger (1978) proffered some models in which different experiments and tests could be carried out to achieve a goal in either body or glaze formulation. These models will help to determine the proportion or composition of materials that will be considered suitable and acceptable for the production of desired body or glaze.

They include:
a. The Bi-axial Test Blend Method
b. The Tri-axial Test Blend Method and
c. The Quadri-axial Test Blend Method

In the same vein, to get a standard blend of 2 and 3 glaze or body materials in all possible blends of proportions, the bi-axial blend and tri-axial blend, respectively, is best, (Ajala, 2010).

Tri-axial Blend Method

The tri-axial blend is a series of tests of mixtures of 3 materials, in which proportions are systematically varied until all possible combinations are tried out, (Ajala, 2002).

In the case of this research project, 6 x 66 (6 lines, 66 combinations) was used for the 3 raw materials – eucalyptus ash, ball clay and granite.

FINDINGS AND DISCUSSIONS

Tri-axial Blend Test Results

Two tests were carried out, the first with washed ash and the second with the unwashed ash.

Chemical Contents/Behaviour of Materials

Each of the parameters qualified in the sample materials were determinants of their behaviour in the tests. The ash was divided into two; washed and unwashed. From the Table 2 above, highest in the ranking among the constituents of the ash was silica, as traditional of ashes. The washed ash had 56.29% while the unwashed had 56.60% of silica. This infers that the unwashed ash was a better glass former. Second to silica is calcium oxide with an average of about 20%. Alumina content of the washed ash was 6.13%. Magnesium oxide had an average

of 10.23%, potassium 4.12%, iron oxide 2.44% and sodium oxide 0.36%. Other untested constituents measured an average of 0.26%.

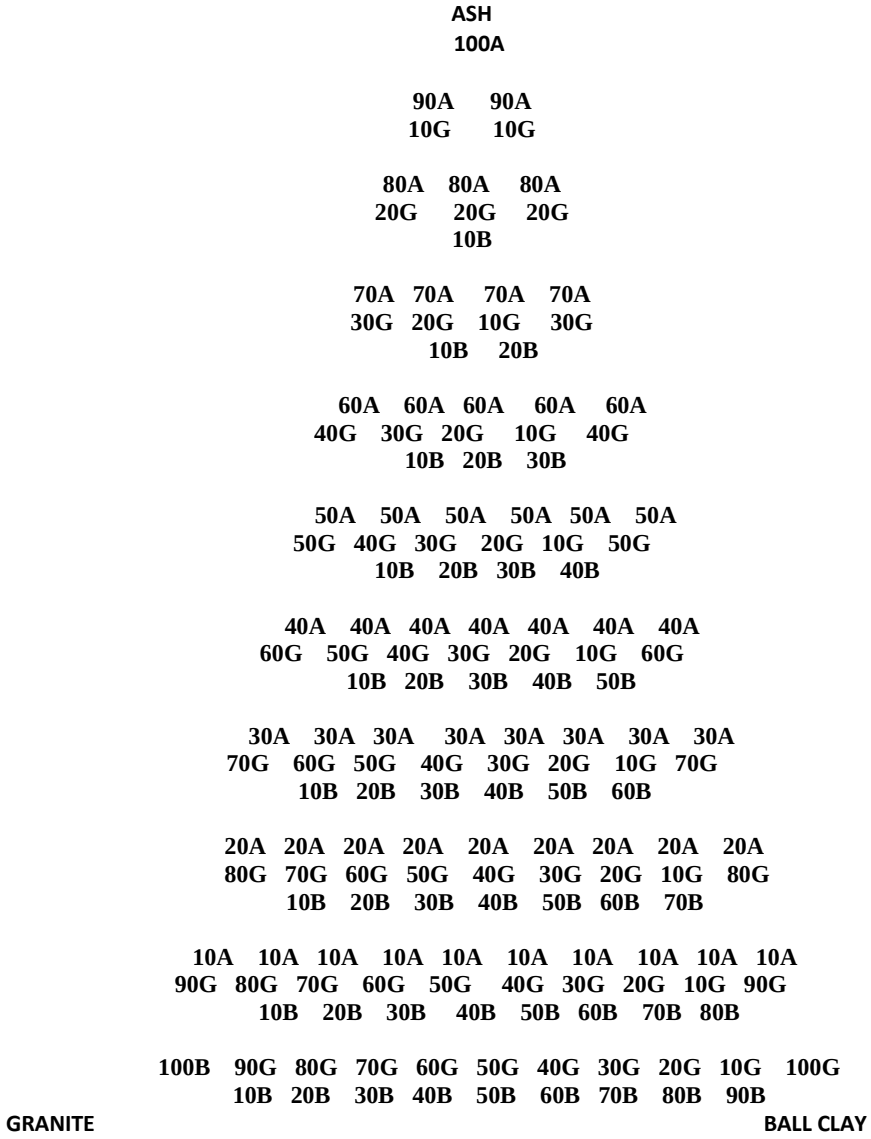

Fig.1: Percentages of Batch for Tri–Axial Blend

The silica content of the washed ash was slightly less than the unwashed as obvious in the result. More glaze fuses was recorded in the unwashed ash result. The average silica content of the unwashed ash was 56.36%, alumina with average of 5.92%, iron oxide had 2.68% (more than that of the washed ash), while calcium oxide averaged 11.11%. Magnesium, potassium and sodium oxides had average3s of 10.29%, 4.12% and 0.42% respectively.

Ball Clay

Next to granite, ball clay had the highest silica content of the three (3) materials used with 60.80%. It fused alone in the tests having alumina content of 22.09%. the brown and tan colours that characterized some of the test results was due to the 5.32% iron oxide content of ball clay, which ranged highest of the materials used. Calcium oxide, magnesium oxide potassium oxide and sodium oxide contents were 6.22%, 1.92%, 2.47% and 0.36% respectively.

Table 3: Comparative result showing fired colour and character of glazes from washed and unwashed ash

Test Tile No.	Fired Colour		Fired Character	
	Washed	**Unwashed**	**Washed**	**Unwashed**
1.	Clear brown	Clear brown	Highly vitreous	Highly vitreous
2.	"	"	"	"
3.	"	"	"	"
4.	"	Transparent Green	"	"
5.	"	Clear brown	"	"
6.	"	"	"	"
7.	"	Transparent Green	"	"
8.	Dark	Transparent	Vitreous	Highly vitreous
9	Clear brown	Highly vitreous	Highly vitreous	"
10.	"	"	"	Highly vitreous
11.	Transparent Green	Transparent	Vitreous	Vitreous
12.	Transparent Green	Transparent	Vitreous	Vitreous
13.	Transparent Green	Transparent	Vitreous	Vitreous
14.	Dark Green	Transparent	Vitreous	Vitreous
15.	Transparent Green	Transparent	Vitreous	Vitreous
16.	Dark Green	Transparent	Vitreous	Vitreous
17.	Dark Green	Speckled Green	Vitreous	Vitreous
18.	Dark Green	Dark Green	Vitreous	Vitreous
19.	Dark Green	Speckled Green	Vitreous	Fused
20.	Dark Green	Speckled Green	Vitreous	Vitreous
21.	Dark Green	Dark Green	Vitreous	Vitreous
22.	Speckled Green	Speckled Green	Fused	Matt
23.	Speckled Green	Green	Fused	Fused
24.	Green	Green	Vitreous	Matt
25.	Speckled Green	Green	Fused	Fused
26.	Dark Green	Dark Speckled Green	Fused	Fused
27.	Speckled Green	Dark Speckled Green	Fused	Fused
28.	Speckled Dark Green	Dark Speckled Green	Fused	Fused
29.	Green	Dark Speckled Green	Matt	Fused
30.	Green	Speckled Dark Green	Matt	Fused
31.	Green	Green	Matt	Fused
32.	Green	Dark Green	Matt	Matt
33.	Speckled Green	Green	Fused	Fused
34.	Speckled Dark Green	Speckled Green	Fused	Fused
35.	Speckled Dark Green	Speckled Dark Green	Fused	Fused
36.	Speckled Dark Green	Speckled Green	Fused	Fused
37.	Temmoku	Speckled Green	Fused	Fused
38.	Temmoku	Speckled Brown	Fused	Fused
39.	Temmoku	Temmoku	Fused	Fused
40.	Temmoku	Temmoku	Fused	Fused
41.	Temmoku	Temmoku	Fused	Fused
42.	Speckled Green	Temmoku	Fused	Fused
43.	Temmoku	Brown Speckled Green	Fused	Fused
44.	Speckled Green	Brown Speckled Green	Fused	Fused
45.	Speckled Green	Dark Green	Fused	Fused
46.	Speckled Brown	Brown	Fused	Fused
47.	Speckled Brown	Brown	Fused	Fused
48.	Speckled Brown	Brown	Fused	Fused
49.	Speckled Brown	Brown	Fused	Fused
50.	Speckled Brown	Speckled Brown	Fused	Fused
51.	Speckled Brown	Speckled Brown	Fused	Fused
52.	Speckled Brown	Speckled Brown	Fused	Fused
53.	Temmoku	Speckled Brown	Fused	Fused
54.	Temmoku	Speckled Brown	Fused	Fused
55.	Temmoku	Speckled Brown	Fused	Fused
56.	Brown	Brown	Under fired	Under fired
57.	Brown	Brown	Matt	Under fired
58.	Brown	Brown	Matt	Under fired
59.	Brown	Brown	Matt	Matt
60.	Brown	Speckled Brown	Fused	Fused
61.	Speckled Brown	Speckled Brown	Fused	Fused
62.	Speckled Brown	Speckled Brown	"	Fused
63.	Speckled Brown	Speckled Brown	"	Fused
64	Speckled Brown	Speckled Brown	"	Fused
65.	Speckled Brown	Speckled Brown	Fused	Fused
66.	Speckled Brown	Speckled Brown	Fused	Fused

Granite

Bauchi granite is quite rich in alumina with about 19.32%, which is next to the ball clay that was used. Of all the materials used in this research, granite had the highest silica content. The silica and alumina contents therefore was responsible for it fusing alone as glaze in the tests. The granite contains 64.90% silica, the 3.98% iron oxide it possessed informed the brown colouration of the results. Bauchi granite contains 1.86% calcium oxide, 1.71% magnesium oxide, 4.88% potassium oxide and 2.61% sodium oxide. Other untested trace elements made up the remaining 0.76%.

CONCLUSION

From test tiles #1 to #10 (100% Ash to 70% Ash and 30% ball clay on the one side and granite on the other) produced highly vitreous glazes. This is obviously because of the high silica content in the batches due to the amount of ash involved. As in the washed ash test, results of the unwashed tri-axial test gave highly vitreous glazes in the first ten (#1 to #10) tiles. This inferred that the blends needed more binder/stiffener to yield better results.

From test tiles #11 to #21 produced fused glazes that were less vitreous than the ones above. As the blend went down the line, the amount of ash decreased while, concurrently and arithmetically, those of ball clay and granite increased. More alumina and the refractory strength, of ball clay and especially granite, accounted for the increase in the stability of the glazes. Transparent, green and dark green glazes abound from tile #11 to #21.

Test tiles #22 to #66 produced fused glazes. There were some with pinhole and boiling effects, which may have been due to improper homogenization of the batch while blending. #22 to #66 proved feasibly for matt, gloss and Temmoku glazes. Except for #56, #57 and #58, which appeared under fired in the unwashed ash test.

The glaze types produced in this tests were Transparent, Green, Speckled green, Brown, Speckled brown and Temmoku. The washed ash test was about 96.96% successful; with 10.61% matt, 15.15% highly vitreous, 18.18% vitreous, 51.52% Stable and 1.50% under fired results. In the same vein, the highly vitreous outcome, for the unwashed ash test, was about 15.15%, the vitreous 15.15% too, matt 6.06% under fired 4.55% and the stable fused glazes make up 57.58%. The ash alone and granite alone fused. The ash(s) gave green effects, the ball clay brown and the granite some speckled effects.

The research produced a variety of fused Earthenware glazes. The chemical constituents of each of the elements had particular characteristic effects on the resultant glazes, according to their percentage content in the materials remaining before and after washing respectively. Therefore, the tested eucalyptus ash treatments had a significant effect on the formulated ceramic glazes.

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Evaluation of Pre-Consumer Textile Waste Treatment Practices and its Potential for Economic Sustainability in Akure, Ondo State

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ABSTRACT

Municipal Solid Waste Management (MSWM) and Sustainability have become a global concern especially with relevance to its impact on the environment. Textile has great potential for reuse and recycle and is currently being practiced in developed counties, however, In Nigeria, reuse and recycling is generally at its developing stage. This study was carried out to examine the current practices of pre-consumer textile waste (fabric scraps) treatment by tailors and fashion designers and also to determine potentially the commercial value of products made from such waste. One hundred tailors and fashion designers within Akure, were administered with questionnaires which were collated and analyzed using descriptive statistics such as pie charts to be able to establish the awareness of reuse of textile waste as cross referenced with the educational qualification of the tailors and fashion designers thereby checking their level of independence. About 77% of the sample population were aware that fabric scraps could be reused, 89% still prefer to dispose of their textile waste using the public waste management service and only 6% actually reuse their textile waste. It was also observed that there was a correlation between the educational qualification of the sample population and their awareness of the reuse of fabric scraps. Design can incorporate the concept of environmentally responsible and sustainable products by focusing on reinvention i.e. reinvention of materials and materials use to give value to waste textile products. This is important for future change in attitude to the current environmental waste disposal.

Keywords: Sustainability, Textile Waste, Waste Management, Municipal Solid waste, recycling

INTRODUCTION

Sustainability as explained by Clifford (2010) and Udeh (2010), is a concept that endeavors to fulfill the needs and aspirations of the present without compromising the ability to meet those of the future. He goes further to state that "It is a process in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspiration" (Clifford, 2010). Sustainability has become a global issue in recent years mainly as a result of the rapid and constant population growth in developed and developing worlds which has led to a massive increase in waste generation (Awopetu et al., 2013). In Nigeria, waste generation and management is a major challenge because the amount of waste generated especially from urban areas within the country cannot be efficiently managed by the facilities and practices currently in place (Babayemi & Dauda, 2009; Ogwueleka, 2009; Uwadiegwu, 2013). Municipal solid waste (MSW) is a major part of the waste produced and it includes refuse from residential, commercial, institutional, industrial and construction sites, and consist of various materials such as food waste, wood, plastic, textiles, metals, glass and special wastes (electronics, batteries, oil, tires etc.) (Abur, Oguche, & Duvuna, 2014). Municipal Solid Waste Management (MSWM) involves the collection, sorting, transportation, storage, treatment and disposal of solid waste, however, in Nigeria, priority is placed on collection and disposal which poses a challenge for the principle of waste Reduction, Recycling and Reuse (Achi, Adeofun, Gbadebo, Ufoegbune, & Oyedepo, 2012).

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Originally in developing countries, recycling and reuse was generally practiced out of necessity, but with the onset of globalization, developing countries like Nigeria have adopted the waste management methods of the developed countries which favour landfill for waste disposal. The increased awareness of the impact of waste management practices have on the environment have convinced more countries (especially the developed countries) to focus more on sustainability and view "waste management" more as "resource management" thereby creating more efficient means of waste disposal and establishing policies and laws that encourages a culture of waste reduction and supports the development of recycling and reuse infrastructures (Abur et al., 2014; ISWA, 2010; Zavodska & Uhuo, 2011).

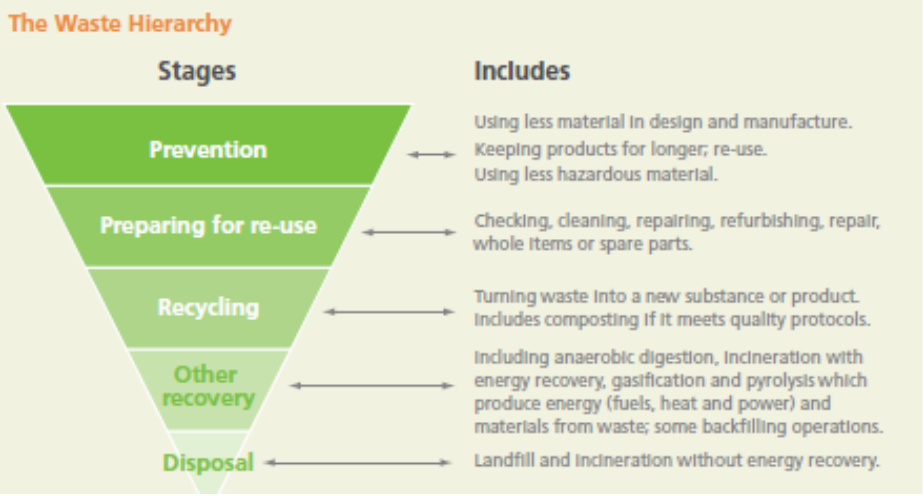

Figure 1: The Waste Hierarchy Pyramid formalized in the 2008 European Union (EU) (Defra, 2011).

Waste reduction, recycling and reuse is environmentally more desirable as it reduces the amount of waste needed to be collected and disposed of, as well as helping the economy by recovering and reusing valuable materials. The application of this principle ensures that only 'true waste' is disposed of (waste which is impossible to recycle or reuse), which invariably suggests that what is reusable should be prepared for reuse what can be transformed into a reusable resource may be used as such (recycling) (Awopetu et al., 2013). With regards to textiles, a lot of work has been done to reduce the environmental impacts of the production and use which has helped to establish industrial standards which promote sustainability. However, until recently little attention has been given to sustainable ways of textile disposal (McGill, 2009).

Textile waste is created in two broad categories, Pre-consumer and Post-consumer textile waste. Pre-consumer textile waste is created during manufacture of fibre, yarn, fabric and garments, it includes fabric off-cuts or scraps created during the cutting phase of clothing manufacture. Post-consumer textile wastes is created by consumers and is made of garments or household textiles the consumer decides to dispose of either due to damage, wear, change in size/fit or the item may be out of vogue (Caulfield, 2009). Good quality garments in this category are usually sold as second-hand clothing while damaged fabrics are generally shredded into fibres and used to produce other materials such as carpet underlays and fillings, pre-consumer waste can also be treated this way but in the developed world a large percentage is still being dumped into landfills(Caulfield, 2009; Defra, 2011; Kozlowski, Bardecki, & Searcy, 2012; Miraftab, Rushforth, Horoshenkov, & Swift, 2004)

The predominant method of making clothes involves cutting fabric and assembling the pieces through sewing, fusing, welding and other techniques of making garments (Rissanen, 2013). The marking and cutting of the patterns is a major area of pre-consumer textile waste generation in Nigeria. According to Antonucci & Stein (2012) , the average efficiency for a

garment is 80%, and a minimum 10-15% of each garment produced is waste. Despite the known desirability of reusing resources and the known recycling of textile products for many years, attempts to reclaim and reuse fabrics from old garments, scraps and rags have encountered large obstacles which have prevented the development of a practical, commercial approach. Consequently, there is a dearth of information on textile recycling and reuse in Ondo state. This study was put together to provide data with regard to the current trend of textile waste disposal practices of tailors and fashion designers in Akure town, It will validate the feasibility of the reuse of fabric scraps to produce products that are functional and commercially acceptable, which will ultimately encourage the reduction in waste disposal and creating entrepreneurship.

METHODOLOGY

Using random sampling method, one hundred (100) tailors and fashion designers located in various areas in Akure, Ondo State were involved in the research and questionnaires were administered individually. Ninety-seven (97) were recovered and Scale values were assigned to the responses to enable computation as follows: yes – 1, no – 2, not sure – 3. The method adopted for the analysis of the data was descriptive statistics using pie charts and the non-parametric chi-square test of independence using SPSS version 16. The awareness of the reuse of fabric scraps was cross referenced with the educational qualification of the tailors and fashion designers to check the level of independence.

RESULTS AND DISCUSSION

It is very important for fashion designers and tailors to be aware of the impact of waste generation on the environment, and from the results obtained from the survey, about 72% of the sample population are aware of the issues associated with waste generation as shown in figure 2 and 77% are know that the textile waste generated from their studios can be reuse or recycled (figure 3). However, 90% of the sample population still prefer to dispose of their textile waste using the available government public waste management service while only 7% recycle/reuse their textile waste as shown in figure 4. The recycle/reuse percentage is very low and some of the reasons given for this is the labour intensive nature and considerable of amount of time involved in collecting, sorting and reusing the waste. Some also expressed concern that customers may be displeased to see pieces of their quality fabrics being used for other purposes.

When the sample population was asked if they will be willing to donate their textile waste if a system was created specifically for textile reuse and recycling, 65% were willingly to be cooperative while about 25% refused due to suspicions and fear that customers who owned/bought those fabrics may be exposed to some sort of spiritual harm. This shows that cultural beliefs and practices are still relevant and can influence the mind set individuals regardless of their educational qualification,

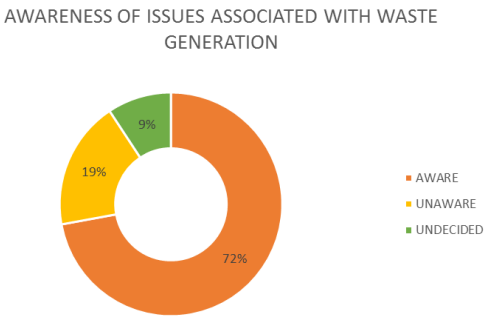

Figure 2 Pie Chart showing sample populations opinion on their awareness of issues associated with waste generation

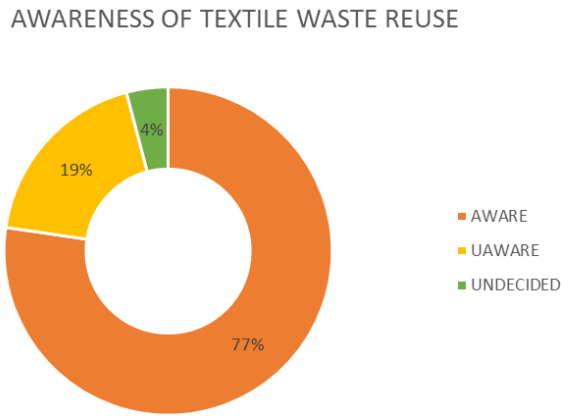

Figure 3 Pie Chart showing sample population's awareness of pre-consumer textile waste reuse

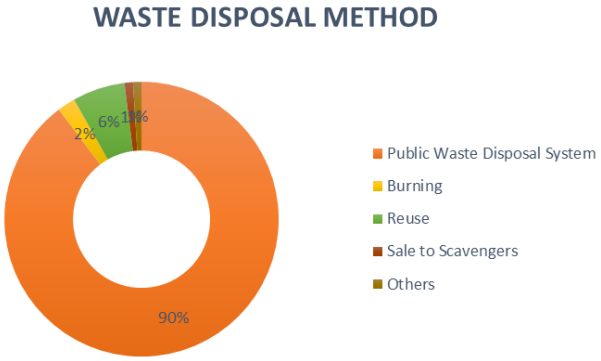

Figure 4 Pie chart showing sample population's preferred method of textile waste disposal

To validate the feasibility of textile waste reuse, some fashion design and interior design items were made from some of the textile waste collected from various tailor and fashion designers studios. The products made include handbags, laptop bags, duvet and a braided rug. It was observed that a great deal of time was spent sorting the textile waste which supports the reasons given by the sample population for not reusing their textile waste, however, it is an avenue for job creation. Based on the products that can be produced from textile waste, the sample population was asked to access the commercial value of the products and the consumers' response to the products. The results garnered showed that while it was agreed that products made from textile waste have good commercial value (figure 6), consumers may have a lukewarm reaction to the products. This is because products made from waste aren't viewed to be of good quality and so they may not be willing to pay good money for the value even though the products made may be standard.

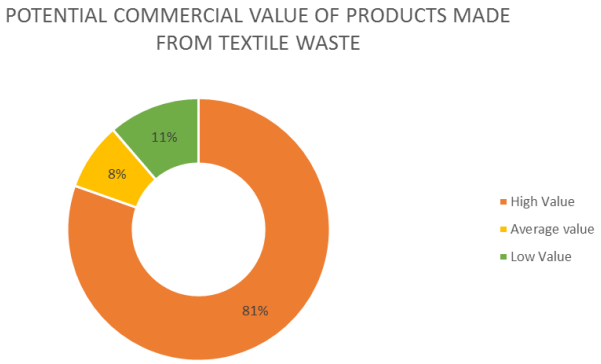

Figure 5. Pie chart showing the sample population's opinion on the potential commercial value of products made from textile waste

Figure 6 Bags made from pre-consumer textile waste (fabric scraps)

Figure 7 A braided center rug made from fabric scraps

A relationship was discovered to exist when the educational qualification of the sample population was cross referenced with their awareness of the reuse of textile waste. The bar chart in figure 6 clearly shows that 100% of those who had tertiary education were aware of textile waste reuse while 75% of those who had no formal education had no awareness of this fact. This suggests that education is very important and relevant to vocational practices and their impact on the environment. It also brings about development and innovation to the industry when practitioners are aware of new and sustainable methods involved in waste management.

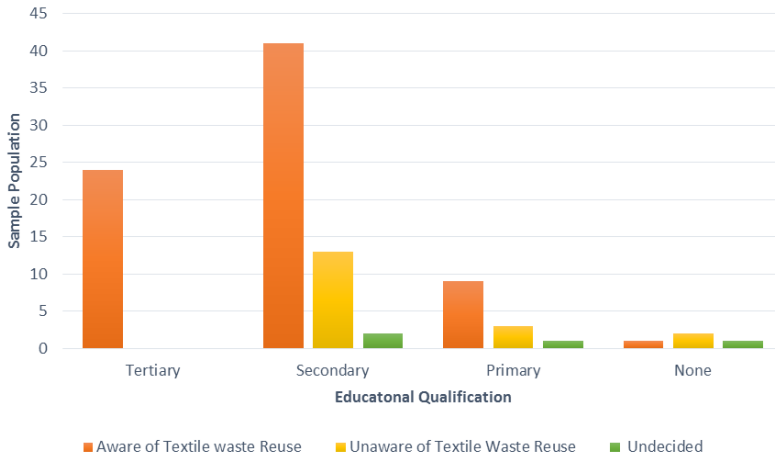

Figure 8 Bar chart showing the correlation between the educational qualification of sample population and their awareness of Textile Waste Reuse

CONCLUSION

Awareness of the impact current practices of textile waste disposal have on the environment is applicable to all spheres of life, industries, and countries, with emphasis placed on the wise and sparing use of resources. Design can incorporate the concept of environmentally responsible and ethical products, so that actual physical changes can impact on the local, national and international industry. This concept is hinged on reinvention, that is, reinvention of materials and the way they use them, reinvention of the value of waste and reinvention of both the role of the designer and of the consumer. This is very significant for future change as well as having an impact on the environment in terms of proper waste disposal (Smal, 2011). During times such as this where waste is regarded as an economical and environmental issue, a lot of consumers do not see the value in spending money on "recycled' products. Which is perceived as 'second hand' in comparison to brand new products. Although these processes are time and labour intensive and production is commercially viable on a small scale, the textile industry must address manufacturing in a sustainable and environmentally friendly manner if it is to remain relevant on the long term on its immediate environment.

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Merging, Art, Design and Technology: A Virtual Tour Design of the Department of Industrial Design, Federal University of Technology, Akure, Nigeria

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ABSTRACT

The fusion of Art, Design, and Technology is exemplified in many products and services in the contemporary society. These products and services range from computer games to interactive and non-interactive multimedia tutorial, animated cartoons and virtual reality tours, to mention but a few. The merging of the trio of Art, Design and Technology has influenced many of the activities of man in recent time, especially as man's romance with the ICT is becoming more intimate by the day. One of such domain of activities influenced by the computer technology is the Virtual Reality Tour, a feat made possible by an integration of art, design and technology. The paper therefore examines the relationship that exist between art, design, and computer technology and then narrow down to "the Virtual Reality Tour", one out of the numerous offspring of the union between art, design and technology. The case study of the virtual tour of the Department of Industrial Design of the Federal University of Technology Akure, Nigeria is considered. The paper therefore presents a technical report on how the virtual tour of the said department was conceptualized, designed and then produced.

Keywords: Art, Design, Technology, Virtual Reality Tour

INTRODUCTION

It has become a truism that the romance of art, design and technology, in the information age cannot be divorced; in fact, the relationship keeps getting stronger by the day. With the growth in the rate of software development in the areas of computer games, graphics and multimedia software and other forms of interactive graphic and multimedia packages, one would not but expect dynamism in the fusion the trio of art, design and technology.

Defining art has not been easy due to difference in individual view of the word "art". However, Art, as opines by Barnes (2009), is the product of creative human activity in which materials are shaped or selected to convey an idea, emotion, or visually interesting form. The word *art* can refer to the visual arts, including painting, sculpture, architecture, photography, decorative arts, crafts, and other visual works that combine materials or forms. Barnes (2009) also adds that art in a more general sense can include other forms of creative activity, such as dance, drama, and music, or could be used to describe skill in almost any activity, such as "the art of bread making" or "the art of travel."

Design as viewed by the Design Council, is an activity that translates an idea into a blueprint for something useful, whether it's a car, a building, a graphic, a service or a process. According to Brady (1998) the difference between art and design is in the way one look at them. Design is meant to be looked away from and art to be looked at and into. Brady (1998) notes that Design graces our lives with the aesthetic presentation of useful and beneficial things, and art graces us with representations of things to ponder and perceive. It further posits that Art and Design are closely related but nevertheless distinct, therefore the need to keep them straight.

Merritt (2009) defines Technology as the processes by which human beings fashion tools and machines to increase their control and understanding of the material environment. The term 'technology', Merritt (2009) states was derived from the Greek words *tekhnē,* which refers to

Ibiwoye, T. I. ; Ogunlade, B. & Ugah, H. O. (2016). Merging, Art, Design and Technology: A Virtual Tour Design of the Department of Industrial Design, Federal University of Technology, Akure, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1083-1091

an art or craft, and *logia,* meaning an area of study; thus its concludes that technology, literally means the study, or science, of crafting.

The virtual tour of a design departmental building is an offspring of the merging or coming together of art, design and technology. The article elucidates the beauty and aesthetic which art represents the organisation and idea represented by design, and the tools in form of computer and graphic/multimedia software used symbolises the technology. The article therefore presents a report of a virtual tour, which gives credence to the fusion of art, design, and technology.

Advances in science and technology seem to occur almost weekly in today's world, The dynamic nature of technology has informed the invention of new machines; new ways of problem solving and quest to keep abreast of the latest development in the Information, Communication and Technology (ITC) world. Tenner (2005) opines that since the beginning of the 20th century, technological choices of man had been slow over decades. It believes that in a short while it will be possible to accomplish even more radical changes, such as altering the appearance not only of poodles (dog) and peonies (horses), but of human through genetic engineering. Tenner (2005) further postulates that man will be able to select from a wealth of information on his computers, and decide which older data to convert to new electronic formats and which one to abandon to extinction.

LIST OF ABBREVIATIONS USED

Virtual Tour - Computerized walk-through of a site, building and the likes

3-D - Three Dimensional

Rendering - the computer calculations that, based on light placement, surface types, and other qualities, generates the image.

Wire-Frame Representation – a composition of different basic shapes into an object in line format

CAD/CAM - Computer-aided design and manufacturing

VR applications - virtual reality applications

Auto-cad - Automatic Computer Aided Design

Archi-cad - Architectural Computer Aided Design

Spline- a spline is a tin invisible line that can be drawn and used in cinema 4d to create and guide objects

Cinema 4d tags- a command and preset object generation location tool in cinema 4d

Wmf- windows media file

Avi- windows movie

3dx- Three directX

Texture- a texture is the appearance of the surface of an object; it could be a leather, rubber, water, sand or grass surfaces and etcetera.

Scripting and Linking - programming languages in swish-max and the process of merging a command from a button with an object in swish-max.

Png- portable network graphics

Flv - Flash video

Swf- Flash movie

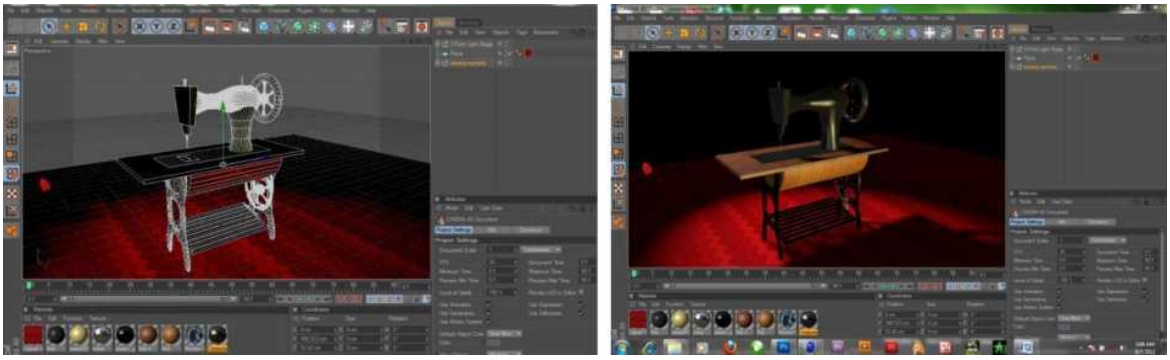

Fig. 1 Modelling of Sewing Machine; One of the equipment found in the Textiles Studio of the Industrial Design Department
Source: Authors (2013)

Virtual Reality and Tour

Virtual reality (VR) according to Al–Saedi and Ibrahim (2014) is a term that applies to computer-simulated environments that can simulate physical presence in places in the real world, as well as in imaginary worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced, haptic systems now include tactile information, generally known as force feedback, in medical and gaming applications (Al–Saedi and Ibrahim, 2014).

Lanier (2012) records that; Jaron Zepel Lanier (born 3 May 1960) is the American computer scientist, best known for popularizing the term virtual reality, the popularity of VR had seen continued growth, though steadily. Virtual Reality (VR) covers remote communication environments which provide virtual presence of users with the concepts of telepresence and telexistence or a virtual artifact (VA) either through the use of standard input devices such as a keyboard and mouse, or through multimodal devices such as a wired glove, the Polhemus, and omnidirectional treadmills. The simulated environment can be similar to the real world in order to create a lifelike experience, for instance, in simulations for pilot or combat training, or it could be somewhat differ appreciably from reality, as in the case of Virtual Reality games. In practice, it is currently very difficult to create a high-fidelity virtual reality experience, which of course is largely due to technical limitations on processing power, image resolution, and communication bandwidth; however, the technology's proponents hope that such limitations will be overcome as processor, imaging, and data communication technologies become more powerful and cost-effective over time (Al–Saedi and Ibrahim, 2014)

The virtual reality is a very compelling technology which aim at mimicking real world via the use of technology by computer-generated environment and engage all the senses of man. As a result of advancement in human-computer interface and emulation system, a brand new virtual world is maturing day by day with various applications such as digital heritage, training simulation, digital carving and virtual concert and so on, compare with traditional graphic research, virtual reality technology emphases on the interaction between user and system that is, the user could enter and experience the digital environment in real-time, feeling like being actually there (Wu,Wang, and Wang, 2015).

Brooks (1999) remarks that Virtual Reality is often used to describe a wide variety of applications commonly associated with immersive, highly visual, 3D environments. The development of CAD software, graphics hardware acceleration, head mounted displays, database gloves, and miniaturization have helped popularize the notion. Brooks (1999) further notes that Michael R. Heim, in the book titled, "The Metaphysics of Virtual Reality" highlighted seven different concepts of virtual reality as; simulation, interaction, artificiality, immersion, telepresence, full-body immersion, and network communication. VR is often identified with head mounted displays and data suits (Brooks, 1999). The Medical Product Manufacturing News (2008) believes that Virtual Reality can serve new product design, helping as a supplementary tool for engineering in manufacturing processes of new product prototypes, and simulation. Electronic Design Automation, Computer Aided Design, Finite Element Analysis, and Computer Aided Manufacturing are some of the generally utilized programs in Virtual Reality. The use of Stereo lithography and 3D printing shows how computer graphic modelling can be applied to create physical parts of real objects used in naval, aerospace, and automotive industries, which can be seen. The News also cites for instance, the VR laboratory of Volkswagen in Mladá Boleslav. It is also observed that away from modelling assembly parts, 3D computer graphics techniques are currently used in the research and development of medical devices used therapeutic processes, treatments, patient monitoring and early diagnoses of complex ailments.

Virtual Tour

Boland (2004) remarks that Virtual Tour is a simulation of an existing location usually composed of a sequence of video images. It sometimes involves the use of other multimedia elements such as sound effects, music, narration, and text. The phrase "virtual tour" is often used to describe a variety of video and photographic-based media. The phrases "panoramic tour" and "virtual tour" have mostly been associated with virtual tours created using still cameras. Panorama indicates an unbroken view, since a panorama can be either a series of photographs or panning video footage. However, such virtual tours are made up of a number of shots taken from a single vantage point. The camera and lens are rotated around what is referred to as a no parallax point, that is, the exact point at the back of the lens where the light converges.

In the case of a video tour, it is a full motion video of a location which differs from the virtual tour's static wrap-around feel; a video tour gives an impression or illusion of the viewer walking through a location. Using a video camera, the location is captured while moving from place to place. Video tours are continuous movement taken at a walking pace. The first use of a Virtual Tour and the derivation of the name, according to Realtor (2015) were in 1994 as a museum visitor interpretation, providing a 'walk-through' of a 3D reconstruction of Dudley Castle in England as it was in 1550. This consisted of a computer controlled laserdisc based system designed by British based engineer Colin Johnson. History has it that one of the first users of a Virtual Tour was Her Majesty Queen Elizabeth II, when she officially opened the visitor centre in June 1994. Because the Queen's officials had requested titles, descriptions and instructions of all activities, the system was named and describes as: "Virtual Tour, being a cross between Virtual Reality and Royal Tour" (Realtor, 2015).

King (2004) notes that 3D virtual reality is becoming widely used for urban regeneration and planning and transport projects. Virtual tours are very popular in the real estate industry. Several types of such tours exist, including simple options such as interactive floor plans, and more sophisticated options such as full-service virtual tours. An interactive floor plan shows photographs of a property with the aid of a floor plan and arrows to indicate where each photograph was taken. Clicking on arrows shows the user where the camera was and which

way the camera was pointing. Full service virtual tours are usually created by a professional photographer who will visit the property being sold, take several photos, and run them through stitching software. Full service virtual tours are usually more expensive than interactive floor plans because of the expense of the photographer, higher-end equipment used, such as a digital SLR camera, and specialized software. Real estate virtual tours are typically linked to the listing in the Multiple Listing Service (King, 2004).

Four technologies that is very crucial to VR as mentioned by Brooks (1999), Durlach and Mavor (1995), Burdea and Coiffet, (1994) are:

i. the visual (aural and haptic) displays that immerse the user in the virtual world and that block out contradictory sensory impressions from the real world;
ii. the graphic rendering system that generates, at 20 to 30 frames per second, the very changing images;
iii. the tracking system that continually reports the position and orientation of the user's head and limbs; and
iv. the database construction and maintenance system for building detailed and realistic models of the virtual world.

A completed campus virtual tour system is the composition of various technologies. The nub of it is the sub-system for environment models and user events processing, certainly, there are some other modules like user inter action and material management surrounding the kernel. To achieve the most lifelike feelings during user's virtual tour, Wu, Wang, and Wang, (2015) observe the need for integrated acoustic and haptic interfaces and their response effects into a system besides traditional real-time visual display. A typical virtual tour experience for instance could paint a picture of a user who starts off from somewhere in the campus, roams in some areas with the virtual locomotion device, (for instance, the user pedals to stimulate walking or running), and the surroundings are displayed on his head mount. The user may also hear same background sound along with the scene changing, liken to the sound of water when he is getting close to a fountain (Wu, et al. 2012).

METHODOLOGY

The techniques used for the study is the product design method, since the aim is to arrive at a multimedia product that can solve an information problem. The process includes:
Planning, selections of appropriate softwares to be used, production process, testing and finally packaging

Software Used

The software used includes:

i. Corel-Draw: - a vector based graphic design software used majorly for creating graphic designing.
ii. Adobe Photoshop: - an image editing software, it can also be used for graphic designing.
iii. Auto-card: - a 3d software but generally used for drawing of building plans and projection especially by trained architects and designers.
iv. Archi-card: - a 3d software mostly used by architects to raise plans of buildings with accurate block positions, aspect ratios and basic building components.
v. Cinema4D:- A 3 dimensional software used for 3d designing and modelling. It involves the use of basic shapes and other basic 3d elements such as lightening shadowing, textures, and etcetera.
vi. Adobe Premiere: - a video editing software.
vii. Adobe Media Encoder:- a video exporting software

viii. Swish-max: - a Flash enabled multimedia interactive video production software; it is also used for designing flash based websites

Equipment and Materials Used

The major equipment used is the computer system, digital camera, tripod stand, and printer. The materials include; compact disc, matte paper, Top Bond, Uhu gum and cutter.

PROCEDURES

Modelling with Cinema 4d Software

The buildings navigated in this multimedia project were modelled starting with the drawing of the plans with Auto-cad using the basic drawing tools, like pen tool. The plans were then saved in 3dx file format and exported to Archi-cad. In Archi-Cad the plans were raised to the appropriate sizes using the build or block tool that can be found in the tool box on the left side of the interface and the basic building components were then imputed and positioned properly starting from the first floor up to the last floor and the roof was finally built also in Archi-cad and raised properly with the proper roof type selected using 3D roof selection tool. The finished work was then scaled down to a reasonable size so as to reduce the size of the data it contains but yet maintaining the aspect ratios. It was then finally saved as a 3dx file and finally imported into cinema 4d for finally modelling and finishing.

In cinema 4d there are two types of interface options; the 2d, and the 3d interface options. Since the file to be processed was a 3d file, the 3d interface was activated by clicking on the left hand side of the menu bar where the edit option is located, this displayed a list of sub commands and the 3d editor view was clicked on and activated. After launching the 3d interface option the next step taken was to import the 3dx file into cinema 4d and this was done by clicking on the file option in the menu bar which is at the topmost part of the software interface, and clicking on the open option and selecting the file to be opened.

Fig. 2 Modelled Image of School of Environmental Technology

Fig. 3 Modelled Image Industrial Design Studios

Many textures were lost while importing the 3dx file into cinema 4d because cinema 4d could not recognize the texture format used by the other software used to create the document. The

next step was to correct all missing textures, and after correcting the missing textures, the windows, doors within the buildings were adjusted and properly positioned. The floors and ceilings within the buildings, and the various objects that featured in the buildings like chairs, tables, table tags, fans, lightings, computers, studio equipment, and the like were created from scratch using basic geometric shapes and cutting, trimming, welding, and merging the necessary areas. While choosing the appropriate texture types for the different surfaces, a number of tools were involved such as the polygon tool, the spline tool, the plane tool, the node or point tools.

After that, the surroundings and environment were created using planes. The trees and skies were modelled; the planes were filled with grass surface textures while the polygons and cubes were filled with flower textures. After this the proper lightening settings were done to give the environment and building a feel of realism and neutrality.

Virtual Camera Control

The next step taken was to apply the navigation effect and that was done using the camera and spline tools, A spline was drawn within the building starting from where the navigation should start and going along the necessary places the final viewers were expected to see to the desired end point. After that was done a camera was brought in using the camera tool and was merged or attached to the spline using cinema 4d tags under the command tool. The camera was then set to 0% at the starting point of the animation timeline which is located right under the visualization panes, and 100% at the end point. A total of 800 key frames where used because the doors were to be opened when approached by the cameras therefore each key frame on the animation timeline were edited to suit the camera and object's behaviour on that particular time line.

The finished work was then prepared for exporting by carrying out a preview test. And that was done by setting the exporting options to the desired modes, a resolution size of 1000(optimal), screen size of 1240 by 800, a pal DV widescreen and Avi video export settings and other output configurations were used for this test preview and it took almost two weeks to complete the preview test for each animated building. At the end of the preview test the previewing animation was slowed down and saved as an Avi video. And the video was taken and imported into Adobe Premiere where it was edited and slowed down to make navigation smoother and finally rendered, encoded with Adobe Media Encoder and exported as a Windows Media File (WMF) to step down the size and make it playable in all media formats. The video was then ready for use in swish-max.

In swish-max, there exists the layout interface face and the script or programming interface. This interactive project video was archived by first creating background templates for all the scenes to be viewed within the video, the backgrounds and images to be used were first designed in Corel-draw and then edited in Photoshop and saved as Portable Network Graphic (PNG) files after which they were finally imported into the swish-max library. And the various images and text documents were arraigned as desired within the various scenes where they were needed with the desired motion and behavioural effects attached to them.

Button Creation, Linking, Scripting

After the arraignment, the next step was to create buttons within the video, and that was done by converting an image, vector box and ellipse objects within swish-max into button objects that had over states, up states, down states and hit state.

All buttons created were then linked properly to perform the right actions or load the proper scenes they have been linked to when they are clicked upon. And to do this the interface was changed from the layout interface to the scripting interface, where the various buttons were

linked using programming languages also known as scripting in swish-max. The proper scripts were written and assigned to the respective buttons as commands for the buttons to obey with conditions and variable options.

The finished videos from Cinema 4d and Adobe Premiere were then embedded into their respective scenes within the swish movie, since the videos were in Wmf format or Avi and swish-max only recognizes Flv formats of videos, the swish-max application automatically converted the videos being imported into Flv formats and that action stepped down the quality a bit in order to make the video playable and user friendly in swish-max.

Fig 4 Modelling the School of Environmental Technology on Swish Mass Software

Saving, Exporting and Production

The movie was then saved as a swish-max movie and a preview test export was done with compression mode activated, and when the movie was believed to be okay, the whole document of video was finally exported with compression mode deactivated as a flash (swf) movie. The flash movie was finally burnt to /copied to Cds that had a design done in Corel-draw and Photoshop to represent the project printed on them and were finally slotted into Cd-jackets with a similar design printed on them.

CONCLUSION

The report gave an account of one the offspring of the fusion of art, design and technology. The offspring or product in this context being the virtual reality tour of the Industrial Design Department of the Federal University of Technology, Akure. This did not only give an insight into the world of virtual reality tour, but went further to describe the procedure involved in designing and producing a functional virtual reality tour. The quality of information packed in the produced Virtual Tour of the Industrial Design Department, presented a rich information about the department. The study noted that Industrial Design is associated with production of prototypes basically driven by human need, societal pressure and technological advancement, of which are encapsulated, in the produced Virtual Reality Tour.

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The Production and Exploitation of Rattan Products for Interior Decoration

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ABSTRACT

This study of the production and exploitation of rattan products for interior decoration explains the productions of rattan furniture for a sustainable development especially in the area of job creation. Rattan is the most common material used for the production of wicker furniture. Rattan furniture can be made from natural or man-made hard fibres such as rattan, cane, bamboo, willow, reed, rush, grasses, resins, and vinyl. Wickerwork is an old weaving process being used to make furniture sets such as chairs, sofas, dinning set, bedstead, barstools and so on with natural materials. The study explains the production of wicker products with different methods such as peeling, scraping, splitting / tearing, straightening and so on. Division of labour is very important because of series of measurement, nailing, brazing, patching, and treatment. These basic procedures are carefully explained for the best results.

Keywords: Rattan, Wicker, Production, Exploitation, Decoration

INTRODUCTION

In some developing nations rattan has served as a veritable tool to bridge the gap occasioned by raw wood material shortage (Renuka, 1999).Rattan is among the minor forest resources found in considerable quantity in Nigerian forests. Adewole and Onilude (2011) observe rattan grows naturally and abundantly available in Bayelsa, Akwa Ibom, Cross River and Rivers states. Rattan can grow up to hundreds of feet in length. It is one of nature's strongest vines. Rattan has a solid core, unlike bamboo pole, making it much more durable and harder to break. In the field of interior decoration, rattan is known to man as an ornamental plant. Lucas and Dahunsi (2004) further observe the diameter of rattans to range from 7.2 mm to 17.8 mm for small stemmed rattan species and from 12.5mm to 38.5mm for the larger diameter. It will not warp and is ideal for making furniture. Adewole and Onilude (2011) observe that, 70% of the rattan harvested and processed in four states goes for furniture making and 30% for weaving of local household items. Since creation of the world, man has been able to create out of God's creations.

Therefore, rattan has been adapted to making of things needed for a comfortable home especially the living room, bedroom, kitchen, toilet and bathroom. Also, provisions are made for offices, bars, restaurants, hotels and recreational centres and so on. For example, there are objects from rattan products such as chairs, tables, shelters, flower-vases, bedsteads, baby-cots, sieve, strainers, baskets, laundry-boxes, bedroom furniture, patio furniture, outdoor furniture, loveseats and rocking chairs and so on. Presently, rattan wicker workers all over the country have started to adopt and develop rattan into complex and technical productions. In order to make a good quality and a successful work, the rattan wicker workers make use of certain tools and materials such as nails, blue –blow lamp, wood-vanish, hack saw, pincher wood mallet and so on. It has been discovered that rattan wicker workers have greatly contributed to the development of interior decoration in homes, offices, hotels, restaurants and some recreational centres in Nigeria.

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Source of Raw Materials

According to Ogunwusi (2012) rattan harvesting is very difficult but done by the commercial harvester. Rattans are selected, cutting from the base, drawing of rattan after cutting and trimming to commercial lengths of 12ft. After this, the rattans are bundled into packs, stacked, air dried for few days and sold (RMRDC, 2006). Processing of low quality rattan can result into low quality and poorly finished household furniture items. One of the notable concentration points for rattan wicker furniture processing is situated at Kosofe Local Government, Mende, Maryland in Lagos which is popularly known as Cane-Village. Rattan and willow come in bundles from suppliers from Edo, Delta, Rivers and Epe in Lagos and their prices range from N900:00 to N1, 400:00 per bundle according to their sizes (Okafor 2015). Rattans and willows are purchased from the dealers. On arrival at the workshops, the outer leaf sheaths are removed with knife and the old sheaths are thoroughly scraped off to leave the fresh, clean, workable rattan beneath. Furthermore, Rattan and willow are also found in Bayelsa, Akwa Ibom, Cross River and Rivers States. Warri, Port Harcourt and Benin. Willow is cut into 12 feet while rattan is cut into 12 feet for easy transportation. Harvested rattans and willows are transported to rattan processor in the city where they are usually sold.

Curing

The next step is to cure the rattan, turning its colour from a pale green into the yellow by smoking it in sulphur fumes. The raw, washed rattan is loaded into what looks like a wood-framed tent that has its floor about a foot off the ground. Raw rattan are piled on top of one another until the wooden frame is full. The frame is then covered with tarpaulin, which is secured to the ground using stone weights. The sulphur is ignited and placed under the tent, and the smoking process begins. It usually takes about a day or so to complete this curing and smoking process. The stems are left to dry .in the sun for a few days after which they are cut into workable diameter. Sometimes, most processors do not follow the optimal procedure which includes drying for about 2-3 weeks, curing in oil, bleaching, deglazing to remove silicified epidermis and fumigation (Liese, 2002). The moisture content of fresh stems varies between 130 and 160 percent, requiring about two to three weeks air drying to be reduced to about 20%. Similar with this, is curing which is done by immersion of canes in a hot oil bath to prevent deterioration by stabilizing the moisture content (Liese,2002) rattans are dried in the sun and often smoked using Sulphur. Large rattans are boiled in oil to make them dry and to protect them from insects.

MATERIALS, TOOLS AND EQUIPMENT FOR RATTAN -WICKER FURNITURE MAKING CURING

Cane

Cane is gotten when rattan's outer skin or peel is removed and cut into thin strips material. Cane when wet, are pliable to be woven and create unique wicker-weaved designs seen in wicker furniture. The designs on most rattan furniture are created with wicker weaved on top of the rattan core frame. Rattan cane is used for weaving chair seats or wrapping joints on wicker furniture and is produced in many different gauges, ranging from carriage fine to the largest slab rattan. Cane is considered beautiful in its natural state because it has a natural glossy finish and does not accept stain or paint very well.

Willow

Willow is used for framework of any cane products. It is rigid jointed stem-like rattan. Willow is between 25 millimetre and 50 millimetre in diameter. It is only used for frame work in rattan furniture production. Willow can be soaked for flexibility and woven or bent to form graceful, rounded shapes. Willow can be heated, processed and used to frame chairs, baby cots, flower vases and so on.

Tools and Equipment

Oxford Advanced Dictionary, define tools as an instruments held in the hands by workmen; similarly, rattan and willow require certain tools to make out a product. These tools include hacksaw, hammer, pocket knife, file, spanner, sharpen stone, pincers, blow-lamp and sewing machine. Tools alone cannot do the work, so some of these following equipment are necessary:- nails of various sizes, sand paper, plywood, measuring tape, wood vanish, enamel paint, painting brushes, glue, containers, wood foam and pesticide. Rattan and willow are the only raw materials used in the production of rattan products, without these materials and equipment, it would be impossible to produce any tangible and acceptable utilitarian objects.

Apprenticeship system

Rattan wickerwork is a craft which can be learnt. Before someone can become an expert he/she might have been a learner under somebody that is, he has to be an apprentice to a master who in turn teaches intricacies of the craft.

Qualifications:

Qualification depends on intelligence and an ability to work. Nowadays a minimum of Primary School Leaving Certificate is necessary not compulsory but the apprentice should be able to read and write. Education is necessary because of the intricacies of the work which must be studied, such things as measurement, calculation, proportion and ability to imagine very well are very crucial to the success of cane production. Both male and female who is eighteen years and above can apply as an apprentice.

Agreement

Interested candidate purchase a form from the boss, fill and submit. The apprentice pays some amount of money for his training. The amount varies and this depends on the duration. Usually, a fast learner can spend up to six months but the duration is between six months and two years. The apprentice then buys basic tools such as pocket file, measuring tape, hammer and some other necessary materials.

Division of Labour

In any set-up where there is a mass production of a particular production, there must be a division of labour. In the production of rattan work, there are different people who are been assigned to a work under a master. In order to make the work easier, it is shared among the apprentices into five stages which are scraping, splitting or tearing, framing, tying of joints and weaving. This division of labour is crucial as it enables the learners to be deep in the knowledge of the stages of all cane work.

Material Processing

Rattan

Rattan is slender and has a rough outer surface with jointed stems like that of sugar cane. It grows between ten millimetres and twenty millimetre in diameter. It creeps or trails over other vegetation and may reach the length of five hundred feet. Rattan leaves its raw stage to more refined stage by peeling, scraping, splitting or tearing.

Peeling

Rattan can be bent with hands to remove the bark. This is because the inner layer is flexible while the bark is stiff. So, when bent, the bark breaks and falls to the ground.

Scraping

Scraping is the second stage of production. It deals with the outer layer of the stem. A sharpened knife is required. The cane surface tends to be hairy after scraping, if the knife in use is not sharp enough. Scraping is either to scrape the outer layer of the cane with a sharp knife until becomes creaming white or peel the bark with hands. Then it is slated into the

required sizes. Scraping is better in sitting position, that is, either on a bench or any comfortable stool. Rattan is held in the left hand (for right handed person) with the index finger supporting it at the back. Hand is allowed to rest on the left thigh for comfort ability. Then a sharp knife is held on the right hand and placed against the rattan. The knife is allowed to rest at angle 60^{o} with the edge facing out. The edge of the knife is pushed hard along the surface of the rattan. Scraping continues until the surface becomes creaming white (depending on the type of cane). Then the rattan is allowed to dry in the sun for about five hours (weather determines this). Therefore, the rattan is now ready for splitting.

Splitting and Tearing

Splitting involves the breaking of rattan into smaller sizes. The sizes of the rattan and the type of work determine the number into which to split the rattan. Rattan for weaving is split horizontally into small sizes, this is called **flat**. The inner layer is then removed in order to make the flat flexible for a more complicated wickerwork. On the other hand, the flat used in basket weaving is heavier because the inner layer is not removed. The rattan is split into the size of between four piece and six pieces. After splitting, the flats are allowed to dry in sun for two hours, and then they are ready for weaving.

Willows

Willow is the wooden aspect of any cane product. It is used for framing only. It also consists of three layers like that of rattan. But the only difference is that the bark is already scrapped right from the forest. It is rough on the surface and also consists of jointed stem. The stem is not straight but wavy or curve. So willow cannot be used for any decent production without straightening, cutting and bending.

Scrapping

Scrapping of willow is done like that of sugarcane. Willow after scrapping, is allowed to dry in the sun for three days. If it is not allowed to dry very well the framework will sag and the frame will lose it rigidity. Therefore, the chair with which willow is used may collapse at any time. As earlier mentioned willow is not straight but wavy or curve. It becomes straight when heated with blow-lamp.

Straightening

Willow is held with the left hand (right handed person) and the blow lamp on the right hand. Intensive hot flame is directed on the surface of the willow. It is pulled straight when hot because, willow becomes soft when hot. Therefore, it can be bent or straightened as desired.

Cutting and Bending

Cutting goes along with measurement. Cutting depends on the size and the shape of work. The skill intelligence is highly displayed here. According to Alade (2014) cutting and bending is the most tedious of all stages of production. Because the outcome of a rattan product is determined by accurate measurement of the willow with measuring tape and cutting into the required sizes with a hacksaw. Measurement is done according to the planned sketches of the producer. When bending, the portion that is needed to be bent is heated then bent to the required shape with hands and hold into shapes until it cools, then cut into the desired sizes according to the design. After this, framing can be done.

Production Processes of a Chair

There are basic rules and guidelines towards production of rattan product. A rough sketch of a proposed chair is made; this will serve as a guide while the work is in progress. There is a standard measurement for a particular type of chair to be made. Then, the willow was cut with a hacksaw according to the size and proportion of the work. The type of work determined whether to cut and bend, or bend and cut. Accurate measurement during framing

enhances the finished products especially where there is a need to produce more than one of the same products (Ojo, 2014). Two lengths of willow which measured 50 inches each was cut and bent to an arc shape. These serve for arms' length and part of the chair's front legs. Other lengths of the willow were cut for the chairs back and for brazing.

Nailing

The already cut willow are arranged and placed side by side each other. Later they were nailed together to form a skeletal chair. It is advisable to make use of the right nail for the right place. Nails which are between the ranges of half and inch and four inches ($^1/_2$ "-4") were used prominently for the product. For example, if a big size nail is used for a small size willow, it will tear the willow apart and makes it useless. At the same time, if the nail is too small, it will not hold the willow tightly to each other. Therefore, the product will become weak and collapse in a very short time. Moreover, the proper application of willow (fat and thin) during framing is necessary for durability.

Brazing

Ten pieces length of willow which measured 24 inches were cut, heated and then bent to the desired shape. These were place in between the legs of the chair and at the corners. Each were placed in their appropriate place then nailed. This is known as brazing -the importance of brazing are:

i. to serve as a supporter and a shock-absorber in a chair or settee
ii. to serve as a form of decoration.
iii. to serve as a support in other products especially when brazing is placed at the arm-length of a chair.
iv. it is used to support the legs of a table.

Treatments

Willow is an organic plant. It has an inner layer where insects and pests such as gammaline 20, comprehnol and solignum. The chemical can be used separately or mixed with some quantity of water as directed by the manufacturer. The chemical was first applied with a brush ($1\ ^1/_2$ or 2 inches in size) to all the joints, then to all over the surface of the frame work. The chemical was also injected into the stem with a syringe. These chemical kills every available insect or pest in the willow and prevent other pest to enter or destroy it. Solignum, among all the three chemicals, changed the natural colour of the willow to a dark one. Finally, the chemical was allowed to dry before moving the product (chair) so as to avoid staining human skin. After this stage, patching was done.

Patching

There are various ways of decorating rattan product especially chairs or settees. The choice of design depends on individual taste and choice. These methods include, tying of joints, spooking, wrapping, netting, coiling and weaving. Two or more methods of decoration can be used for the chair's decoration.

Tying of joints/Landing

This involves the joining of two or more willow placed side by side together with a flat. The frame was tied to make a unified work. Landing is a process whereby the brazing is fastened to the main body. Flat is used in tying brazing together with the patched areas. Then landing are tied neatly with belts for a good finishing.

Spooking

Spooking is a process where bars of rattan are laid across the frame to form a seat. Cushion can be placed on it for comfort. The rattan used for spooking is only scrapped out but not

split so that it can be strong and rigid. Rattans are placed very close to one another. At times, spooking is done in spiral shape on a seat to create an additional aesthetics to the products.

Wrapping

This involves the covering of the wooden part of the work with a well scrapped flat. Wrapping is mostly done in bedstead and settee. Wrapping is done to cover the rough surface of the wooden part of the bedstead, to beautify the general outlook of the frame work and for good finishing of the product.

Netting

This is the nailing of rattans across each other to form a design. It is used to cover the back of a chair (this depends on the design). In shelf or room-divider, netting is used to block the back so that when things are kept inside, it will not fall to the other side. Netting is done according to the pre-planned of the designer.

Coiling

This is a process in which a length of a cane is wound into a continuous circular shape. It can occur at any part of the work but it is mostly used at the feet of a seat for the following purposes.

i. to serve as a support to the seat on which cushion is placed.
ii. to serve as legs to the settee.
iii. to serve as another type of design.
iv. to serve as an additional beauty to the cane products.
v. to make the settee unique.
vi. to serve as decoration on the rattan products.

Weaving

Weaving can be combined with coiling, netting and wrapping and spooking. Weaving is an interlacing of warp and weft at right angle. Plain weave is commonly used in basket weaving. Done completely by hand, weaving takes from one to four days, depending on the type and complexity of the piece. The tighter the weave, the more time is needed and the more costly the process. Rattan strips are attached and woven over the frame in either an open (spaced) or closed (tight) weave. Wicker called ‘kanash’. This weaving is highly decorative. The other type of kanash is called ‘double kanash’ (this type of weaving is more complicated and tedious to weave). It is used for sophisticated works especially the interiors (Folorunsho, 2014)

Finishing

The surface of the willow is sandpapered to make it smooth. A blowlamp (at a low range) is used to remove every rough fibre. The frame is used to burn some portions to create a decorative effect on the willow and rattan. Later, wood vanish is applied with either a spraying machine or a brush. It is allowed to dry and then re-coated for a finer effect. The wood vanish makes the cane products stronger, shine and water-proof. After this, the work is allowed to dry very well. At times, the work can be painted in oil (enamel) to suit the taste of the customer. Upholstery is done by another person who has specializes in the making of a seat-cover. The cushion is tied to the seat with a length of tiny strand of cloth. This makes it possible to remove and wash whenever it is necessary. Seat cover fabrics of beautiful colours are used. At times, batik-designed fabrics are used. Now, the product is ready for sale.

CONCLUSION

Rattan products, especially those that are used for interior purpose, such as settee, dinning set, room divider, bar and stool, trolley and so on have contributed greatly to the natural beauty which nature offer in homes. There is an urgent need to develop rattan industrial

sector in Nigeria Rattan products are cheaper to purchase than wood furnishings. Rattan products, if well treated during the production can last as much as wood products. If government can develop rattan sector, it can contribute to poverty alleviation, generate employment among the youths and boost foreign exchange earnings in Nigeria.It is advisable that master should be kind and genuinely reveal the secrets of the craft to their apprentices whenever it is necessary to do so. Also, the master should be considerate in terms of apprentice should be patient and obey the rules and regulations of the job because, one day, he will. As unemployment rate still high in Nigeria, rattan weaving business has been proffered as a way out, especially if government encourages teaching of the craft in schools. Learning is a continuous process. Therefore, people should be encouraged to learn such work instead of staying idle. It is a lucrative job which can serve as a good start in life. With N50, 000:00 the business can fully take off.

The production of rattan products has tremendously generated tax and income into Kosofe Local Government, Lagos. The government should encourage them by improving soft loans, through their cooperative societies.

RECOMMENDATIONS

It is recommended that, rattan products producers should build up more skills by consulting book and magazines (foreign) for more inspirations in their productions. Also, government should organize workshops so as to allow free interactions of ideas among the rattan workers.

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Personal Communications

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Mr. Alade – specialized in bending 18th of March 2015 Kosofe Local Government, Mende, Maryland in Lagos.

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Training for Industrial Design Product Development and Manufacturing in Nigeria: Implications for Sustainable Economic Development

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ABSTRACT

The 21st Century Human Habitat is a function of what nature offers and what humans make of it. "What humans make of it", alludes to what we produce and utilize. This is to say that making things has been part of human existence over the centuries, and has turned out to be the basis for sustainable economic growth. Industrial design product innovation and development has been identified as key to sustainable economic growth. The programme is pivotal for Nigeria to industrialize but concerted efforts to train the manpower to handle it as a sustainable programme is even more pivotal. The study identifies a missing link along this line of thought. The paper looks into the problem using the questionnaire instrument to survey the opinion of respondents. A pilot study was conducted with the aim of testing the reliability and validity of the instrument. Data collected through purposive sampling technique was then analyzed using averages and mean values. Results were presented in paired sample table format while findings revealed that training product designer in the real sense of Industrial Design and getting them involved in the strategic plan for industrialization will not significantly facilitate the realisation of the industrialization dream.

Keywords: Economy, Corruption, Industrial Design, Industrialization, Sustainable Development

INTRODUCTION

Habitation of the earth since time immemorial by humans, other gifts of nature and recent exploration of space beyond the earth have profound impact on the ecosystem. With simple agrarian beginning, the world is gradually transforming into industrial nations and recently, cosmological expeditions have become the interest of fore front nations. The 21st Century habitat is pervaded with industrial products from various revolutionary human technological strides that have turned out to be the wealth of nations. Initialized in the late 18th Century, industrialization has far reaching social, economic and political consequences, however, centuries after, some parts of the world have remained under-industrialized and dependent, with globalization, trade liberalization and deregulation models making their economies weaker. Academic institutions over the centuries are known to offer innovations, research and development initiatives to industries. The Bauhaus, established in 1913, was significant in the propagation of the collaborative association and the establishment of the International Style, a modern design movement that left legacies in architecture, design and arts. Today, countries around the world are establishing technology-based institutions to further the ideals of technical education for economic development. Industrial Design and related academic disciplines are concerned with the creation and execution of design with recourse to appropriate use of form, function, ergonomics, usability, marketing and sales of products.

The economic strength of a nation is directly linked to her material and product resourcefulness and good governance. Raw mineral materials are abundant in many countries of the world, but what makes an economic difference among nations is the ability to extract and process these raw materials for *properly managed* internal consumption and export. Indeed, management of the economy is germane to the whole gamut of national development. That the economy has vascular sickness is neither an understatement nor unpatriotic remark.

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There are challenges in the Nigerian education industry and the polity itself. That sector of education and training which are expected to play remarkable roles in human development has been discovered in Kruegar and Lindhal (2001), Dike (2002) to be neglected for decades. As it were, respect, integrity and responsibility are supposed to be fundamental moral values essential for any economy (Lickona, 1992). All these values are products of good quality education. Corrupt leadership and bad governance are closely knitted like seamen twins. Yet leadership problem that has confronted Nigeria since independence appears to be worsening because the state of the polity is rapidly deteriorating. Leaders in government appear to be good at identifying economic problems but lack the political will and integrity investment to get problem solved or provide the institutional framework for way out (Acemaglu, 2003, Dike, 2003, Edison, 2003, Dike, 2007). However, countries with capacity to convert processed raw materials into consumer products make more economic progress than those who export raw materials and import finished products and in turn provide better living condition for their citizens. Adeoye (2005) posits that governments in developing countries lay emphasis on extensive technology-based development of productive (manufacturing) system as a means to transform their economies. Good governance, in addition, guarantees judicious use of economic proceeds for infrastructural development and overall wellbeing of a nation. It is therefore factual to assert that industrialization is central to economic development. This paper, through historical and empirical analysis will attempt to highlight the implications of training for industrial design (products) innovation and development for sustainable economic development in Nigeria.

Problem Statement

The essence of the paper is to highlight the importance of training industrial designers in the quest for industrialization of Nigeria. Government formulates industrialization plans with neglect of the aspect of training Nigerians to design products for mass production. When all other factors such as power, transport system, primary health care, HIV/AIDS and the primary and intermediate raw materials processing for manufacturing are being addressed. There will be urgent need for designers to be empowered to provide indigenous prototypes for mass production else we continue to rely on direct foreign investment that ends with capital flight and non-transfer of technology.

Purpose of the study

Training product designers in the real sense of Industrial Design and getting them involved in the strategic plan for industrialization will facilitate the realisation of the industrialization dream of the Nigerian nation.

Hypotheses

H_o Training of manpower to handle industrial design products helps the economic stability of the public sector.

H_1 Training of manpower to handle industrial design products helps the economic stability of the private sector.

RELATED LITERATURE

Industrialization and Economic Development: An Overview

Three revolutions have taken place already in the industrial sectors of western civilization. They have been largely described as radical and disruptive spring in industrial processes characterized by greater productivity. According to Woodham (1997), there was wider availability of mass-produced goods, facilitated by electroplating, stamping, moulding and the exploration materials that had the capacity to imitate hand crafted luxury goods with high decorative finish, consequently, calling for the reconciliation of design thinking with the realities of mass-production techniques. Industrialization is simply growing manufacturing

activities of a nation alongside electricity generation, transportation facilities and communication networks. Kirk-Greene in Iwuagwu (2011) defines industrialization as "an increase in the share of manufacturing in the Gross Domestic Product (GDP) and in the occupations of the economically active population." Therefore to industrialize is to replace hand tools with machines and power tools, expected to yield huge socio-economic gains and increased advanced education. It is generally acknowledged that three phases of Industrial Revolution have been experienced and the fourth revolution imminent, with its precursors in digital technology as evident in the transformational changes and innovations taking place in digital domains. The first industrial revolution was centered on hydropower technology and evolution of machine tools. The second came in the widespread use of electricity and assembly line for mass production. While the third, in the form of green revolution, is focused on cleaner energy technology, electronics and information technology.

Industrial Revolution in Nigeria

Nigeria, since independence in 1960, has battled with the increasing challenges of economic development through rapid industrialization. Several economic development policies with focus on the industrial sector had been adopted and abandoned by successive governments, while diversification from the monolithic national economic earning from crude oil export remains a mirage. Electricity inadequacy increases the cost of production, reduces competitive advantage and threatens the survival of industries. The economy cannot absorb the labour supply, mainly unskilled; hence unemployment is on the rise. Advanced education has become a status symbol instead of a force for economic growth. Indeed, an industrial revolution is most needed in Nigeria. In February, 2014 the Federal Government of Nigeria renewed government commitment to industrialization, by launching the Nigeria Industrial Revolution Plan (NIRP), out-judged to be the "most ambitious industrialization programme" ever pursued in the country. (Economic Commission on Africa, 2014). The Plan, according to Nwoye (2014), is expected to add about N5 trillion to Nigeria's annual manufacturing revenue in the next 3-5 years. However, it is feared that the 2015 change of hands in governance may discontinue the implementation of the NIRP, as it had been with older plans and policies. Iwuagwu (2011) argues that Nigeria has never been lacking in policies, but the political will to implement policies that are capable of transforming the nation's processes from primary production.

According to Onwuma (2015), poor planning and monitoring of programmes, inadequate funding, corruption, and poor accountability were some of hindrances to the full implementation of the development plans namely:

i. First National Development Plan (1962-1968)
ii. Second National Development Plan (1970-1974)
iii. Third National Development Plan (1975–1980)
iv. Fourth National Development Plan (1981–1985)
v. Structural Adjustment Programme (1986-1989)
vi. National Rolling Plans (1989)
vii. Vision 2010 (1996)
viii. National Economic Empowerment Development Strategies (2003)
ix. Industrial Development Strategy (Cluster Concept) (2007)
x. Vision 20:2020 (2009)
xi. Nigeria Industrial Revolution Plan (NIRP) (2014)

The failure to totally implement the above plans has negatively impacted on the development of Nigeria's industrial sector. Adeoye (2005) asserts that the Nigerian economy has high import dependency on intermediate, finished and capital goods, which increases yearly with

higher domestic demands. He further explains that trade liberalization and globalization hinders an economy without strong basic and supporting industries from enjoying international market opportunities because of disadvantaged competitive position.

Assuming the government sustains the implementation of the NIRP, which is designed to accelerate growth in food and agricultural products processing, metals and solid minerals processing, oil and gas related industries, construction, light manufacturing and services; when electricity is in abundance and can support industrial activities; when the transport system and other infrastructural facilities have grown to facilitate positive socio-economic development, it is expected that the manpower needed to raise and sustain the industrialization process will have to come from the products of academic institutions. The question about the nature of the training and the quality of graduates come to the fore. Raji (2015) states that acquisition of technical and vocational education and training are instrumental to achieving the National Industrial Revolution Plan (NIRP) in Nigeria. Industrial Design, in its real sense, would play a key role in achieving the desired progress in the manufacturing sector.

Industrial Design and Industrialization

Industrial design, also known as product design and commercial design, has a key role to play in a big industrialization dream, particularly in manufacturing for the economy to grow. Developed after Industrial Revolution, which is characterized by mechanization of industry; Industrial Design concerns mainly with manufactured products by industrial mass production processes, ranging from kids toys to automobiles. Manufactured consumer goods usually undergo the process of design before mass production. Designing a product entails so much - specifying its overall shape, colour, and texture with consideration for ergonomics, user profile; choice of materials and production process. Point-of-sales related matters may be part of the design specification. According to Learn.org (2015) "Industrial designers carry a product from initial idea on paper and computer-assisted design to a physical prototype and final product. Multi-function cellular phones, 4x4 trucks, household appliances, retail displays and fixtures, running shoes, and product packaging are all results of industrial designers doing their jobs". Industrial design therefore, seeks to add aesthetic and usability values to manufactured products. A study, Tezel (2011) describes Industrial Design as a strategic tool for the developing economies to compete in the globalised international market in addition to its role as a vehicle to satisfying user physical functionality. The study particularly applauds Turkey's realization of the contribution of Industrial Design to government policies for sustainable development, as it is newly recognized as one of the developing economies of the world.

The NIRP described the manufacturing sector in Nigeria as structurally weak and lacking in basic industries such as steel and iron, and over many years has failed to transform and play a leading role in economic growth and development. It also stipulated that the technological base for manufacturing is lacking; skilled manpower needed to ensure competitiveness is grossly inadequate; deficient power and transport infrastructure have led to high production costs and non-competitive operations Federal Ministry of Industry, Trade and Investment (2014).

The growing global consumer class raises demand for manufactured goods thereby making manufacturing contribute 18 percent of the US$70 trillion global economy and accounts for 70 percent of global trade. Nigeria obviously has very insignificant share in this global wealth, however, the underlying philosophy of the NIRP is to build Nigeria's competitive advantage, broaden the scope of industry and accelerate expansion of the manufacturing

sector to become one of the global top 10 players in at least 10 key manufacturing categories within 5 to 10 years (Federal Ministry of Industry, Trade and Investment, 2014).

METHODOLOGY

The study is a survey that administered questionnaire as inventory to collect data from respondents about the importance of training Nigerians to be proactive in product design and manufacturing processes and whether such concept will help boost the economy of the public and private sectors. Stemming from the scope, the population is defined to be civil servants and entrepreneurs who are into private practice. Statistical method was used to analyse the collected data. Data were also analysed using average and mean values to determine the importance of some factors as indicated by the respondent. The percentages and the cumulative percentages of variables of interest were also determined. Percentages help in rating a number of factors according to the degree of importance attached to them. In order to reflect the relative importance, reliability or agreement of some of the relevant criteria over others and the indices were calculated as follow. Mean is expressed as:

$$X = \frac{fx}{N}$$

Where X =Mean
x= number of score
$\sum$ = summation
N= Number of Effective Questionnaire Collected

RESULTS

Hypothesis 1a

$H_{0:}$ Training of manpower to handle industrial design products development and manufacture significantly helps to stabilize the economy of the public sector.

$H_{1:}$ Training of manpower to handle industrial design products development and manufacture does not significantly help to stabilize the economy of the public sector.

Decision Rule: If the P-value is > α=0.05, do not rejectH_0. Otherwise, rejectH_0.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Agree	120.55	20	32.662	7.303
	Disagree	24.75	20	22.133	4.949

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Agree & Disagree	20	-.636	.003

Paired Samples Test

		Paired Differences				
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference	
					Lower	Upper
Pair 1	Agree - Disagree	95.800	49.759	11.126	72.512	119.088

Paired Samples Test

		t	Df	Sig. (2-tailed)
Pair 1	Agree - Disagree	8.610	19	.000

Since P-value=0.000< α=0.05, it is statistically right to reject H_0 for H_1.

Discussion: It can be inferred from the above test that, training of indigenous manpower to handle industrial design product development and manufacturing processes does not imply

significant stability for the public sector economy. This result seems not surprising because the inculcation of training though, will breed more efficient hands in the design and production sector, corruption in high places will make the whole efforts remiss.

Hypothesis 1b

$H_{0:}$ Training of manpower to handle industrial design products development and manufacture significantly helps to stabilize the economy of the public sector.

$H_{1:}$ Training of manpower to handle industrial design products development and manufacture does not significantly help to stabilize the economy of the public sector.

Decision Rule: If the P-value is > α=0.05, do not reject H_0. Otherwise, rejectH_0.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Strongly Agree	110.35	20	44.157	9.874
	Strongly Disagree	50.70	20	37.838	8.461

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Strongly Agree & Strongly Disagree	20	-.705	.001

Paired Samples Test

		Paired Differences		
		Mean	Std. Deviation	Std. Error Mean
Pair 1	Strongly Agree - Strongly Disagree	59.650	75.751	16.938

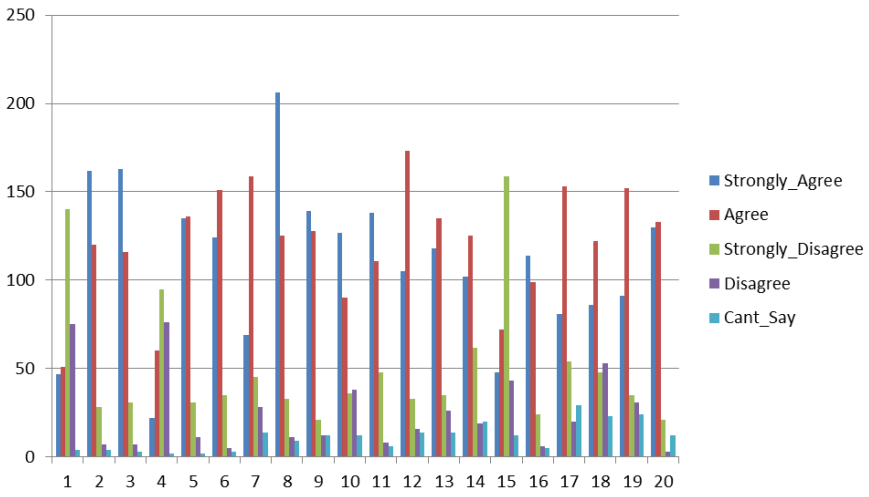
Paired Samples Test

		Paired Differences		
		95% Confidence Interval of the Difference		
		Lower	Upper	t
Pair 1	Strongly Agree - Strongly Disagree	24.197	95.103	3.522

Paired Samples Test

		Df	Sig. (2-tailed)
Pair 1	Strongly Agree - Strongly Disagree	19	.002

Since P-value=0.002< α=0.05, it is statistically right to reject H_0 for H_1.



Discussion: It can be inferred from the above test that, training of indigenous manpower to handle industrial design product development and manufacturing process in the public sector

does not significantly help to stabilize the economy of the public sector. This result seems not surprising because it is a commonplace to say that, no matter the depth and frequency of training, Nigerians need a change in the areas of corrupt leadership attitude, and economic mismanagement.

Hypothesis 2a

$H_{0:}$ Training of manpower to handle industrial design products development and manufacture helps to stabilize the economy of the private sector.

$H_{1:}$ Training of manpower to handle industrial design products development and manufacture does not help to stabilize the economy of the private sector.

Decision Rule: If the P-value is > α=0.05, do not rejectH_0. Otherwise, reject H_0.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Agree	106.40	20	27.563	6.163
	Disagree	28.70	20	17.547	3.924

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Agree & Disagree	20	-.529	.016

Paired Samples Test

		Paired Differences				
					95% Confidence Interval of the Difference	
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper
Pair 1	Agree - Disagree	77.700	39.743	8.887	59.100	96.300

Paired Samples Test

		t	Df	Sig. (2-tailed)
Pair 1	Agree - Disagree	8.743	19	.000

Since P-value=0.000< α=0.05, it is statistically right to reject H_0 for H_1.

Discussion: It can be inferred from the above result that, training of indigenous manpower to handle industrial design product development and manufacturing process in the private sector does not significantly help to stabilize the economy in the private sector either.

Hypothesis 2b

$H_{0:}$ Training of manpower to handle industrial design products helps to stabilize the economy of the private sector.

$H_{1:}$ Training of manpower to handle industrial design products does not help to stabilize the economy of the private sector.

Decision Rule: If the P-value is > α=0.05, do not reject H_1. Otherwise, reject H_0.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Strongly Agree	93.35	20	33.248	7.434
	Strongly Disagree	49.95	20	35.399	7.915

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Strongly agree - Strongly Disagree	20	-.674	.001

Paired Samples Test

		Paired Differences		
		Mean	Std. Deviation	Std. Error Mean
Pair 1	Strongly Agree - Strongly Disagree	43.400	62.807	14.044

Paired Samples Test

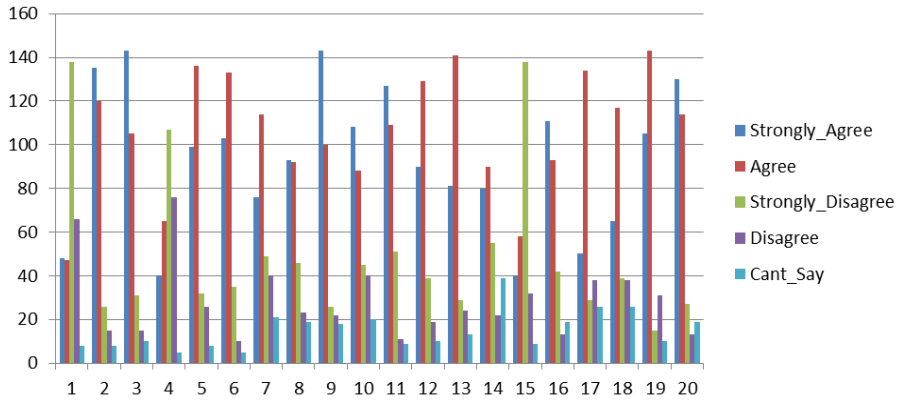
		Paired Differences		
		95% Confidence Interval of the Difference		
		Lower	Upper	t
Pair 1	Strongly Agree - Strongly Disagree	14.006	72.794	3.090

Paired Samples Test

		Df	Sig. (2-tailed)
Pair 1	Strongly Agree - Strongly Disagree	19	.006

Since P-value=0.006< α=0.05, it is statistically right to reject H_0 for H_1.

Discussion: It can be inferred from the above result that, training of indigenous industrial designers to handle industrial design product development and manufacturing process in the private sector does not significantly help to stabilize the economy in the private sector.



Empirical findings

Findings from the study actually show that there is a missing gap which is the training of young graduates to be able to participate in the industrialization process of the nation but the same findings also show that this does not make significant difference in the economy of both the private and public sectors. Nigerians' unsavoury integrity towards work and money seems to be a reason for this. The study also aggregately reveals that the Nigeria nation has been driven by different sectors of the economy such as oil and gas, power, transport, industry and leadership as well as education, but all have put both the public and private sector economies in messy, austere conditions. Over-dependence on crude oil explains the reason why the nation is unable to diversify her economy. What has not failed us and which has not been accorded the pride of place is training and re-training of industrial design manpower. Training product designers in the real sense of Industrial Design and getting them involved in the strategic plan for industrialization will facilitate the realisation of the industrialization dream. It is high time the emphasis is shifted to training of indigenous hands to take charge of product design economy and entrepreneurial development of the nation. This will help grow the economy of both the public and private sectors.

CONCLUSION

The hindrance to industrial revolution in Nigeria is the manifestation of the plethora of problems the nation has battled with over the decades, they include: bad governance,

indiscipline and corruption; poor policy implementation; deficient education sector. These altogether have hindered Nigeria from harnessing the full benefits of the first, second and third Industrial Revolutions; iron and steel processing, textile manufacturing, rail transport, electricity generation, new materials and cleaner technology, ICT, microelectronics, renewable energies and energy efficiency, 3D printing and digital manufacturing. It is, therefore, important to sustain the 2014 Nigeria Industrial Revolution Plan with intensified efforts in addressing the huge infrastructure deficit. Concerted efforts toward reducing importation and increasing local manufacturing must be made with purposeful training of Nigerians in designing for mass production. Hence, design courses should be given special attention in tertiary institutions, particularly, Industrial Design that is attuned to prototype generation for mass production. Transfer and acquisition of technology must be encouraged. Nwoye (2015) asserts that foreign assistance without adequate development of available local resources have stalled industrial sector growth, and that Nigeria does not have the capacity to channel her natural resources to industrial use; export of raw materials and import of manufactured products have become the practice over the years. This ugly situation can be reversed; only when proper measures are taken by all stakeholders.

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Review of Philosophical Paradigms of Landscape Architecture

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ABSTRACT

Philosophical foundation is central to the successful practice of any discipline. Such should be focused, non-sectarian and result-oriented. Unfortunately, the practice of landscape architecture is guided by non-coherent and sometimes opposing philosophical thoughts. The purpose of this paper is to critically review the dominant philosophical paradigms of landscape architecture and their core tenets. These include naturalism, environmentalism and urbanism. The study attempts to compare their tenets to identify what are common and what are not. It brings together those commonalities to develop a holistic philosophical approach. The study singles out nature, environment and city from the three paradigms respectively and proposed Eco-natural Humanism as a holistic philosophy of landscape architecture. After addressing how to resolve the identified competing ideas among the existing three paradigms, the study reflects on the proposed paradigm and recommends its further intellectual criticism along geographical divides and human groupings.

Keywords: Ecology, Environmentalism, Humanism, Naturalism, Organic Architecture, Science, Urbanism

INTRODUCTION

The practice of every discipline is based on relevant theoretical backgrounds or philosophical foundations (Hunt, 2000; Certeau, 1984; Thomas, Sim and Poulton, 2001). These determine the roles and responsibilities of the practitioners and the procedures of their operations in the discipline. Such interaction between theory and practice is also true of landscape architecture as a discipline. Unfortunately, unlike many other disciplines, it has its origin from many theoretical backgrounds which are associated with the disciplines from which it has "borrowed" different parts at varying degrees. This results in disparity in the products of the discipline of landscape architecture. The situation is worsened by the changing roles of its practitioners over periods of time consequent upon changing environmental, social, political, economic, and cultural challenges (Davis and Oles, 2014).

Though landscape architecture has its primary origin in agriculture, it also leans on theories and practices from horticulture, gardening, forestry, engineering, architecture, fine arts and ecology. In view of these multiple source of theoretical background and philosophical thoughts, it belongs to the group of disciplines based on eclecticism, that is, "a conceptual approach that does not hold rigidly to a single paradigm or set of assumptions, but instead draws upon multiple theories, styles, or ideas to gain complementary insights into a subject, or applies different theories" (Leonard, 1975). According to Kelley (2005), eclecticism appears at the confluence of several intellectual movements and their paradigms.

The purpose of this study is to critically review each philosophical paradigm of landscape architecture and their core tenets; attempt to compare those tenets to identify what are common to all paradigms and what are not; discuss how to bring together those commonalities to develop a holistic philosophical approach by connecting the similar principles in all paradigms and by addressing how to resolve competing ideas among these paradigms; and reflect on the limitations of such a unified philosophy. This becomes necessary in view of the current negative impact of urbanization, like deforestation, on the built environment where nature has also been "designed out". Accordingly, landscape

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architecture is expected to play significant roles in solving these environmental problems. While the study acknowledges the multiplicity of the theories applicable to landscape architecture, it is concerned with the key philosophical thoughts of naturalism, environmentalism, and urbanism and their respective disciplines of architecture, ecology and urban design in view of their core relevance to the current environmental sustainability debate. The study explored archival resources on writings and built works of practitioners and theorists in landscape architecture with respect to architecture, ecology and urban design. It compares their tenets to identify what are common to all paradigms and what are not, then proposes and discusses a unified philosophy towards application to solving the current problems in the built environment occasioned by urbanization. This position is also judged suitable in this discourse since a host of others are either derivates or can be subsumed in these majors.

NATURALISM AND ARCHITECTURE

Naturalism is a philosophical standpoint in architecture that has produced the theory of organic architecture. An examination of the duo as matrixes suggests the non-existence of one without the other. What then is philosophical naturalism in organic architecture?

Naturalism

Naturalism commonly refers to the viewpoint that "laws of nature operate in the universe" (Oxford English Dictionary). Followers of naturalism (naturalists) assert that "natural laws are the rules that govern the structure and behaviour of the natural universe, that the universe is a product of these laws" (Catholic Encyclopedia). Philosopher Kurtz (1990) argues that "nature is best accounted for by reference to material principles" including "mass, energy, and other physical and chemical properties accepted by the scientific community". It is a process of long evolutionary path including the interaction of humans with land to form landscape. The "understanding" of science and philosophy is one facet of this, even when it reflects upon its own emergence and science and other intellectual enterprises can be seen as building upon human capacities for dealing with their environment, improved piecemeal over many generations. Accordingly, science (ecology) is seen as a social phenomenon that is "cognitively reliable, and increasingly so" (Dress, 2003). Therefore, according to Kitcher (1993) "the human, historical, and social character of science need not undermine scientific credibility."

Naturalism therefore engages conceptually with landscape architecture without its other philosophical complexities in relation to religion as ecological design/design with nature paradigm. According to Dagenais (2008), "the nature with which landscape designers are working is manifold in its expression." He observed that "researchers as well as philosophers who have studied ecological concepts, theories and conservation practices contrast ideas of nature as a collection of objects, to ideas of nature as process." In fact, in the same way that conservation of biodiversity implies interventions akin to gardening, designing with biodiversity is very much compatible with garden and landscape design. In the second conceptualization of nature, it can be understood as a "force, a process, sometimes irrespective of the species or number of species involved in an ecological", perspective and is didactic to poetic descriptions of processes occurring in the landscape or garden as the only way to acknowledge and represent the passage of time (Dagenais, 2008).

Naturalism in environmental movements is a part of conservation ethic in relation to preserving natural ecosystems. It is a state of nature and conformity to nature as realism (http://www.mondofacto.com/facts/dictiona). Clark (1963) observed that

> *"we are surrounded with things· which we have not made and which a lift and structure different from our own: trees, flowers, grasses, rivers, hills, clouds. For centuries they have inspired us with curiosity and awe; They have been objects of delight; we have recreated them in our imaginations to reflect our moods. And we have come to think of them as contributing to an idea which we have called nature."*

Naturalism embraces "nature" in a more intentional and expressive way. First, any designer that calls his or her work "naturalistic," "sustainable", or "ecological" cites nature as an authority to justify their designs (http://landscapeofmeaning.blogspot.com/2010/05/modern-naturalism-artifice-in-natural.html). Secondly, ideas about nature ultimately reveal more about us than it does about the landscapes they describe (Alessandro, 2007). Spirn (1997) argues that "nature is an abstraction," and "a set of ideas for which many cultures have no one name, a singular name for the real multiplicity of things and living processes." Consequently, in landscape design today, "naturalism is a science (ecology), a moral calling, and an aesthetic. All true naturalism must first be humanism. According to her, the landscapes that captivate both intellectually and spiritually are those that blur the lines between natural and cultivated", since "nature is both given and constructed" (Spirn, 1997). These realities are true since nature outside of mankind as given landscape and nature that is inside of mankind as constructed landscape is one. The critical role of ecology therefore manifests being the body of knowledge concerning the economy of nature, the investigation of the total complex interrelations of all human and non-human nature.

Organic Architecture

The rule of nature in naturalism of landscape architecture has its expression in organic architecture as evident in the works and writings of Frank Lloyd Wright called "architect of the landscape". To Wright, nature was the manifestation of God: "Nature should be spelled with a capital 'N' not because Nature is God but because all that we can learn of God we will learn from the body of God, which we call Nature. Therefore "the noblest ministry of nature is to stand as the apparition of God" (Emerson, 1836) and designers who refer to their work as "natural" cites nature as authority to justify decisions to select some materials or plants and exclude others, to arrange them in particular patterns, and tend the result in certain ways (Spirn, 1997). The authority of science is cited to augment the authority of nature and God and most landscape architects regard ecological science as an important source of principles for landscape design (Emerson, 1836).

Indeed, the adoption of ideas from ecology contributed to a renewal of the discipline in the 1960s. Some, however, have embraced ecology as the primary authority for determining the "natural" (and therefore correct) way to design landscapes. To its most extreme practitioners, ecological design is deterministic, its "laws" couched in terms that recall religious dogma. Debates over what constitutes a "truly ecological landscape architecture" have escalated in recent years, with various groups accusing each other of "non-ecological" behaviour (George and Frederick, 1997). Accordingly, there have been bitter quarrels over the proper materials, styles, and methods of "ecological" landscape design. Some "advocate the exclusive use of native, as opposed to naturalized, plants. Some urge the eradication of "exotic invaders" and condemn others for planting naturalized, non-native, plants. Some conceal the artifice of their works; others celebrate the human ability to transform the landscape" (Spirn, 1991). "Some privilege the role of reason in design and promote science as the sole source of truth about nature, while others prefer personal revelation and reject science as a way of knowing" (Spirn, 1991).

Organic architecture is a philosophy of architecture which promotes harmony between human habitation and the natural world through design approaches so sympathetic and well integrated with its site that buildings, furnishings, and surroundings become part of a unified, interrelated composition (Wright, 1958) (Plate 1). The term organic architecture was coined by the famous architect, Frank Lloyd Wright. Architect and planner Pearson (2001) proposed a list of rules towards the design of organic architecture.

Plate 1: Edgar J. Kaufmann House, designed by Frank Lloyd Wright over a waterfall on Bear Run in the western Pennsylvania highlands (Source: Robin, 1995)

These rules are known as the *Gaia Charter* for organic architecture and design. It reads (Pearson, 2001):

> *Let the design: be inspired by nature and be sustainable, healthy, conserving, and diverse; unfold, like an organism, from the seed within; exist in the "continuous present" and "begin again and again"; follow the flows and be flexible and adaptable; satisfy social, physical, and spiritual needs; "grow out of the site" and be unique celebrate the spirit of youth, play and surprise; express the rhythm of music and the power of dance*

Freed (2007) takes a more seminal approach in making his description:

> *Using Nature as our basis for design, a building or design must grow, as Nature grows, from the inside out. Nature grows from the idea of a seed and reaches out to its surroundings. A building thus, is akin to an organism and mirrors the beauty and complexity of Nature."*

ENVIRONMENTALISM AND LANDSCAPE DESIGN

Environmentalism

There have been debates over what environmentalism should really mean for more than four decades after its emergence. This has been "characterized more by passion than by clarity, with definitive and persuasive answers hard to come by" (Conan, 2001). The goals of environmentalism thus include "creating, harmony between humans and nature, providing unity in nature, healing the environment, and restoring nature to the city" (http://www.doaks.org/resources/publications/doaks-online publications/environmentalism/env6.pdf).

Environmentalism is a broad philosophy, ideology and social movement regarding concerns for environmental conservation and improvement of the health of the environment, particularly as the measure for this health seeks to incorporate the concerns of non-human elements(Donald, 2003). It "advocates the preservation, restoration and/or improvement of

the natural environment, and may be referred to as a movement to control pollution. For this reason, concepts such as a Land Ethic, Environmental Ethics, Biodiversity, Ecology and the Biophilia hypothesis figure predominantly. At its crux, environmentalism is an attempt to balance relations between humanity and their broader organismic and biogeochemical milieu in such a way that all the components are accorded a proper degree of respect. The exact nature of this balance is controversial and there are many different ways for environmental concerns to be expressed in practice. Environmentalism and environmental concerns are often represented by the colour green, (Cat, 2009) but this association has been appropriated by the marketing industries and is a key tactic in the art of Greenwashing.

Environmentalism can also be seen as "a social movement that seeks to influence the political process by lobbying, activism, and education in order to protect natural resources and ecosystems" (http://modernsociety.wikia.com/wiki/Environmentalism). An environmentalist is thus "a person who may speak out about our natural environment and the sustainable management of its resources through changes in public policy or individual behaviour by supporting practices such as not being wasteful" (http://modernsociety.wikia.com/wiki/Environmentalism). In various ways (for example, grassroots activism and protests), environmentalists and environmental organizations seek to give the natural world a stronger voice in human affairs (Robert, 2005).

Evangelical environmentalism is an environmental movement in the United States in which some Evangelicals have emphasized biblical mandates concerning humanity's role as steward and subsequent responsibility for the caretaking of Creation (Gottlieb, 2005). While the movement has focused on different environmental issues, it is best known for its focus of addressing climate action from a biblically grounded theological perspective. The Evangelical Climate Initiative argues that human-induced climate change will have severe consequences and impact the poor the hardest, and that God's mandate to Adam to care for the Garden of Eden also applies to evangelicals today, and that it is therefore a moral obligation to work to mitigate climate impacts and support communities in adapting to change (http://christiansandclimate.org/learn/call-to-action).

Various rhetorical positions on environmentalism exist within the landscape architecture profession, categorized, for the purpose of this discourse, by deep environmentalism, preservation environmentalism, integrative environmentalism, and ecological environmentalism (http://www.doaks.org/resources/publications/doaks-online-publications/environmentalism/env6.pdf). Such categorisation is not intended to suggest absolute philosophical boundaries or established group Positions. This rhetorical analysis began with a metaphysical query into the differing possible relationships between humankind and the natural world. This led to the construction of categories that fell along a continuum from the most ecocentric position, in which humans see themselves as mere animals among all the other species of creation, to the most anthropocentric position, in which humans see themselves as owners of all of creation, which exists to please, satisfy, or profit them. The purely ecocentric position is that in which "humans are posited to be part of a larger ecosystem and, as such, have no privileged position within that system. The human animal is decentred, having as many rights to the riches of nature as any other animal, plant, or mineral."(http://www.doaks.org/resources/publications/doaks-online-publications/environm entalism/env6.pdf). This extreme position is best represented historically by Muir (1988). Ironically, although Muir is often cited as a "patron saint" of modern environmentalism, his metaphoric style did not become common parlance in landscape architecture (Hastings, 1996). Therefore, ecocentric environmentalism functions here as an ideal state of ontological parity-an unattainable limit that may only be approached by humankind.

The deep environmentalist (sometimes referred to as radical environmentalist or ecofundamentalist) position holds that the human actor is somewhat privileged, especially in acting on behalf of nature, which the moral stance of this position mandates. Deep environmentalism holds that "nature has intrinsic rights that stem from a spiritual base, although the origin of this spirituality is not uniform among deep environmentalists" (http://www.doaks.org/resources/publications/doaks-online-publications/environmentalism/env6.pdf). The spiritual experience of nature may be drawn from pagan Gaia worship, Eastern religions such as Taoism or Buddhism, or any of the many New Age understandings of the human-nature relationship (McHarg, 1969; Denig, 1985). Deep environmentalism functions as a transcendent value that infuses the other three categories to varying degrees. What deep environmentalists have in common are not their spiritual bases but their belief that nature has some intrinsic rights that humans are responsible for protecting (http://www.doaks.org/resources/publications/doaks-online-publications/environmentalism/env6.pdf). Deep environmentalism's proponents include Dave Foreman, Arne Naess, and Aldo Leopold (Nadenicek and Hastings, 2000).

Preservationist environmentalists seek to preserve "an unsullied nature and restore degraded lands. They are anthropocentric to the degree that they view humankind as being responsible for protecting and maintaining wild areas" (McHarg, 1969). Often, this is due to a deep environmental spiritual connection to nature, but not all preservationists are deep environmentalists; motivations can range from a romantic desire to return to a pre-Fall Eden to a selfish need to be "purer than Thou." (Nadenicek and Hastings, 2000).

Integrative Environmentalists understand their relationship to the natural world as Adam's post-Fall relationship to the Garden - as stewards of a world we did not create. From this vantage point, humans have a special responsibility to protect all creation, and this responsibility also endows us with the right to use all creation to meet our needs. Nature existed for us as a font of not only physical nourishment, but also spiritual nourishment; nature was essential to human spiritual development (Nadenicek, 1997). He advocated a harmonious integration of nature and human culture for the optimal mental, physical, and spiritual development of humankind. Soper's metaphysical view of nature aligns with this integrative category of environmentalism. According to Soper (undated) "One is invoking the metaphysical concept in the very posing of the question of humanity's relation to nature." Nature as a human construct, the idea of integration, and suppositions about human naturalness falls into Soper's category of the metaphysical perspective (Cronon, 1995). Ecological Environmentalism (Nadenicek and Hastings, 2000) distanced itself from the moralistic or sentimental understandings of nature as those offered by science. Ecological environmentalism brings an understanding of the world as process. Humans have the dual role of being both part of the process and observers of it. In view of the conceptual overlapping, ecological environmentalism also parallels with landscape ecology and shall be more discussed under it.

Criticisms of environmentalism tend to fall into two major categories: environmental skepticism and anti-environmentalism. Environmental skeptics dispute the claims of environmentalists, claiming they are either inaccurate or exaggerated (Huesemann and Huesemann, 2011). Anti-environmentalists, on the other hand, accept many of the claims made by environmentalists while simultaneously accepting that change is inevitable, regardless of cause and speed. They do not deny the impact of humanity, but they dispute the argument that humanity can kill the planet, citing life's several billion year history as evidence that it is more resilient than many environmentalists realize. Humans are now recognized as being a part of the natural world, and the ecological study of human interventions, even on the scale of landscape architecture, has become acceptable for

sympathetic ecologists. A deeper scientific understanding of the environment can also be a source of inspiration to landscape architects, both as motivation and as artistic idea (Nadenicek and Hastings, 2000).

Landscape Ecology

In the canon of the disciplines that made up Landscape Architecture practice in theory and practice, ecology provides the single indispensable basis for landscape architecture and landscape planning, landscape planning being the development and application of large scale strategies, policies and plans to create successful environments, in both urban and rural settings, for the benefit of current and future generations (Landscape Institute, 2011). Because landscape architecture has critical roles to play in the domestication and designing of nature in cities, there is the supremacy of the natural, and therefore of ecology, in the landscape discipline as an ideological imperative. When McHarg (Spirn, 1998) calls ecology "not only an explanation but a command" he conflates ecology as a science (a way of describing the world), ecology as a cause (a mandate for moral action), and ecology as an aesthetic (a norm for beauty). While landscape architecture practice therefore involves ecology, the location of the discipline in McHarg's science-design nexus rather suggests a type of practice that is ecological (Raxworthy, undated). Thus, ecology should be seen as a major consideration in the matrix of site information in landscape architecture practice. McHarg (1967) pointed out that where the landscape architect commands ecology he is only "the bridge between the natural sciences and the planning and design professions, the proprietor of the most perceptive view of the natural world which science or art has provided". Similarly, Williams and Patterson (1999) argue that:

> *viewing ecosystems as repositories of socially constructed meanings have implications for what counts as ecosystem knowledge, how we conceptualize and value ecosystems, and how we integrate this knowledge into theory and practice.*

The realist or scientific perspective in Soper's triad of perspectives on nature is similarly about the "structures, processes and causal powers" at work in the physical environment (Soper, undated). This is the nature to whose laws the world is subject.

McHarg (1969) promoted an ecological view in landscape architecture, in which the designer becomes very familiar with the area through analysis of soil, climate and hydrology. He argued for the need to define the problems of modern development and present a methodology or process prescribing compatible solutions. His work had an impact on a variety of fields and ideas. "Environmental impact assessment, new community development, coastal zone management, brownfields restoration, zoo design, river corridor planning, and ideas about sustainability and regenerative design all display the influence of" his works (Steiner, 2004). His *Design with Nature* (McHarg, 1969) had its roots in much earlier landscape architecture philosophies. The Woodlands (Plate 2) is one of the best examples of his ideals. Most of the actual work was done by a large team while McHarg was still there and by many others in the years since he left. The Woodlands continues to be a successful ecological community even today (Forsyth, 2003). He saw the earlier tradition as a precursor of his philosophy, which was rooted less in aristocratic estate design or even garden design and more broadly in an ecological sensibility that accepted the interwoven worlds of the human and the natural, and sought to more fully and intelligently design human environments in concert with the conditions of setting, climate and environment. Always a polemicist, McHarg (1969) set his thinking in radical opposition to what he argued was the arrogant and destructive heritage of urban-industrial modernity, a style he described as "Dominate and Destroy."

Plate 2: The Woodlands CDP, Texas co- designed by McHarg and established in 1974. (Source: U.S. Census Bureau, 2006)

Urbanism and Urban Design

Urbanism

The philosophy of urbanism posits that cities are vitally important to society. According to urbanists, the difference in population entails a difference in the social and political order as well (Eduardo and Rasna, 2007). Amin and Graham (1997) argue that the urbanscape can best be understood as a site of co-presence of multiple spaces, multiple times and multiple webs of relations, tying local sites, subjects and fragments into globalizing networks of economic, social and cultural change. Olmsted (1990), widely recognised as the pioneer and visionary of modern landscape architecture (Fadamiro, 2010), was among the foundational proponents of urbanism. He had high expectations for his design's psychology and visual effects on people. He believed that the perfect antidote to the stress and artificialness of urban life was a nice stroll through a pastoral park (Plate 3). He foresaw places with graceful undulating greensward and scattered growths of trees. He believed and promoted the idea that such an environment would promote a sense of tranquillity. Olmsted's vision was that the sense of calmness that would come from the park by his separation of the different landscape themes and conflicting uses. For Olmsted, the importance of contact with wilderness for human well-being, the effect of beautiful scenery on human perception, and the moral responsibility of democratic governments to preserve regions of extraordinary natural beauty for the benefit of the whole people (Roper, 1973) are non-negotiable. Olmsted favoured a more sanitized urbanism of parks and parkways and argues that aesthetic of urban design must therefore be rooted in the normal processes of nature and of living. It should link function, feeling, and meaning and should engage the senses and the mind. Similarly, Spirn (1988) concludes that the city is both natural and contrived a transformation of "wild" nature to serve human needs, an evolving entity shaped by both natural and cultural processes.

Plate 3: Panoramic view of Central Park, New York from the Rockefeller Centre,co-designed with Calvert Vaux by Olmsted, Frederick Law in 1857. (Source: Miller, 2003).

Urbanism in its wider sense also includes the study of the interaction between the city and the rural hinterland (http://www.cityvision.edu/wiki/node/15709). The word urbanism is also

used as a qualitative complement to the description of various urban and rural forms i.e.: informal urbanism, new urbanism, self-sufficient urbanism, sustainable urbanism, centralized or decentralized urbanism, neo-traditional urbanism, transitional urbanism, green urbanism and landscape urbanism. Green and landscape urbanisms in particular are the closest to landscape architecture practice.

Landscape Urbanism is a theory of planning and design for urbanism arguing that *landscape*, rather than *architecture*, is more capable of organizing the city and enhancing the urban experience (http://en.wikipedia.org/wiki/Landscape_urbanism). It describes "the ability to produce urban effects traditionally achieved through the construction of buildings simply through the organization of horizontal surfaces" (Waldheim, 2006). Landscape urbanism sees landscape as a medium of urban order for the contemporary city. According to Reed (2006)

> *Contemporary landscape practices are witnessing a revival of sorts, a recovery of the broader social, cultural, and ecological agendas. No longer a product of pure art history and horticulture, landscape is re-engaging issues of site and ecological succession and is playing a part in the formative roles of projects, rather than simply giving form to already defined projects."(http://wsd-landscape.blogspot.com/2012/03/landscape-optimism-interview-with-chris.html).*

Green urbanism is the practice of creating communities beneficial to human and the environment. According to Beatley (2000) it is an attempt to shape more sustainable places, communities and lifestyles (Bicknell et al, 2009) and consume 75percent of the world's resources (Karlenzig et al, 2007; Lehmann, 2010). Green urbanism is interdisciplinary, combining the collaboration of landscape architects, engineers, urban planners, ecologists, transport planners, physicists, psychologists, sociologists, economists and other specialists in addition to architects and urban designers.

Urban Ecology

The philosophy of urbanism has its role as Urban Ecology in landscape architecture practice. In contemporary urbanism, also known as urban design in many parts of the world, there are as many different ways of framing the practice as there are cities in the world. Barnett (2011) acknowledges a list of sixty contemporary urbanisms. Knox (2010) refers to one of many trends in contemporary urbanism as the "aestheticization of everyday life". Krieger (2009) studies urbanism theory in order to provide insight into how urban practitioners work. He identifies ten spheres in which urbanism takes place in practice. The ten are: the bridge connecting planning and architecture, a form-based category of public policy, the architecture of the city, urban design as restorative urbanism, urban design as an art of place- making, urban design as smart growth, the infrastructure of the city, urban design as landscape urbanism, urban design as visionary urbanism, and urban design as community advocacy or doing no harm. Krieger (2009) concludes by stating that "urban design is less a technical discipline than a mind-set based on a commitment to cities." Kelbaugh (2009) writes about three urbanisms on the cutting edge of theoretical and professional activity in Western cities. These three paradigms include New Urbanism, Everyday Urbanism, and Post-Urbanism (Kelbaugh, 2009).

Another important thinker in the history of ecological urbanism is Jane Jacobs who argues that, "human beings are part of nature" as are cities and that "nature, sentimentalized and considered as the antithesis of cities, is apparently assumed to consist of grass, fresh air and little else" (Spirn, 2011). She focused on the city as a human habitat and regarded urban design as a way to support and fulfil human needs. Jacobs advocated an ecological approach to designing and managing cities, arguing that cities are problems of organized complexity,

akin to living organisms, and that there are lessons for urban design from the study of systems where half-dozen or even several dozen quantities are all varying simultaneously and in subtly interconnected ways. Jacobs's, McHarg's, Lynch's, and Mumford's ideas about an ecological approach to the design of cities were supported by scientific knowledge about the place of cities in the natural world and the role of humans in shaping the environment (Spirn, 2011).

The growing literature on the environmental history of particular cities provides a temporal context for understanding the ways that human activities and settlements respond to and shape their natural environments. Ecological urbanism grew out of ideas and action in landscape architecture, architecture, and urban design and cities are part of the natural world. Accordingly,

> *Nature in the city is far more than trees and gardens, and weeds in sidewalk cracks and vacant lots. It is the air we breathe, the earth we stand on, the water we drink and excrete, and the organisms with which we share our habitat. Nature in the city must be cultivated, like a garden, rather than ignored or subdued. The idea of nature as consisting of the biological, physical, and chemical processes that create and sustain life, the earth, and the universe is fundamental to ecological urbanism. If one embraces this idea, then the false oppositions between city and nature, the given and the built, fall away (Spirn, 2011).*

Wilson's (1988) biophilia hypothesis argues that "humans have an innate attraction to life and life's processes". Urban design that fosters and intensifies the experience of the natural processes that sustain life fulfils this need. Aesthetic experience of such places has the potential for recentering human consciousness from an egocentric to a more bio-centric perspective. This is the whole essence of landscape architecture.

FINDINGS AND DISCUSSIONS

The goal of this section is to examine each of the paradigms in order to isolate their core tenets towards understanding their commonalities and disparities as shown in Table 1. To avoid rhetoric, each paradigm is summarized to definitional status of key words. In this sense, naturalism sees landscape as *nature* in time, established through "divine" ecological processes, governed by "supernatural" laws whose products are established in space. Landscape thus has history and geography as temporal and spatial entity. Therefore, naturalism exclude the thought of landscape as abstraction, an idea or mere concept that cannot be experienced, explained as science, lived-in and enjoyed by humans. While it accepts the centrality of humans at the receiving end through interaction with land to form landscape in a cultural process, it emphasizes the supremacy of divine rule as the verdict of what becomes of the landscape. Accordingly naturalism is partly humanism and majorly natural-determinism. It sees humans as part of the ecological system and at the same time stewards of its conservation. The tenet of naturalism that "nature is both given and constructed" collapses the partition between the inner-nature of man and the outside-nature of the landscape. Practitioners of naturalism make *nature* the authority for their landscape designs. With the interchangeableness of ecology and science and upholding the idea that nature should be respected as much as its Creator, being the manifestation of God, the key debates in naturalism are anchored on the words: natural, supernatural, ecology, reality, complexity, flexibility, free-flowing formation, fractal composition, dogmatism and divinity against personal revelation, intuition, ingenuity, simplicity, regularity, rigidity and artificiality.

Table 1: Core tenets of the philosophical paradigms of landscape architecture

Paradigm	Key word and Definition	Core tenet	Inclusions	Exclusions	Deductions
Naturalism	Landscape as *nature* in time, Established through "divine" ecological processes, Governed by "supernatural" laws whose products are established in space	Nature is both given and constructed" Anchored on the words: natural, supernatural, ecology, reality, complexity, flexibility, free-flowing formation, fractal composition, dogmatism and divinity against personal revelation, intuition, ingenuity, simplicity, regularity, rigidity and artificiality.	Centrality of humans Supremacy of divine rule	Landscape as abstraction, An idea or mere concept that cannot be experienced, explained as science, lived-in and enjoyed by humans	Naturalism is partly humanism and majorly natural-determinism. It sees humans as part of the ecological system and at the same time stewards of its conservation
Environmentalism	Landscape as total *environment* of humans and nature	Unity in biodiversity Nature in cities Healthy environment Biophilia hypothesis Ecological conservation Environmental restoration Proportional balance between humanity and its broader concerns, Eco-system and natural resources protection, Biblical stewardship of nature and activism.	Nature as a human construct The world as a process Humans as privileged, Do not believe in change Humanity can kill the planet.	Urban-industrial modernity, arguing that it is arrogant, destructive and domineering. Nature as a human construct The world as a process, Humans as privileged	Distances itself from the scientific explanations of ecology despite the systematic procedures in science
Urbanism	*City:* ideology on population, social and political order, economic and cultural change in globalizing networks	Cultivated nature in cities Ecological cities Designs that envision tranquillity, serenity, sense of calmness, contact with wilderness, beautiful scenery, normal processes of nature, multiplicity of spaces and times	The dictum and maxim of ecology City where landscape is the medium of urban order Human beings are part of nature	Oppositions between city and nature, the given and the built, as false	The city is shaped by both natural and cultural processes and therefore believe in change

Environmentalism sees landscape as total *environment* of humans and nature without complete clarity in spite of great passion. It pursues the following in its tenets: unity in biodiversity, nature in cities, healthy environment, biophilia hypothesis, ecological conservation, environmental restoration, proportional balance between humanity and its broader concerns, eco-system and natural resources protection, biblical stewardship of nature and activism. Conversely, in its approach of two diametrically –opposed extremes of ecocentric and anthropocentric positions in humans relation with nature, it betrays its self-confidence and exhibits lack of clarity. Environmentalism is also opposed to urban-industrial modernity, arguing that it is arrogant, destructive and domineering. Unfortunately too, it sees nature as a human construct, the world as a process, humans as privileged, do not believe in change and that humanity can kill the planet. While it agrees that human environments should be intelligently designed, it does not believe in change. Although it embraces ecology in its thoughts and actions, it distances itself from the scientific explanations of ecology despite the systematic procedures in science and still argues that a deeper scientific understanding of the environment can also be a source of inspiration to landscape architects. Without offering its contextual explanation of culture and probably having an oversight of landscape as product of modification of land by humans through cultural processes, environmentalism argues in favour of an "untouched" nature in consonance with human culture. The whole gamut of ideology in environmentalism is therefore not only inconclusive but self-betraying, confusing and unnecessarily complex.

The keyword in the philosophy of urbanism is *city*. It concerns itself with ideology on population, social and political order, economic and cultural change in globalizing networks. Because it is people-oriented it is humanistic and for its designs that envision tranquility, serenity, sense of calmness, contact with wilderness, beautiful scenery, normal processes of nature, multiplicity of spaces and times, it is naturalistic. In this wise urbanists argue that the city is shaped by both natural and cultural processes and therefore believe in change. By pursuing aesthetic of urban design through the normal processes of nature and of living and linking function, feeling, and meaning that engages the senses and the mind, urbanism truly conforms to the dictum and maxim of ecology. However, without hypocritical pretension of environmentalism, urbanism believes in designing cities in natural contexts by transforming wilderness to serve human needs incorporating parks and conservation areas in built environments. It envisions city where landscape is the medium of urban order and human beings are part of nature. It promotes human activities and settlements that respond to and shape the natural environments of plants, air, the earth and the organisms with which humans share their habitat. In consonance with naturalism, urbanism argues that nature in the city must be cultivated and therefore upholds the doctrines of "cultivated nature" and "ecological cities". To urbanism, oppositions between city and nature, the given and the built, is false, calling for bio-centric cities.

Table 2: Commonalities and disparities among naturalism, environmentalism and urbanism in landscape architecture

Commonalities	Disparities
Nature is superior, powerful, permanent, indispensable, desirable	Human ingenuity is inferior to nature
Nature can be given or constructed	Eco-balance implies untouched nature
Ecology is the scientific means of understanding nature	Change is not ecological
Humans are the theological, temporal and accountable stewards of earth	Cities and nature are in opposition
	Humans are destroyers of the earth.

In explicating the content of the above discourse on naturalism, environmentalism and urbanism as philosophical standings in landscape architecture theory and practice, the following key commonalities are extractable as shown in Table 2: nature is superior,

powerful, permanent, indispensable, most desirable and can be given or constructed; ecology is the scientific means of understanding and exploring nature for the best use of humans; humans are the theological, temporal and accountable stewards of God's planet earth and its built environment. Conversely, the areas of disparities among the trios are: human ingenuity is inferior to nature; eco-balance implies untouched nature and change is not ecological; cities and nature are in opposition and humans are destroyers of the divine heritage, called earth. A conscious effort is demanded to bring these commonalities together to a common ground by formulating a holistic philosophy for landscape architecture theory and practice and addressing how to resolve competing ideas among these paradigms.

A Unifying Philosophy for Landscape Architecture

Three common keywords have been singled-out so far as derivatives of the three identified philosophical paradigms. These are *nature*, *environment* and *city* from naturalism, environmentalism and urbanism respectively. Though inter-related in meaning at varying contextual scales, the trio inevitably suggests that any unifying philosophy of landscape architecture that may enjoy broad-based acceptability and wider application should be pluralistic. Since *nature* is indispensable, ecology is the science of understanding the natural *environment* and humans are central to the idea of *city*, it may be proposed that such pluralistic philosophy be called Eco-natural Humanism (Figure 1).

Eco-natural Humanism will then mean a holistic philosophy in Landscape Architecture that emphasizes the rule of nature in the design, construction and management of built environment generally, and the city in particular, and conservation areas in the best ecological milieu, in the optimal interest of humans who will be accountable to the Creator. Its tenets will encompass all those that are agreeable among founding naturalism, environmentalism and urbanism. The conflicting principles of this trio might be resolved by a tangential approach to the pluralized focus, *Eco-natural Humanism.* In this wise, human ingenuity will not be comparable with the *supreme* nature but rather enhances the adaptation of nature to the best use of humans in the most ecological stewardship. Furthermore, eco-balance will not imply "untouched nature" but change that is ecologically-compatible and sustainable in the environmental, social, economic, political and cultural agenda of the city. Also, in this approach, cities and nature will not be opposition but co-inhabit the environment of non-humans and humans in the most sustainable mix and then humans will not be labeled as destroyers of the divine heritage, called earth. Accordingly, landscape architecture will be playing significant roles in the environmental sustainability debate in the face of the onslaught of urbanization forces.

REFLECTION, RECOMMENDATION AND CONCLUSION

The confluence of nature and humans is significant to determining the merit or otherwise of any intellectual discourse on landscape architecture. According to Treib (2010) "meaningful landscape design should express a distillation of the essential qualities of human experience paired with a consideration of nature". Such design should be based on and guided by firm and factual theoretical underpinnings built on the nature-human nexus with "nature and ecology at sacrosanct values" (Hohmann and Langhorst, 2011). The proposed pluralistic and holistic *Eco-natural Humanism* philosophy of landscape architecture will belong to this larger school of thought. It will not be an empty idea, a manifesto for landscape political survival but a "food for thought", a flair for beauty, a scavenger of dumb landscape ideas and a catalyst for unimaginable result in the landscape experiment.

Despite its possible humble conception, inability for fuller expression and infancy of possible acceptability, *Eco-natural Humanism* signals the rejuvenation of a discipline in theoretical

disarray and practical confusion. In its broad application, in view of the universality of humanity, it will cross racial, geographic, intellectual and disciplinary boundaries. Whether landscape is conceptualized as rural or urban, heritage or modern, wild or constructed, *Eco-natural Humanism* promises to be a haven for all and more.

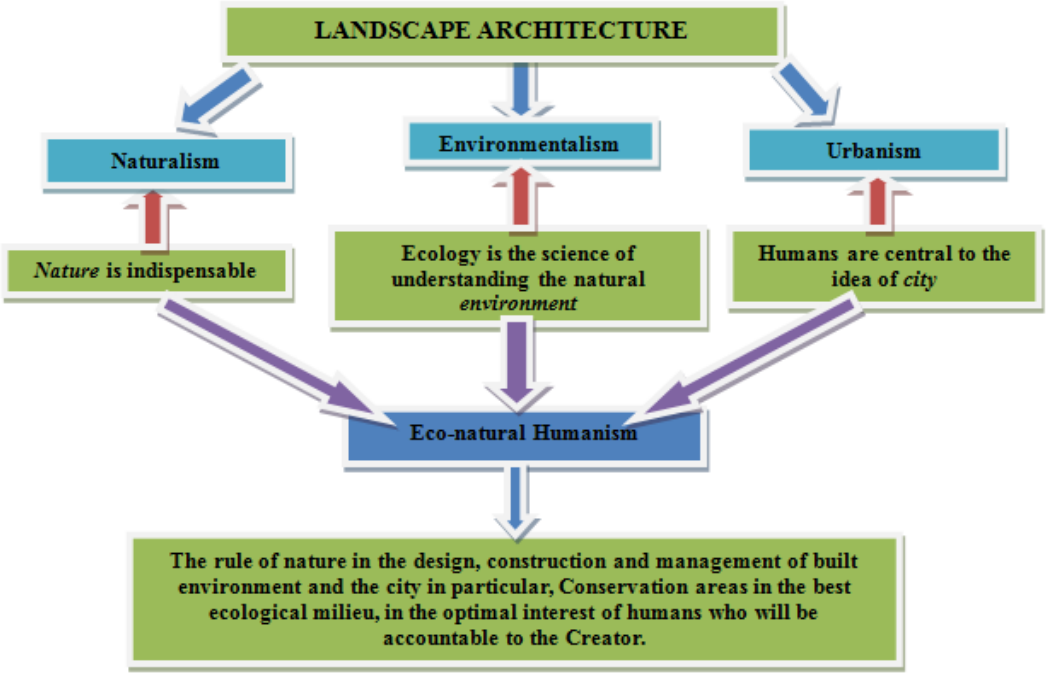

Figure 1: Schematic framework of a unifying philosophy of landscape architecture (Source: Authors, 2016)

However, in view of the peculiarities among genders, age groups and social classes, cultural distinctiveness and economic and quality of life indices, there is need for further analysis on and experimentation of this philosophy among differing human groups. Similarly, detail ecological considerations of this philosophy are necessary on geographical basis because of differences in climatic, geological, and vegetation parameters across regions. Since the profession of landscape architecture demands the rigor of theoretical criticism, *Eco-natural Humanism* could be a cutting-edge grounded theory of landscape architecture. It essentially belongs to the *realism* perspective in which the position that the picture that science (ecology) paints of the world is a true and accurate one (Chia, 2002). Therefore, because of this scientific source, *Eco-natural Humanism* promises to be precise in the key landscape architecture debates.

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Adoption of Sustainable Risk Management: A Study of Chemical Exposure in Textile Industry in Nigeria

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ABSTRACT

The Nigeria textile industry consists of a number of units engaged in spinning, weaving, dyeing, printing, finishing and a number of other processes that are required to convert fibre into a finished fabric or garment. It is however regretted that, this industry exposes workers to many hazards and risks, ranging from exposure to noise and dangerous substances and chemicals, to manual handling and working with dangerous machinery. Each processing stage from the production of materials to the manufacturing, finishing, colouring and packaging posed risks for workers, and some of these are particularly dangerous to human's health. No industrial sector in the world including that of Nigeria today is free of risk belonging to its internal and external environment. This article identified each of these risks in relation to the Nigerian textile industries, along with the possible solutions for their assessment. This study recommends among others that an inventory and risk assessment of all chemicals and dyes that are present at the Nigeria Textile factory be undertaken by the management and the information in the inventory and risk assessment must be made available to all workers; Dyes, chemicals and other auxiliaries should be stored in a separate work area and access to this area should be limited to trained personnel. The storage area should be kept relatively cool and dry (within the range specified in MSDS), and all items must be recorded in log books and clearly labelled in a language understood by the chemical handlers.

Keywords: Chemical exposure; Sustainable Risk Management; Textile Industry; Nigeria

INTRODUCTION

The textile industry has been criticized as being one of the world's worst offenders in terms of pollution because it requires a great amount of three components: Chemicals, dyes and water. Many different chemicals are added to textiles in their different life cycle stages. Many of these can be found in the finished articles and part of them end up in waste water or liquid after washing or chemical cleaning of textiles. As many as 2,000 different chemicals are used in the textile industry, from dyes to transfer agents. According to Ojo, (2003) approximately 42% of chemicals manufactured globally are applied in textile industry and Nigeria's textile industry uses about 25% of the world's textile chemicals. Dyeing agents and different auxiliary substances are also used in textile dyeing processes, to improve the attachment of colour into the fibre (KemI, 2009).

Almost all dyes used in textile industry are synthetic organic compounds. According to Talvenmaa (2002), there are more than 8,000 different synthetic dyes and almost 40,000 commercial dye products. The selection of dyes depends on the quality of the fibre and the fabric as well on the desired colour and its properties (Priha and Riipinen, 2005). There are two types of dyes: textile dyes that attach into the fibres, and pigments that are attached into the fabric using a binding agent. Hazardous substances used in dyes include e.g. the heavy metals copper (Cu), nickel (Ni), lead (Pb), mercury (Hg), cadmium (Cd), chromium (Cr), zinc (Zn) and arsenic (As) (Parvath, Makin & Sutherland, 2009). Many of these substances are carcinogenic.

Water is a finite resource that is quickly becoming scarce, and is used at every step of the process both to convey the chemicals used during every step and to wash them out before beginning the next step. The water becomes full of chemical additives and is then expelled as wastewater; which in turn pollutes the environment: by the effluent's heat; by its increased

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pH; and because it's saturated with dyes, de-foamers, bleaches, detergents, optical brighteners, equalizers and many other chemicals used during the process.

Traditionally produced fabrics also contain residuals of chemicals used during their manufacture—chemicals that evaporate into the air we breathe or are absorbed through our skin. Some of the chemicals are used by traditional dyers in the production of fabrics are equally carcinogenic and may cause harm to children even before birth, while others may trigger allergic reactions in some people. According to James, James & Ashe (1990), the population that is allergic to chemicals will grow to 60 percent by the year 2020. These chemicals can be hazardous to the health of humans and animals, especially when a factory's chimney breathes them out or when people drop the chemicals into lakes, streams, oceans or rivers. Also most of the washing procedures for textiles are harmful to our environment and possess challenges to industries in developing countries like Nigeria.

Exposures in the Nigerian Textile Manufacturing Industry

Textile is a general term which refers to any material made of interlacing of fibers such as fabric, cloth, carpet, and belt among others (Osobu, 2014). Generally, it is a flexible woven material consisting of a network of natural or artificial fibers which are often referred to as thread or yarn. The importance of textiles to human sustenance, and the socio-cultural and economic development of a nation cannot be over emphasized. Apart from food and shelter, textile (clothing) has been identified as the most important in the hierarchy of man's need. In Nigeria, the production of textiles had flourished at both cottage and industrial levels (Akintayo, 2010).

Nigerian Textile manufacturing Industry can be categorized either as traditional or modern/ industrial. According to Okeke (2002) Nigerian traditional textiles can be classified as woven, non-woven, dyed or patterned which are decorated and designed structurally at the surface. These include; "Aso Oke" (Yoruba)' Akwete, (Igbo) "Okene, (Ebira) Ashiasha (Tiv) and Adire (Yoruba) among others. Basically, these textiles are structurally decorated and produced on both vertical and horizontal looms that are exclusively handled by women and men weavers in the society. These fabrics have age long qualities such as high durability, unique textures and traditional designs. The surface decorated ones like Adire are produced by the process of dyeing, printing and direct application of other elements of finishing unto the surface of the locally woven fabric. Industrial textiles refer to textiles produced through the use of automated electronic machines which usually come in a variety of colours, designs, and quality. This became possible due to a number of factors. Traditionally, Nigeria is noted for the production of cotton, silk and other fibers, which are primary materials for the textile industries. Nigeria now relies on imported raw materials and foreign technology to make the industry function.

A typical flow for the transformation of raw cotton into finished fabric in the Nigerian textile manufacturing industry like any other industry according to Faleye (2013) is as follows. Raw cotton bales are opened, and the cotton may be blended with synthetic or other natural fibres at the opening line. The cotton is then delivered to the picking machines, which transfer the fibres to the cards. During these first stages, fibres may be transported by air currents (blowing). Cotton fibres are then processed at the card. From the card, the fibre strands are run on the drawing frame. From the drawing frame, strands of parallel fibres are moved to the roving frame. The product, called 'roving', goes to the spinning frame, and part is spun into warp yarn and part into filling yarn.

Fabrics can be produced in two ways-by weaving and by knitting. Of these two processes, weaving is the older, being thousands of years old (Asaju, 2004). The process of weaving involves the interlacing of two or more sets of yarn at right angles, the warp yarn running the

length of the fabric and the filing yarn being inserted across the fabric. Each cross-wise insertion is called a pick. Knitting is the process of making a usable fabric from threads or yarns by arranging them into interlocking loops (Ogundele,2000, Oloyede,2014). The processing of textile fabrics involves is a combination of three separate operations: (i) preparing, (ii) dyeing and (ii) finishing. The combination is also sometimes referred to as finishing. Most fabrics, except those prepared from wool, are dyed and finished after weaving. The end use of the textile determines whether it is dyed and/or finished.

i. Preparation involves the removal of undesirable materials from fabrics so that they can be dyed or finished in later processes. These processes involves (a) singing, (b) de-sizing, (c) bleaching, (d) scouring and (e) mercerization. In singeing, unwanted surface hairs or filaments are removed with a flame. The aim of de-sizing is the elimination of sizing agents applied earlier to warp yarns. Sizing agents are normally starch. In scouring, the fabric is boiled to remove the remaining sizing agents and impurities accompanying cellulose and other fibres. Mercerization is the short-term treatment of cotton fabrics with a sodium hydroxide solution, which changes the physical and chemical properties of fibres and increases their strength and capacity to absorb dye. Fabric bleaching is intended to eliminate natural substances that impart a grey shade to the fabric. Chlorine-releasing compounds (such as hypochlorites) and hydrogen peroxide are the most commonly used bleaching agents (Adisa, 2013).

ii. Dyeing: The aim of the dyeing process is to impart a certain colour to the fabric through application and fixing of dyes. ln dyeing, the dye molecules penetrate the pores of the swollen fibres and are retained there by chemical or physical forces. Cotton is generally dyed after the yarn has been woven or knitted into fabric, while wool yarn is usually dyed before. In printing, colour is applied to the fabric surface and is bound there by physical and chemical forces. The process is similar to that of dyeing. Sometimes, organic solvents (alcohols, ketones, esters, aliphatic and aromatic hydrocarbons) are used in printing dyes and for the cleaning of printing frames. Several printing techniques, i.e., direct, discharge and resist printing, are used. Printing is done by roller, flat and rotary machines.

Textile manufactures inc1udes spinning, weaving, knitting, dyeing and finishing of all types of natural and synthetic fibres. Machines vary from primitive looms used in cottage industries to sophisticated machines in modern factories (Faleye,2013). Textile workers are exposed to textile dusts (both natural and synthetic) throughout the textile manufacturing process. During spinning, weaving and knitting operations, the use of chemicals is limited. The most important chemicals used in these processes are sizing agents (e.g., starch) and yarn lubricants (spinning oil and polymers). Workers in the cotton industry have been exposed to mineral lubricants used in the spindles during the operation called 'mule spinning' (twitting of yarn). A wide variety of occupational health hazards are present in the textile manufacturing industry. The most ubiquitous exposure in textile mills is to organic dust, in particular to cotton dust. Chemical exposure in spinning and weaving is limited mainly to sizing agents and spinning oils. Raw cotton may be contaminated with bacteria, desiccants and defoliants; raw wool may be contaminated by pesticides from sheep dips. There are no data, however, to indicate the levels of desiccants, defoliants or pesticides in textile mills Makinde (2005). During fabric preparation, workers can be exposed to a variety of bleaching, scouring, singeing and mercerizing agents. In dyeing, printing and finishing, chemicals are widely used and exposures may be highly complex.

In weaving, dyeing and printing, workers are frequently exposed to dusts, dyes, a variety of acids such as formic, sulfuric and acetic acids, fluorescent brighteners, organic solvents and

fixatives. Workers in the finishing operations are frequently exposed to crease-resistant agents, many of which release formaldehyde, and to flame retardants, such as organic phosphorus compounds, chlorinated hydrocarbons and carbonates. These exposures may occur simultaneously with physical hazards, inc1uding noise, vibration and heat. These developments, as noted by Okeke (2002) might not be unconnected with the synthetic dyes and chemicals materials which the workers' were exposures separated from Nigeria's getting in contact with during the production processes.

Hazards and Health risks in the textiles Industry

The textiles industry has many hazards that can cause injury to workers, from transport in the workplace (lift truck), dangerous large work equipment and plant, to the risk of slips from a wet working environment. Workers being struck by objects, such as moving machinery parts and vehicles are a significant cause of injury in the sector. There also exists other health related risks as highlighted below by Heinrich, Petersen & Roos, (2000).

Musculoskeletal disorders

Musculoskeletal disorders (MSDs) are the most common work-related health problem in textile industry, with almost one in four workers reporting backache and one in five complaining of muscular pains. In the textiles industry, risk factors for Musculoskeletal disorders include: Working in awkward postures, such as during spinning, cutting, product control, and packaging; Repetitive movements, such as during spinning, cutting, product control, and packaging; Fatigue from manual handling, during the storage, inspection, treatment, shipping, finishing, and cutting of textiles.

Exposure to chemical agents

Many different groups of chemical substances are used in the textiles industry, including dyes, solvents, optical brighteners, crease-resistance agents, flame retardants, heavy metals, pesticides, and antimicrobic agents. They are used in dyeing, printing, finishing, bleaching, washing, spinning, dry cleaning, and weaving. The textile industry has been evaluated as a sector with an increased carcinogenic risk. Several studies have showed an increased risk of nasal, laryngeal and bladder cancer.

Exposure to dusts and fibres

The exposure of workers to dusts from material such as silk, cotton, wool, flax, hemp, sisal, and jute can occur during weaving, spinning, cutting, ginning, and packaging. Division of tasks along gender lines may mean that women are exposed to organic dusts more than men, with respiratory diseases being diagnosed more often in women than men. Exposure to fibres and yarns may cause nasal or bladder cancer.

Exposure to biological agents

In some activities, such as carding and willowing, workers may be exposed to biological agents such as *anthrax*, *clostridium tetani* (the causative agent for tetanus), and *coxiella burnetti* (which causes Q fever). Exposure to biological agents can result in allergies and respiratory disorders.

Exposure to physical agents

Workers may also be exposed to noise and vibrations, for example during weaving, spinning, sewing, twisting, and cutting. Exposure to loud noise can result in permanent hearing damage such as noise-induced hearing loss and tinnitus. Exposure to vibration, particularly together with risk factors for MSDs, can lead to long-term harm. Electromagnetic fields may also be found in some workplaces in the textiles industry.

In all, Chemical exposure is the most problematic risk challenges to textile workers and the environment. The National Programme on Dangerous Chemicals from 2006 identified

chemicals in textile articles as an issue where improved risk management is needed (Ministry of the Environment, 2006, p. 74-79). Also preliminary report on a study on "Control of chemicals in textile articles by (Häkkinen, 2010) identify the deficiencies of management measures on textile articles.

In most textile production processes variety of chemicals including hazardous ones are used liberally, due to both lacking regulation and management and to particular needs such as preservation during transport and for other such as market economic reasons thus, chemicals in textiles present a special challenge for risk management. The identification, assessment, management and surveillance of chemicals imported into textile articles pose therefore a major issue to be addressed.

LITERATURE REVIEW

The safety management principles of the ISO standards and of the standard textbooks on safety management seem to suggest that science and industry have reasonable models of how safe and reliable organizations should work. However, this is not the case. As Reber, Willin & Duhon (2003) point out, the organizational literature fails to deal specifically with either hazardous organizations or high levels of performance reliability. The standard texts on safety management, for example Heinrich, Petersen and Roos (2010), and Bird and Germain (2007) present neither specific models of the safety management system nor do they provide empirical evidence of how particular aspects of the suggested frameworks contribute to the overall level of HSE.

Hale and Baram (2009) conducted a thorough literature review on health, safety and environment (HSE) management and revealed a number of lines of research and isolated studies which seem to have few links with each other. They concluded that literature on SMS can be characterized, at least until the 1980s, as accumulated experience of common sense and as general management principles applied to the specific field of safety risk management. One of the earliest studies was that of Cohen (1997). He reviewed seven studies that dealt with critical determinants in different industrial settings. Some of the factors associated with high safety performance were: strong management commitment to safety; close contact and interaction between workers, supervisors, and management enabling open communications on safety as on other job matters; workforce subject to less turnover, including a large core of married, older workers with significant length of service in their jobs; high level of housekeeping, orderly workplace conditions, and effective environmental quality control; well developed selection, job placement, and advancement procedures and other employee support services; training practices emphasizing early indoctrination and follow-up instruction in job safety procedures; evidence of added features or variations in conventional safety practices serving to enhance their effectiveness.

Shafai-Sahrai (2001) examined 11 matched pairs of companies conducting on-site interviews and site inspections at each. Factors prevalent in low injury rate companies were senior management involvement in safety; prioritization of safety in meetings, and in decisions concerning work practice; better injury record keeping systems; use of accident cost analysis; reduced span of supervisor responsibility; spacious and clean workplace environment; and improved safety devices on machinery. Additionally, Cohen and Cleveland (2003) reported findings from a linked series of studies examining health and safety management in organizations with good safety performance across different industries. Methods included a questionnaire survey of 42 matched pairs of plants with low and high accident rates, with seven pairs of these subject to detailed site surveys. Those 7 with lower accident rates were characterized by a strong management commitment to safety; a humanistic approach to dealing with employees, with frequent positive contact and interaction; encouragement of

hazard identification by workers; better housekeeping and general plant cleanliness; presence of both informal and formal workplace inspections; greater availability and use of personal protection equipment; improved employee selection procedures; low turnover and absenteeism; and better plant environment.

Referring to these studies, Chew (2005) compared safety activities in 18 pairs of low and high injury rate companies, drawn from three Asian countries. Prevalent factors were supervisory involvement in safety activities; safety inspection; safety training; use of accident record analysis for prevention purposes; carefully applied safety rules; machine guarding; supply of personal protection equipment; and standard of housekeeping. Shannon, Walters, Lewchuk, et al. (2006) conducted a postal survey of over 400 manufacturing companies, each having at least 50 employees. The defining features of organizations with lower rates of lost time injuries included managers who perceived more participation in decision-making by the workforce and more harmonious management-worker relations; encouragement of long-term career commitment; provision of shortand long-term disability plans; definition of health and safety responsibilities in every manager's job description; performance appraisals with topics related to health and safety; and more frequent attendance of senior managers at health and safety meetings.

A Study conducted by (Priha & Riipinen, 2005) also showed that workers in the textile industry are also exposed to a number of chemicals, especially those engaged in the activities of dyeing, printing and finishing. Chemicals based on benzidine, optical brighteners, solvents and fixatives, crease-resistance agents releasing formaldehyde, flame retardants that include organophosphorus and organobromine compounds and antimicrobial agents are used in textile operations.

Mangal, (2010) examined the links between exposure to formaldehyde and nasal and lung cancer as well as to brain cancer and leukemia, which can be fatal. This study revealed that in the long run, exposure to formaldehyde could lead to respiratory difficulty and eczema. Contact of the chemicals with skin as well as inhalation of the chemicals can lead to several serious health effects.

Study conducted in by Hale & Hovden, (2008) revealed a correlation between the presence of cancer of the buccal cavity and pharynx and occupation in the textile industry. Another study revealed that textile workers were at high risk for developing cancer of the stomach while another study indicated a low degree of correlation between oesophageal cancer and working in the textile industry. Moreover, a high degree of colorectal cancer, thyroid cancer, testicular cancer and nasal cancer was observed among textile workers. Also, a relationship between the presence of non-Hodgkin's lymphoma and working in the textile industry was observed.

A study conducted on 1300 people working in 'tie and dye' units in Jodhpur and neighboring areas by Kant, 2012), 100 workers were observed to have occupation-related dermatitis. This constituted 7.69% of the total sample. Red RC base and naphthol were observed to be the most common culprits in this regard.

Shannon, Mayr and Haines (2007) reviewed 10 studies each including at least 20 separate workplaces or organizational units and using injury rates as an outcome variable. Forty-eight variables representing areas of management practices were examined. The study only listed the practices consistently associated with performance, i.e. the association was significant on one direction in at least two thirds of studies in which it appeared, and the direction of relationship was consistent for all studies.

Finally, an extensive review on the literature dealing with internal management system of

organizations was provided by Hale and Hovden (2008). Literature on risk management at the national or industry level dealing with regulation, standard setting, risk policies, enforcement, and the management of individual workplaces and work groups was excluded. These concern notably participative management studies and studies of high reliability organizations, which concern themselves with on-line management of risk, as opposed to the off-line concern with management structure found in much of the literature.

Risk and Risk Management

Every organization and association has its own risk management tools and techniques and it depending on the nature and size of business, and the level of risk is also depends on the size and operation of business. For example, textile companies with a complex chain of processes and whose business operation is across the world has more probabilities of risk occurrence and hence requires proper risk management policies and techniques for minimizing the risk.

Risk

Risk can be defined as the probability of harmful consequences (ISDR, 2002), or expected losses (lives lost, persons injured, damage to property and/or the environment, livelihoods lost, disruption of economic activity or social systems) due to the interaction between humans, hazards and vulnerable conditions. According to Hakkinen, (2010) the term risk can be defined as," the chance of something happening that will have an impact on objectives. A risk is often specified in terms of an event or circumstances and the consequences that may flow from it. Risk is measured in term of combination of the consequences of an event and their likelihood." Risk is usually associated with the inability of men to manage hazard events that may eventually lead to negative consequences like destruction of the environment, socio-economic activities, properties and losses of lives (Sadgrove, (2005).

In other words, Risk can be seen as the possibility that a particular hazard might exploit a particular vulnerability (Nierkerk, 2002). It is the production of the possible damage caused by a hazard due to the vulnerability within a community. In other words, risk is usually due to hazard events exploiting the vulnerable situation of an environment or community. A risk is a random event that may possibly occur and if it did occur, would have a negative impact on the organization goals (David, 2008). Risk is based on three factors: hazards, exposure and vulnerability.

Hazard

Hazard can be defined as a potentially damaging physical event, phenomenon or human activity which may cause the loss or life or injury, property damage, social and economic disruption or environmental degradation. Hazards can include hidden conditions that may represent future threats and can have different origins. These include natural (geological, hydro-meteorological and biological) and/or induced by human processes (environmental degradation and technological hazards) (ISDR 2004). According to Niekerk (2002), hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity and probability. Typical examples of hazards can be the absence of rain (leading to drought) or the abundance thereof (leading to flooding). Chemical manufacturing plants near settlements can also be seen as hazards. Similarly, chemicals, dyes and textile waters from factory chimney or when people drop the chemicals into lakes, streams, oceans or rivers. Hazards can either be a creation of humans or the environment. Although the former can be planned for than the latter, in both cases, the management of hazard will remain the same.

Exposures and vulnerabilities

Exposure

Exposure refers to the elements that are subject to the impact of a specific hazard (Aven, 2008). Tangible, intangible and institutional are the basic elements of exposure. Tangible elements include people, building and infrastructure related to power and water supply. Intangible elements include heritage and community relationship. Capacity to share information and the effectiveness of emergency management plans and coordination arrangements are the institutional elements. (Keml, 2009). Exposure shapes the risks from chemicals in textiles: the dose makes the poison. Exposure scenarios generally depend on the chemical and its occurrence in textiles or other materials after release, its bioavailability in the environmental matrices as well as on the vulnerability (proximity and behaviour) of the organisms exposed.

These scenarios need to be specified to assess risks more realistically. However, for many chemicals in textiles, assessment is based crudely on limited concentration. Exposure of workers and consumers to chemicals in textiles naturally takes place through skin and nose. These routes can be important for contact allergens and skin-permeable substances.

Vulnerability

According to Shafai (2001) the term vulnerability has been defined in the following words. "Vulnerability is the human dimension of disasters. To understand what makes people vulnerable, we have to move away from the hazard itself to look at a much wider, and a much more diverse, set of influences: the whole range of economic social, cultural, institutional, political and even psychological factors that shape people's lives and create the environment that they live in." All these variables, that is risk, hazard, exposure and vulnerability resulted in what is called disaster.

Disasters

Disaster is a serious disruption of the functioning of a society, causing or threatens to cause, widespread human, material, or environmental losses which exceed the ability of affected community to cope using only its own resources (Parvath, et. al, 2009). Disasters can be sudden (flash floods) or progressive (drought). Disasters are caused due to the interaction of humans with their environment. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk (ISDR, 2002). Extreme natural phenomena do not in themselves constitute hazards. It is only when such phenomena occur in an environment where they pose a threat to human life, property, infrastructure or the environment that they can be classified as hazards. Similarly in the case of technological developments, it is only when such developments pose a danger e.g. industrial accidents, infrastructure failures. In essence, a disaster is the result of a hazard's impact on society. So the effects of a disaster are determined by the extent of a community's vulnerability to the hazard.

Hazards in themselves do not constitute disasters. The magnitude of disaster, according to Niekerk (ibid) is usually described in terms of the adverse effects which a disaster has had on lives, property and infrastructure; environmental damage; and the costs attached to post disaster recovery and rehabilitation. Simply out, therefore, disaster risk is the product of the combination of three elements – vulnerability, coping capacity and hazard (ISDR, 2004).

Risk Management

Risk management is any set of actions taken by individual corporations in an effort to alter the risk arising from their business Massey, Hutchins, Becker and Tickner (2008). Also Risk management is the identification, assessment, and prioritization of risks (defined in ISO

31000 (2009) as the effect of uncertainty on objectives, whether positive or negative) followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities; while risk assessment is the qualitative and quantitative evaluation of the risk posed to human health or the environment by the actual or potential presence or use of specific materials, conditions, or procedures. The end result of risk assessment is therefore termed risk management (David & Webster, 2007). Management as a function comprises all processes and functions resulting from the division of labor in an organization such as planning, organizing, leading and controlling (Crockford, 1996). In most organizations more or less formalized management systems serve to structure, develop, and direct business processes. Risk management within the organizations and government bodies is becoming very important in these days. All level of organization is involved in the management of risk. (Dorfman, 2007). No business is risk free as at any time, something wrong happen that leads to a heavy lose. While doing business, there is no point for avoiding risks completely.

The essence of risk management is to prepare, protect, and preserve the resources of the enterprise. This approach demands analyzing the current and past operating hazard, risk, and loss producing patterns and forecasting expected hazard, risk, and loss-operating patterns. According to Bamber (2003), risk control strategies may be classified into four main areas: risk avoidance, risk retention, risk transfer and risk reduction. Risk avoidance means the deliberate decision on the part of the organization to avoid a particular risk. Risk retention relates to the decision of the organization to meet any resulting loss from within the organization's financial resources. Risk transfer refers to the legal assignment of the costs of potential losses from one party to another. The most common approach is by insurance. The principles of risk reduction or risk control rely on the implementation of a Health, Safety and Environment (HSE) program, whose basic aim is to protect the company's assets from wastage caused by accidental loss.

The system elements to be managed in risk management include amongst others:

i. health and safety of employees, suppliers, contractors, customers, and residents of the community (e.g. improvement of public health and safety)
ii. reliability and safety of products and services, of materials, equipment, work systems and plants, of transport of hazardous goods
iii. integrated pollution control, radiation protection, waste minimization, recycling, and waste disposal
iv. sustainable management of natural resources (soil, water, natural areas and coastal zones), reduction in the consumption of non-renewable energy.

Sustainable development means the improvement in the quality of life which does not impair the ability of the ecosystem to maintain life. Managing for sustainability is predominantly based on the principles of inter-generational and intra-general equity as well as social and ecological balance (Covello & Allen, 1988).

Adoption of Sustainable Risk Assessment and Management in Textile industry

Risk management process helps in risk management plan, and steps involved in this process that has been set out by health, safety and environment risk management standard (1997) & Kant, (2012) **can** be highlight generally.

Step 1: Identifying hazard risks and those at risk

The first step is identifying risks and description by determining the possible causes. Many techniques can use for identification. Examples are records, experience, brainstorming, system analysis and scenario analysis. Risk identification is a step where organization

exposure to uncertainty can be identified. For this purpose, in -depth knowledge of organization is essential. Marker in which it is operating, legal, political, social and cultural environment in which it exits needs interrelated knowledge. Risk identification is an approach that ensures all significant activities within organizations and all possible risk flown from these activities defined. Looking for those things at work that have the potential to cause harm, and identifying workers who may be exposed to the hazards. Using workers' knowledge helps to ensure hazards are spotted and workable solutions implemented. Consultation encourages workers to commit themselves to health and safety procedures and improvements.

A risk assessment should cover all workers regardless of whether they are employed on long- or short-term contracts. Where there are persons employed by another organisation on site, there is a duty on the two employers to cooperate and safeguard the health and safety of workers. Risk assessment should take account of differences in workers, such as by gender, age, or disability. For example, older employees may learn differently than a younger worker, and also have different concepts of risk due to a lack of experience. Different prevention measures may be required for these worker groups. Work, its organisation and the equipment used should be adapted to the worker.

Step 2: Evaluating and prioritising risks

Having spotted the hazards, you then have to decide what to do about them. The law requires you to do everything 'reasonably practicable' to protect people from harm. You can work this out for yourself, but the easiest way is to compare what you are doing with good practice.

Evaluate how likely it is that the hazard will lead to harm or injury, and how severe that injury is likely to be. Consider what control measures are in place and whether they are sufficient. It is essential that the work to be done to eliminate or prevent risks is prioritised. The focus for cost-effective and sustainable risk management should be on collective protection and preventative measures.

Step 3: Deciding on preventive action

Strategies are made directing towards risks that are evaluated in the previous step and actions for, avoiding the risk by stopping the activity that generate risks, Reducing the consequences of the occurrence and transferring the risk. Selected treatment strategy are used for specify risk. Identifying the appropriate measures to eliminate or control the risks. List the preventive measures needed in order of priority, then take action, involving the workers and their representatives in the process. Targeting the underlying problems is the most cost-effective method of risk management.

In other words, it is the process in which selected and implemented measures modify the risk. Every organization and association has its own risk treatment system. International Risk Standard (IRS) 2002 explains that any risk treatment system should provide as minimum effective and efficient operation, effective internal control and compliance with legal rules and regulations of organization.

Step 4: Taking action

Risk assessment is the first step to successful risk management. Put in place the preventive and protective measures through a prioritisation plan (most probably all the problems cannot be resolved immediately) and specify who does what and when, when a task is to be completed, and the means allocated to implement the measures. Interventions should be agreed with the workforce, either directly or through worker safety representatives. The agreed solutions should be carefully implemented, monitored and evaluated. The information arising from the risk assessment must be shared with the appropriate persons. Action should be supported by appropriate training.

Step 5: Monitoring and reviewing

Monitoring is an important step in the risk management process. It contains about monitoring all steps involved in the process and any new risk and changing the current assessment strategies. For monitoring risk, a registered database is main tools for this purpose. Ranking of risks, persons responsible for specific risk are recorded in this database. Time to time updating of register data base would be an integral part of the ongoing project management process. It has to be revised whenever significant changes occur in the organisation or as a result of the findings of an accident or "near miss" investigation.

CONCLUSION

Assessing and managing the risks of hazardous chemicals should play an important role in any textile industry. It is essential that the workers be aware of the various occupational hazards in the industry. At the same time, it is necessary that the management take the necessary steps to protect workers from potential hazardous situations. Safety management in the textile workplace should be more than just a "paper system" of policies and procedures. A Safety Management System (SMS) should start and end with an analysis of what is contained in the paperwork and emphasize how the system should be transferred into practice. Such an analysis should identifies what an organization should be doing to protect its workers, the public and the environment from harm and also reveal what is actually happening at the worksite and whether or not people and the environment are being protected and adverse events are not occurring.

The following suggestions can be made to improve and manage the risks of hazardous chemicals to workers' health conditions the in textile industry:

i. The management should regularly check and document the national laws and regulations concerning workplace safety and develop a protocol through which to implement these laws.
ii. An inventory and risk assessment of all chemicals and dyes that are present at the factory must be undertaken by the management and the information in the inventory and risk assessment must be made available to all workers.
iii. Dyes, chemicals and other auxiliaries should be stored in a separate work area and access to this area should be limited to trained personnel. The storage area should be kept relatively cool and dry (within the range specified in MSDS), and all items must be recorded in log books and clearly labelled in a language understood by the chemical handlers
iv. To minimize exposure to hazardous chemicals appropriate personal protective gear should be used. This may include gloves, safety glasses and masks depending on the chemicals being handled
v. Employees that work in the laboratory must be made aware of the risks of the chemicals and equipment they are using. They should be properly trained in the use of machinery, laboratory equipment, and the use of dyes and chemicals, as well as the importance of keeping logs of chemicals used
vi. Sufficient fire extinguishers should be made available and signs should be placed in prominent places so that people are aware of their presence; and there should also be signs saying "No Food and Drink" in areas such as the laboratory, store room and factory floor, and any other areas where it is not safe to consume food, for example because of the risk of contamination by chemicals.
vii. The working environment should be kept as dry as possible to prevent accidents. Signs informing people of damp and wet floors must be displayed when required. Dust should also be minimized or extracted to reduce inhalation of particles

viii. Proper training on the use and maintenance of machinery and other equipment; Health and Safety; and Fire Hazards and Emergency, needs to be provided. Training should be repeated regularly - at least once a year.

ix. Medical examinations should be conducted by the employers for the workers from time to time. If significant occupational health problems are observed, appropriate measures should be taken by the management.

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SUB-THEME FOUR

Education and Professional Ethics

Facilities Maintenance-Towards Enhancing Learning and Teaching Environments: Case Studies of Higher Education Institutions (HEIs) in Nigeria

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ABSTRACT

The purpose of this paper is to identify factors preventing effective maintenance of the Higher Education Institutions built environments in Nigeria. The study focuses on sustaining HEIs built environments in Nigeria, as this will enhance the performance levels of students and the faculty staff, thereby encouraging increased productivity. The study is based on the collection and application of both soft and hard data, (that is, semi-structured interviews, and questionnaire survey), and were analysed by using thematic contents analysis and correlation analysis respectively. The objectives of the study include: identification of factors militating against effective facilities maintenance management of HEIs buildings in Nigeria; to provide effective budgeting system and strategies; and develop an effective framework. The findings revealed that, the following sustainable variables, such as: adequate and regular supply of electricity; water, waste collection and disposal; drainage system; use of appropriate procurement strategies; maintenance method; maintenance budget; and post occupancy evaluations are not adequately provided due to poor or lack of budget. It is therefore recommended that, HEIs in Nigeria could provide those variables mentioned above via appropriate budgeting; use of effective strategies; and the developed framework.

Keywords: budget, environment, maintenance, strategy, sustainable

INTRODUCTION

The British Standard (BSI, 1993) defines building maintenance "as a combination of any actions required to retain an item or restore to, an acceptable condition". David (1999) explains that frequencies of maintenance works on a building or asset depends on many factors, such as quality of materials used, quality of workmanship, frequency of use, nature of use, the age of the asset, ecological factors, nature of activities within and around the asset. Alan (1998) defines defects as ugly spots on both old and new buildings, and such spots reduce the commercial values of the assets as well as their service years. Chika (2008) asserts that, no single maintenance method and strategy can effectively provide needed remedies to both natural and artificial defects on buildings.

Figure 1

In Nigeria, ownership of Higher Education Institutions (HEIs) can be categorised as being Federal government owned, state owned, and those in private ownership. However, meaningful skills and knowledge need to be imparted to learners in a very conducive environment .In addition the workplace for academic and other faculty staff must also be

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conducive. The restoration of a building into an appropriate and acceptable standard in an appropriate timescale, taking into account an approved budget are necessary steps in maintaining a sustainable built environment.

Background of the Research

The restoration of a building into an appropriate and acceptable standard in an appropriate timescale, taking into account approved budgets is necessary steps in maintaining a sustainable built environment. A well maintained Higher Education Institutions (HEIs) building connotes a better and effective teaching and learning environment for students and other faculty staff. A healthy building will impact on staff and learners' performance, and improve their productivity levels. If the asset is not maintained on time, dilapidation will follow which in turn could lead to collapse. A cursory look at some of the HEIs buildings being studied suggests that, they are not well maintained in the last five years as revealed by the current interviews conducted for the Directors of the twelve HEIs being considered in this study.

Justification of the Study

A healthy building will impact on staff and learner performance, and improve their productivity levels. A cursory look at some Higher Education Institutions buildings in Nigeria, especially those built more than five years ago, suggests that they are not well maintained. It is suspected that some Higher Education Institutions (HEIs) have not considered budgeting for maintenance at all. The study sampled government owned HEIs (Federal and states).

Scope of the Research

The scope of the study will cover the general maintenance management of all elements of a building (from foundation to roof, including finishes) and services (mechanical, electrical and plumbing systems) that provide comfort to the users. Also, consideration will be given to project production information documents (drawings, bills of quantities, specifications, schedules and contract agreement), and project production management documents (construction programme, construction methodology, early warning system chart, information requirement schedule and others).The study used all the twelve Higher Education Institutions in south western Nigeria as case studies which three each of the Federal and State Universities and three each of the Federal and State Polytechnics.

FACILITIES MAINTENANCE MANAGEMENT

Xianhai (2014) defines facilities management as the integration and alignment of the non-core services required to operate and maintain a business to fully support the core objectives of an organisation. Joe, et al., (2010) assert that asset maintenance management focuses on life cycle management of the physical assets of an organisation for the purpose of making products or for providing services in a manner that satisfies various business performance rationale. Nichola (2010) asserts that, physical asset maintenance management is the management of fixed or non-current assets, such as equipment and plant.ISO 55-2 (2004) asserts that the following tools are associated with successful asset management, such as: value engineering, life cycle costing, reliability centred maintenance, and risk based inspection. These guidelines classify assets management into five types as explained in page one above. In addition, these guidelines are comprehensive and generic for the use of all organisations, and allow each organisation to adopt and use any procurement strategy, and maintenance method that suit its policy and objectives. However, these guidelines could not specify the appropriate technique that could be used in gathering data for preparing maintenance budget. In contrary, each HEI could use outsourcing for large and complex projects and in-house technical staff for simple and small projects. David (1998) defines

facilities management as the practice of co-ordinating the physical workplace with the people and works of the organisation, integrates the principles of business administration, architecture, and the behavioural and engineering sciences. This author explains further that, facilities management integrates the people of an organisation with its purpose (work) and place (facilities).

RESEARCH METHODOLOGY

For the purpose of the study, the researcher used mixed methodology for data collections, and used the multiple regressions for data analysis. For the first phase of data collection, the researcher conducted semi-structured interviews for the twelve directors of the selected HEIs in Nigeria. The researcher used questionnaire survey for the second phase of data collection in order to collect information from 144 facilities users of the selected HEIs in Nigeria to describe, compare or explain their knowledge, feelings, values and behaviours.

FACTORS MILITATING AGAINST EFFECTIVE FACILITIES MAINTENANCE MANAGEMENT OF HEIS BUILDINGS

Procurement Strategies

Majority of the HEIs in Nigeria do not have full complements of technical staffs, almost all of their facilities maintenance projects (small and simple, and large and complex) are outsourced. Those HEIs with a few numbers of technical staffs still combine the use of in-house technical staff with outsourcing. Some of the HEIs in Nigeria with a few numbers of technical staffs on their pay roll; still prefer outsourcing of their projects (both small and simple, and large and complex) for lack of skilful manpower.

Maintenance Methods

On maintenance method, majority of the HEIs in Nigeria adopt and use curative maintenance method (run to a halt) for shortage of maintenance funds or suffer long delays before maintenance cash is released. Some combine the use of curative and routine maintenance methods together. Some of the Directors of the HEIs work and services departments interviewed agreed that, Planned Preventive Maintenance Method is the appropriate method, but complained of poor funding and low technical skills on the part of the technical staff. However, the use of Planned Preventive Maintenance Method backed up with the use of Maintenance Control Toolkit could be the best alternative.

Maintenance Budget

Some of the HEIs do not run maintenance budget, they prefer the use of central budgeting system. Maintenance projects are carried out whenever there is the need to rescue situations that are going out of control (curative method). Furthermore, those HEIs that are running maintenance budgets, majority of them prefer to add certain percentages to the previous year maintenance budgets for the coming year.

Post Occupancy Evaluations

Majority of the HEIs sampled do not carry out Post Occupancy Evaluations of their built environments. They over rely on letters of complaints from the facilities users.

Projects Quality Control

Majority of the HEIs are aware of the existence of some regulatory requirements on environmental protection and maintenance management of their built environments, but do not comply. However, works and services departments of HEIs in Nigeria only control project qualities by enforcing contractors to comply with all projects specifications and schedules. For personal gains, contractors influence project quality by using inferior project materials, components, and labour.

Sustainable Programmes

Majority of the HEIs in Nigeria do not prepare and use sustainable programme for their built environments at the face of incessant power outages, lack of or poor supply of drinkable and sanitary water. Other factors include: poor or lack of adequate drainage systems, recreational facilities for staffs and students. In addition, majority of the HEIs students' lecture rooms and staff offices need repairs or replacements of some building elements now in dilapidated conditions.

Cultural Influences

Majority of the technical staffs cannot interpret projects drawings, specifications, and schedules. Others include: the attitudes of some them to work connote dereliction to duties. Technical staffs' absenteeism and lateness to work are common, while official corruption among technical staffs is on the high side.

Use of Maintenance control toolkits

Maintenance Schedule

Olowoake (2006) asserts that maintenance schedule is a comprehensive list of works to be done to each item and at what intervals it must be done. Bamisile (2004) explains that, it is detailed information about works to be done at specific periods.

Maintenance Planning

Maintenance planning helps in establishing in advance the works to be done, the methods, tools, calibre of labour required and the timing necessary (Chika, 2008; and Olowoake, 2006).

Maintenance Programme

Maintenance programme is a design to establish when each element shall receive the specified attention throughout the planning period, preferably by the planning department in collaboration with the maintenance department (Bamisile, 2004; and Olowoake, 2006).

Maintenance Records

Maintenance records are records of all maintenance works carried out. It is explained further that, these records are needed when budgeting in maintenance, preparation of maintenance schedules, design, costs of labour and materials (Chika, 2008; David, 1999; and Olowoake, 2006).

Maintenance Profile

Maintenance profile is a short description or biography of the types of maintenance works carried out on a particular plant or building elements in the past, and the periods of such maintenance (Taiwo, 2010; Olowoake, 2006; and Oyewande, 1992).

The Facility Register

The facility register is used to establish what needs to be maintained, and also determines the type and the amount of the equipment to which it relates It is explained further that, a card is created for each element making up a building in order to identifying which of the elements it refers, given such constructional and technical details and other information, such as drawings and manufacturer's handbooks (Iwarere and Lawal, 2011; and Olowoake, 2006).

The History Records

The history records are provided on the history of each building for the purpose of recording and analysing results achieved on facility register, maintenance schedule, job specification and the programme in order to improve on these procedures. It is explained further that, there should be summarised details of adjustments made, failures and the action taken to rectify them, it is the memory of any planned maintenance scheme (Akinpelu, 2002; David, 1999; and Olowoake, 2006).

Job Specification

According to (Bamisile, 2004; and Olowoake, 2006) master job specifications are used in detailing the various periodical operations required by individual element each operation on each element is detailed.

Codes of Practice

Codes of practice are issued by the British Standard Institution, and they cover workmanship requirements and methods of carrying out various classes of works It is explained further that, they are valuable when used in drafting specifications for building maintenance and alteration works Each professional body has codes for their members (Bamisile, 2004; and Olowoake, 2006)

Preparation and use of Facilities Maintenance Budgets

i. *Previous year budget plus a percentage*: Many HEIs works and services departments use the previous year maintenance budgets to prepare the current year budget with only a percentage increase, and the current prices of building components and materials.
ii. *Some based the budget preparations on "Forecasts".* However, the best approach is to conduct reconnaissance surveys of the built environment (to identifying the existing defects, and possible future defects), and use letters of complaints from the users

Analysis on Budget Preparations

However, the preparation, and the use of maintenance budget helps in saving project costs by avoiding project over-run. The defects identified are measured and priced in order to give accurate budget figure. In addition, for prompt approval and release of maintenance cash, the following maintenance control toolkit could be attached, such as, maintenance programme, maintenance schedule, jobs satisfaction, and facility register. The use of Bills of Quantities are also very essential—to allow for competitive tendering.

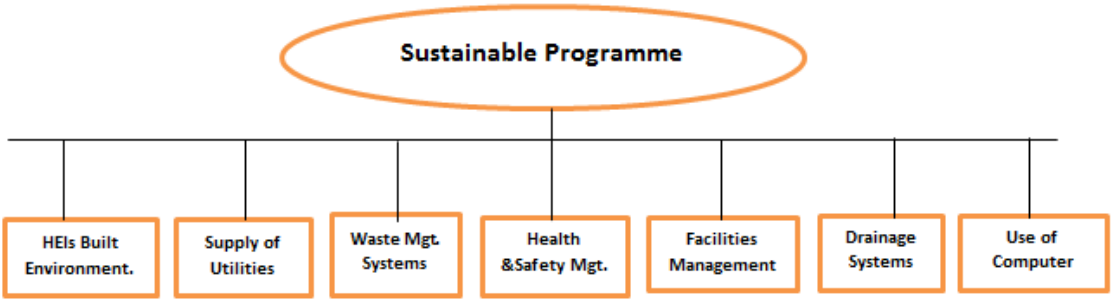

Figure 2 Sustainability Diagram for the Built Environment

Analysis of Built Environments Sustainability

Sustainability of HEIs built environment could be treated in three integrated principal ways, such as: environmental; economic; and social. Most HEIs in Nigeria are characterised with irregularities, such as: epileptic supply of electricity; poor drinkable water supply; poor waste collection, treatment, and disposal system; poor drainage system; poor maintenance budgeting system, and poor maintenance method. In spite of the erratic supply of electricity, majority of them use direct current (use of generating plants), only that poor budgeting system and the delay in releasing maintenance cash hinder the efforts. In addition, only a few of the HEIs in Nigeria are residential, and those that do, can only accommodate a few students due to limited numbers of bed spaces. Due to increasing numbers of candidates seeking admissions, and students' population explosion, more academic programmes were introduced. As a result, a few students admitted to existing programmes increased astronomically, with little or no improvement on the existing teaching and learning facilities.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The study objectives, especially the identification of factors militating against effective maintenance of HEIs built environments, budgets, and effective strategies were achieved by reviewing relevant literature, and by conducting semi-structured interviews for 12 Directors of the selected HEIs in Nigeria. In addition, the framework was developed from the strategies derived as mentioned above.

Maintenance Budget

Many of the HEIs works and services departments prepare maintenance budget based on the previous year's budget plus a percentage increase. Some use forecasting, and some use the prevailing prices of materials in the market. However, the best practice is for the HEIs works and services departments to carry out reconnaissance survey of the built environments use the data derived to prepare annual maintenance budget for the built environments. Such budgets are realistic; hence they are derived from accurate and reliable data.

Sustainable Programmes

Most HEIs in Nigeria are characterised with irregularities, such as: epileptic supply of electricity; poor drinkable water supply; poor waste collection, treatment, and disposal system; poor drainage system; poor maintenance budgeting system, and poor maintenance method. In spite of the erratic supply of electricity, majority of them use direct current (use of generating plants), only that poor budgeting system and the delay in releasing maintenance cash hinder the efforts.

Project Quality Control

The researchers recommend the establishment of a Quality Control Unit within each works and services department. Such a unit could be manned by seasoned professionals from the works and services departments plus seasoned professionals from the designing consulting firm. The duties of this unit is: to monitor, control, and supervise the quality of project materials, workmanship, and ensure compliance with all regulatory requirements, advise the production team on issues relating to: cost overrun, and timely delivery of projects. All these could help projects deliveries to time, projects run to budgets, without compromising quality.

i. It is a good practice that each HEI to prepare and operate with maintenance budget. Such maintenance budget could be prepared from data derived from the reconnaissance survey, and letters of complaint from the facilities users. This type of budget could be adequate and reliable.
ii. Each HEI could attach maintenance control toolkit with the budget proposal to the HEI management for approval and prompt release of maintenance cash. Such control toolkit include: Maintenance schedule; Maintenance program me; Jobs specification; Facility register; Maintenance records; and history record of the assets.
iii. Each HEI works and services department could prepare and use sustainable programme for its built environment. Such a programme could include three integrated principal factors, such as: environmental, economic and social. Such a sustainable programme could include: regular supply of electricity; drinkable water; regular waste collection; waste treatment, and waste disposal system; self-cleansing drainage system; preparation and use of maintenance budget; and maintenance method. The existing teaching and learning facilities could be improved upon.
iv. Authorities of each HEI could design a staff developmental programme to train works and services department technical staff. Such staff developmental programme could enable them to perform their official duties satisfactorily.

v. Each HEI works and services department could create a "Project Quality Control Unit" within. The membership of such unit could be drawn from seasoned professionals from among the designing consultants and the seasoned in-house technical staff. In all, the unit could ensure total compliance to all ISO policies on quality of materials and workmanship.
vi. Each HEI could improve on the quality and quantity of facilities being provided to staff offices and Lecture rooms regularly. This could be achieved by carrying out reconnaissance surveys, and letters of complaint from the facilities users.

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Susceptibility of Building Elements to Rework in Selected Higher Educational Buildings in Nigeria

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ABSTRACT

Rework is defined as the non-required effort of redoing a process or activity that was faultily executed at the first time resulting in unsatisfactory completed project subject to cost and time overrun. The susceptibility of building elements to rework in selected higher educational buildings in Nigeria is evaluated using primary and secondary data of 30 educational building projects in the study area adopting the elemental groupings of building component for data collection. Descriptive and inferential statistics were employed in the data analysis using the SPSS version 20 at 95% confidence interval. The Chi-square analysis indicates shortage of materials, poor coordination between design team and members, and poor communication with the design team as leading causes of rework in educational buildings respectively. The Kruskal-Wallis Rank Sum Test shows that all the building elements are significantly susceptible to rework. However the level of susceptibility of individual building elements was found to be between 26% and 40%. It is believed that there is an urgent need to evolve strategies to bring rework to an abysmal level by ensuring the proper implementation of the due process policy and its tenets and the need for the professionals involved on such projects especially the in-house professionals (client's representatives) to do their due diligence in ensuring proper communication of the client's need to the design team to reduce rework to a considerable extent thereby minimizing the financial loss due rework.

Keywords: Building, Elements, Educational, Rework and Susceptibility

INTRODUCTION

Construction industry occupies a focal point in the economy of any nation. It is the driver of every form of development since no sector of the economy can progress without quality and adequate infrastructure which only the construction industry provides. The Construction industry in Nigeria is of great importance as it generates employment opportunity which is second only to Agriculture (Oladinrin, Ogunsemi, and Aje, 2012). Adeagbo (2014) affirmed the capacity of the construction industry to lead the economic growth of the country. The Nigerian Union of Civil Engineering Carpentry, Formwork workers (NUCEFWW)(2015) lamented the huge infrastructural deficit in Nigeria despite the 5.1% contribution of the construction industry to the Gross Domestic Product (GDP) in 2010. This persistent infrastructural shortage in the country is as a result of the many challenges confronting the construction industry prominent of which are time and cost overrun. Others are poor quality construction output resulting from defects, poor quality workmanship and poor quality material to mention a few.

Rework are activities that have to be done more than once or in which work previously executed as part of the project is removed due to error of omission or commission. Rework is a significant factor that does not only affect the construction process but directly leads to client dissatisfaction, reduces profitability and in extreme conditions leads to acrimonious relationship between participants which can either be settled through a recourse to law court or arbitration. According to Love and Smith (2006), it is a major contributor to cost and time overruns in project delivery process. It was also identified as the largest contributor to waste

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on construction projects (Adewuyi & Otali, 2013). It may occur in any conceived construction project at both the design and construction stages and it may be in the form of variation, non-variation, design error or omission which can be occur directly and indirectly.

LITERATURE REVIEW

Rework in Construction Projects

Construction industry is largely project based with various complexities inherent in the construction process such as dealing with diverse interests of multiple stakeholders and resultant changes. Nandhakumar and Ranjith(2015) rported that in India,30% of construction works are subject to rework with 40-60% underutilization of the labour firce. The study carried out by Ade-Ojo and Babalola (2013) on educational building projects revealed that despite the Due Process Policy in place, cost and time overrun were 18% and 108% respectively. Other studies by Fayek, Dissanayake, and Campero, (2003) proposed a methodology for measuring and classifying rework in construction projects while Palaneeswaras (2006) developed a model for the management of rework in a bid to improve construction project performance. Oyewobi and Ogunsemi (2010), assessing the factors that influence rework occurrence observed that despite the contribution of rework to cost and time overrun, it has not been given adequate consideration. The duo identified technical, quality and human as contributory factors to rework. From these studies it obvious that rework is a phenomenon that has stayed with the industry for long without any serious attention given to its existence. From the foregoing, it can be inferred that rework has been a silent killer afflicting the construction industry all over. However, if it cannot be removed, it can be minimized and its effect on the construction output adequately mitigated. It is in line with the latter that this paper seeks to assess the causes of rework and the level of susceptibility of the various building elements to rework using educational buildings in Ondo and Ekiti State. Construction projects in this sector are wholly financed by the Federal government hence there is full compliance with the procurement regulations. As public institutions funded by the public fund, cost data and contract documentation are easier to access than in other sectors most especially the private sector.

Educational buildings

Educational buildings are buildings designed for various activities in primary, secondary or higher education systems which often include living area for students such as: lecture halls, laboratories, workshop, departmental faculties, offices and many others. The gross building and infrastructural deficit in the Nigerian higher educational institutions has been a thing of concern in recent years. The federal government in November, 2012 set up a Committee on Need Assessment of Nigerian Universities (CNANU) to carry out a detail appraisal of the physical facilities for teaching and learning to determine their capacity and functionality. According to the CNANU (2012) Physical facilities for teaching and learning in the public universities were inadequate, dilapidated, over-stretched and improvised. The committee report noted that one of the major challenges facing university education is the unsatisfactory state of facilities for research and teaching in most Nigerian universities (International organization for Migration - IOM, 2014). Since rework has been identified as a common occurrence in construction project and identified as one of the factors that can degrade construction project performance, its effect on the quantity and quality of building projects in our higher institutions cannot be overemphasized.

METHODOLOGY

A qualitative research approach was adopted for the study. A random sampling of building construction projects within the selected higher educational institutions within Ondo and

Ekiti states was carried out to assess the causes of rework and determine the susceptibility of the building elements to rework. A total number of six and eight higher educational institutions were identified in Ondo and Ekiti States respectively with a total number of five questionnaires administered to the client's representative in each institution under the study.

Stratified random sampling was adopted in the process of data collection. A structured questionnaire with two sections was administered on the respondents. The section A was used to collect secondary data in relation to the project's details while section B was used in assessing information on causes of rework and the susceptibility of building elements to rework. The building element classification according to Seeley (1996) was also adapted for the data collection. Respondents were asked to rank the causes and the level of susceptibility of each building element on an ordinal scale of 1-5. The Likert's scale of 1-5 for least susceptible to most susceptible was used for the purpose of data collection. The importance index rating *(IIR)* was used to determine the level of susceptibility of building elements to rework. The susceptibility rate was then established in percentages from the (*IIR)* (Sambasivan et al., 2007). The chi-square test was carried out to determine the level of significance of the various causes of rework while the Kruskawallis test of significance was applied to establish the susceptibility of the different building at 0.05 significance level.

Table 1: Causes of rework in educational buildings in Ekiti and Ondo States in Nigeria

	Factors	Asymp Sig	Remarks
A	**Client related causes**		
	Inadequate contract documentation	*0.043	s
	Lack of fund allocation	*0.041	s
	Poor communication with design consultant	*0.032	s
	Ineffective supervision	0.155	ns
	Lack of experience and knowledge of design	0.155	ns
B	**Contractor related causes**		
	Use of poor quality materials	0.469	ns
	Poor workmanship	*0.020	s
	Lack of fund	*0.015	s
	Corruption	0.287	ns
	Embezzlement of fund	0.453	ns
C	**Design related causes**		
	Ineffective use of quality management practice	*0.044	s
	Inadequate client brief to prepare detailed contract document	0.141	ns
	Poor co-ordination between design team and members.	*0.023	s
	Change in site condition	*0.080	ns
	Change in design	*0.039	s
	Ineffective use of information Technology	0.080	ns
D	**Subcontractor related causes**		
	Use of poor quality materials	*0.035	s
	Shortage of materials	*0.020	s
	Construction error	0.119	ns
	Procurement error	*0.042	s
	Damage	0.155	ns
	Price Fluctuation	0.406	ns
	Defects	0.558	ns

Table 2: Group causes of rework in Educational Buildings

	Causes	MIS	Rank
a	Client-related Factors	3.66	2
b	Design-related factors	3.78	1
c	Contractor Related Factors	3.19	4
d	Subcontractor Related Factors	3.53	3

FINDINGS AND DISCUSSIONS

Table 3: Susceptibility of building element to rework in educational buildings

	Elements	Importance Index Rate (IIR)	Susceptibility Index Rate (IIR)	Rank	Sig. Prob
1.	Substructure	**1.35**	**36.73**	***3***	0.001
2.	**Super Structure**				
a.	Roof	1.61	43.81	1	0.020
b.	External wall	1.53	41.63	2	0.020
c.	Internal walls and partitions	1.52	41.36	3	0.038
d.	Stairs	1.41	38.37	4	0.007
e.	Windows and external doors	1.28	34.83	5	0.001
f.	Upper floor	1.27	34.56	6	0.006
g.	Frame	1.09	29.66	7	0.000
		1.39	**37.75**	***2***	
3.	**Internal finishes**				
a.	Wall finishes	1.41	38.37	1	0.002
b.	Ceiling finishes	1.32	35.92	2	0.001
c.	Floor finishes	1.27	34.56	3	0.007
		1.33	***36.28***	***5***	
4.	**Fitting and Furnishings**	1.48	40.27		0.004
			40.27	***1***	
5.	**Services**				
a.	Communication installations	1.47	40	1	0.002
b.	Special communications	1.37	37.28	2	0.004
9c.	Builder's work in connection with services	1.11	30.20	7	0.001
d.	Protective installations	1.35	36.73	3	0.000
e.	Sanitary appliances	1.35	36.73	3	0.001
f.	Services Equipment	1.27	34.56	4	0.001
g.	Disposal installation	1.24	33.74	5	0.000
h.	Gas installations	1.23	33.47	6	0.006
I	Heating and ventilation system	1.23	33.47	6	0.001
j.	Builder's profit and attendance on services.	1.16	31.56	8	0.000
k.	Water installation	1.11	30.20	7	0.001
l.	Electrical installations	1.08	29.39	9	0.001
		1.25	**33.94**	***6***	
6.	**External work**				
a.	Minor building works	1.45	39.46	2	0.000
b.	Drainage	1.31	35.65	3	0.006
c.	External services	1.51	41.09	1	0.001
d.	Site work	0.97	26.39	4	0.000
		1.31	**35.65**	***4***	

Causes of Rework in Educational Building

The chi- square analysis in table 1 showed the significance values of the various causes of rework in educational buildings in Ekiti and Ondo states under four different groups. Eleven out of the 23 factors were found to be significant at 95% confidence interval. Lack of fund and poor workmanship were significant under the contractor related causes with 0.015 and 0.020 respectively. Shortage of materials (0.02), poor coordination between design team and members (0.023), and poor communication with the design team were significant causes of rework in educational buildings respectively. The use of poor quality materials was most significant at 0.035 under the subcontractor and contractor related causes. This agrees with Josephson et al (2003) who suggested that poor/faulty manufacturing of material was a main contribution to rework. However in table 2, the design related causes is ranked first with a

mean item score *(MIS)* of 3.78 followed by client related causes, 3.66 *(MIS)*, subcontractor related causes and contractor related causes ranked 3rd and fourth with *(MIS)* of .53 and 3.19 respectively. The implication of this is that rework problems are mostly the result of errors in the design of the project which could be due to omission or commission.

Susceptibility of building elements to rework in Educational Building

Table 4.3 shows the susceptibility index of building elements to rework. From the findings, fittings have the highest rate of rework of 40.27, followed by super structure; 37.75%, substructure;36.73%, external works;35.65%, internal finishes; 35.28 and services,; 33.94% for the group of elements. However the level of susceptibility of building elements is between 26% (site works), lowest and 40% (fittings and furnishings) highest for individual elements. Under superstructure, roof is the most susceptible to rework with 43.81% rate while frames is the least with 29.66%. Communication installations have the highest rate of susceptibility under service with 40% while electrical installation is least with 29.39%. Kruskal-Wallis Rank Sum Test shows that all the building elements are significantly susceptible to rework at 95% confidence interval.

CONCLUSION

In assessing the susceptibility of the building elements to rework in educational institutions, results from the data analysis showed that lack of fund and poor workmanship on the part of the contractor are quite significant in giving rise to rework. Poor coordination between the design team and poor communication with design consultants are also significant causes of rework in higher educational buildings in Ondo and Ekiti States in Nigeria. The study also showed that building elements are quite susceptible to rework with most of the elemental components having up to 40% rate of susceptibility. Considering the huge amount of fund required for building project development and the susceptibility rate of the building elements, it implies that between 26-43% of money invested in these projects are wasted as a result of works that needed to be reworked. The high level of susceptibility of the different building elements to rework should be a thing of concern to all stakeholders in the higher educational building project. In lieu of the foregoing and considering the shortage of quality building and infrastructural development in higher educational institutions in Nigeria, there is an urgent need to evolve strategies to bring rework to an abysmal level by ensuring the proper implementation of the due process policy and its tenets, there is also the need for the professionals especially the in-house professional who serve as clients representative on such projects to do their due diligence in ensuring proper communication of the clients need to the design team. These, if taken into consideration will reduce rework to a considerable extent thereby minimizing the financial loss due rework.

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Pedagogic Experience of Spreadsheet Applications to Contemporary Valuation of Property Investments: Perspective of the Federal Polytechnic, Idah

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ABSTRACT

Recent studies have indicated preference for the application of computers in the teaching and learning of property investment valuation. With recourse to the department of estate management and valuation of the Federal Polytechnic Idah, appropriate pedagogies for the application of spreadsheet to contemporary techniques of property investment valuation were identified. Using a combination of narratives and explanatory case study, it was found that demonstrations and case studies are appropriate pedagogies for the delivery of the practical content of the subject matter, while multi-media presentations, lecture-based instruction, tutorials, practical exercises and case studies were found to be appropriate in the delivery of its theoretical content. 57% of students who attempted the compulsory question on spreadsheet application scored below 6 marks in 2013/2014 compared to 63% of students in the 2007/2008 session. Results further indicate a significant improvement in mean score of students who attempted the compulsory question on spreadsheet application to contemporary technique of property investment valuation in 2013/2014 ($p > 0.05$) compared to those who attempted similar question in the 2007/2008 session. The marginal improvement in students' performance in 2013/2014 was attributed to the combination of these pedagogies, availability of adequate teaching resources and personal efforts of students.

Keywords: Contemporary techniques, Pedagogy, Property investment valuation, Spreadsheet, The Federal Polytechnic Idah

INTRODUCTION

Lecturers of property valuation courses have contributed immensely towards teaching their students the rudiments of contemporary property valuation techniques. In view of this, studies relating to estate management education and the changes required for sustained teaching of property investment valuation in the 21st century have been documented (Ali & Alias, 2006; Czarnecka, Sobolewska, Mikulska et al., 2007; Gustafsson & Lundström, 2008; Udoekanem, Adoga, & Kuma, 2013). Furthermore, most higher education institutions offering degree/diploma programmes in real estate/land management across the globe have incorporated courses in computer applications to real estate/property as pre-requisites for graduation (Ali & Alias, 2006; Callanan & McCarthy, 2003; Kampamba, Nkwae, & Tembo, 2015). Specifically Udoekanem et al. (2013), emphasized that the teaching of property investment valuation should be complemented with computer-aided practical. In view of these studies, it is acknowledged that the teaching of spreadsheet applications for contemporary valuation of property investment is indeed a requisite skill for the 21st century valuer in Nigeria. Notwithstanding its being an efficient dimension to the teaching of contemporary techniques of property investment valuation, there is a knowledge gap regarding pedagogic experience of valuation lecturers in that context. The question is: What pedagogies are relevant to spreadsheet applications for contemporary techniques of property investment valuation? This research problem shall be addressed with recourse to the experience of the authors and the impact of these pedagogies and learning resources on the academic performance of students in this context.

Specific objectives of this research include to:

i. examine the curriculum for teaching of spreadsheet skills in valuation;

Ataguba, J. O. & Ogungbenro, M. T. (2016). Pedagogic Experience of Spreadsheet Applications to Contemporary Valuation of Property Investments: Perspective of the Federal Polytechnic, Idah. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1151-1162

ii. identify the required teaching and learning resources;
iii. examine teaching styles deployed by the lecturers; and
iv. evaluate performance of student in the examination.

This study is significant to lecturers teaching property investment valuation and/or computer application to real estate because it unravels innovative ways of course delivery aimed at a successful student-centered learning. The cross breed of ideas and learning process captured in this research would be beneficial to lecturers, students and practicing valuers within Nigeria and other emerging economies of the world as they strive to bridge the digital divide that has plagued the application of computing technologies to property investment valuation.

LITERATURE REVIEW

Estate Management and Valuation Programmes at the Federal Polytechnic Idah

Academic programmes leading to the award of National- and Higher National Diploma in Estate Management and Valuation are offered in the Department of Estate Management and Valuation of the Federal Polytechnic, Idah in Kogi State, Nigeria. Domiciled within the School of Environmental Studies (SES), the department which originally commenced academic activities in the year 2001 is supported by five cognate academic departments comprising Architecture, Building, Surveying and Geo-Informatics, Quantity surveying, and Urban and Regional Planning from where students offer ancillary courses as pre-requisites for graduation.

Both the National- and Higher National Diploma programmes last for a minimum duration of 2 years (The Federal Polytechnic Idah, 2010). In addition, it is required that holders of National Diploma (ND) acquire a minimum of 1-year industrial experience before enrolling for the Higher National Diploma (HND) programme. All programmes in the department have enjoyed sustained accreditation in 2008 and 2014 by the accreditation panel of the National Board for technical Education - NBTE. The department is endowed with vibrant academic staff with postgraduate qualifications, four of whom are registered Estate Surveyors and Valuers.

The Place of Property Valuation as a Subject

Notwithstanding the variation in country contexts for the training of property valuers across the world, there is a consensus that the subject of valuation is central to academic programmes in the property domain (Ali & Alias, 2006; Ashaolu, 2012; Czarnecka et al., 2007; Kampamba et al., 2015). Specifically, the emerging general practice surveyor is taught valuation as a subject and a tool for decision-making with respect to management of property assets, viability appraisal of property development, purchase and sales decisions, property taxation and rating, mortgage and project funding techniques among others. In other words, it may not be out of place to say that valuation is a subject that facilitates understanding of the decisions of stakeholders in the property market.

At the HND level, students are taught a range of intermediate and advanced topics in property investment valuation including the rationale behind property as an investment class which compares with other investments like equities, bonds, and derivative financial assets. It is this fundamental knowledge that drives the use of investment method of valuation which is indeed a specialized body of knowledge within the valuation discipline. With an emphasis on property investment valuation, Udoekanem et al. (2013) recommended the development of a curriculum with practical bias and computer applications for the teaching of contemporary techniques at the university level. This paper addresses the pedagogies necessary to close the gaps in the use of spreadsheets to contemporary techniques of property investment valuation at the HND level in the polytechnic.

Overview of Contemporary Value Models

According to Baum, Mackmin, and Nunnington (1997), all models of property investment valuation are anchored on income capitalization. Differences however emerge in the application of these models such that real cash flows are valued using real discount rates while nominal cash flows are valued using nominal discount (Brown & Matysiak, 2000). Specifically, contemporary techniques of property investment valuation were developed in response to the emergence of the reverse yield gap, which is phenomenon where bond yields are higher than initial yield of property investments (Baum & Crosby, 2007). Figure 1 presents an unambiguous picture of the variants of contemporary techniques and their link with the body of knowledge of investment method of valuation. These techniques evolved from the growth explicit discounted cash flow (DCF), which was originally used for capital budgeting decisions on the basis of net present value (NPV) criterion. Thereafter came the rational model otherwise called the short-cut DCF technique which determines capital value of an interest in property as the sum of term (nominal) rent discounted at the equated yield and the value of reversionary rent which has been adjusted using a growth rate (McIntosh, 1983; Sykes, 1981).

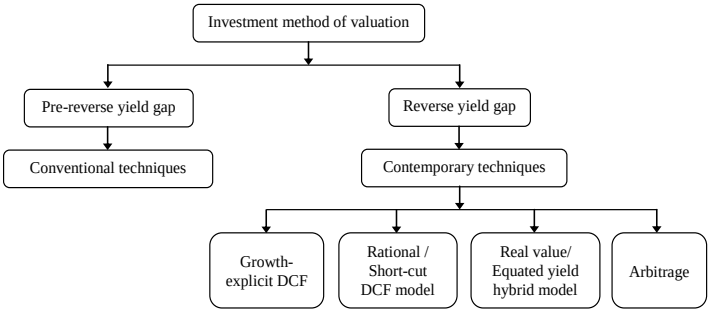

Figure 1: The four major contemporary techniques of property investment valuation

Third in the timeline of contemporary techniques is the real value/equated yield hybrid model (Baum & Crosby, 2007; Crosby, 1983, 1986a, 1986b), which was developed to simplify Dr. Earnest Wood's PhD thesis on real value techniques in 1972. Just like the short-cut DCF technique, the real value/equated yield hybrid model values the term rent of a property using the equated yield, however, the reversionary rent is valued using a proxy of the all risks yield which comprises a 3-in-1 Years' Purchase (YP) formula incorporating the nominal rate of interest (equated yield), period to the next rent review, and real return (Baum & Crosby, 2007).

Informing the development of the arbitrage technique is the notion that tranches of property cash inflows should be discounted in comparison with investments exhibiting similar risk profile (French & Ward, 1995, 1996; Wyatt, 2007). This technique still adopts the convention of term and reversion. Just like the real value model, the term income in the arbitrage technique is discounted using the equated yield, while the reversionary income could be implicitly discounted using a combination of all risks yield and deferred capital yield (real rate of return) (Crosby, 1996; Crosby, French, & Ward, 1997). Alternatively, the implied rental growth can be used to project the deferred capital yield if an explicit valuation of reversionary income is required (Wyatt, 2007).

Valuations produced from these four contemporary techniques have been found to reconcile irrespective of their conceptual variation and input parameters (Crosby et al., 1997). The rationale for such phenomenon is the interrelationship and synergy among input parameters for these techniques.

Except for property investment valuation scholars in Nigeria who might be conversant with the arbitrage technique, it would not come as a surprise that majority of practicing valuers in the country are ignorant of its existence even after nearly two decades since it was developed for the purpose of property valuation. Similarly, the HND curriculum for Advanced Valuation insists on the teaching of contemporary techniques (NBTE, 2002), it was however silent on the treatment of arbitrage. Notwithstanding, the curriculum prepared by the NBTE is only a minimum standard. Hence, valuation lecturers can go beyond that standard in the interest of students.

The Complementary Role of Computer Application Course

Over the years, valuers have utilized computers to handle analytical content of valuations (Dixon, 1986; Dixon, Hargitay, & Bevan, 1991). Specifically, valuers with the requisite computing skills tend to use specific software packages to increase the efficiency of their valuations and analysis. Notwithstanding, Oni (2013) found that the knowledge of ICT application by general practice surveyors in Nigeria stills ranks low when compared to their counterparts in developed countries. While one of the rationales for this digital divide can be traced to the daunting cost of specialist software acquisition and upgrade, it would be appropriate if the emerging valuer is taught how to customize simple spreadsheets to handle tasks in a similar fashion as these proprietary software packages. Hence the pedestal for this ingenious stride is the complementary role of computer application courses offered in connection with degree or diploma programmes in estate management and valuation. Through the incorporation of a course on Computer applications to Real Estate, the curriculum of Estate Management and Valuation programmes in the Federal Polytechnic Idah has been re-designed to avail students with these skills.

Students at the HND level offer EST 418 - Computer Application to Real Estate in the 2nd year of the programme (NBTE, 2002). Goals of this course is to avail students with requisite training on how to deploy computer software packages to address dynamic issues of modern professional practice (valuation, property and facilities management, project management/property development, land administration, and estate agency); and to enhance their employability in organizations with a high taste for office automation. The content of this course include classifications of computer; components of a microcomputer; Meaning and types of software; the use of packaged application software of relevance in real estate; Programming using BASIC; Geographic- and Land Information Systems for Real Estate Practice; and Information and communication technology (ICT) in Real Estate practice. Drawn from the array of topics is an exposition of methods and tools used to teach the application of spreadsheets to contemporary property investment valuations. The essence of this sub-topic under the computer application course is to complement learning outcomes of their advanced valuation courses.

Pedagogies for Contemporary Valuation Models

According to the 6th Edition of the Oxford Advanced learner's Dictionary of the English Language, pedagogy is defined as a study of teaching methods. It is not out of place to say that the teaching of property valuation is appropriately anchored on social constructivism. As a school of thought, social constructivism connotes the combination of teacher-guided and student-centred learning aimed at meeting the competence needs of potential problem-solvers (Westbrook, Durrani, Brown et al., 2013). Problem-solvers in this context comprise a body of professionals (Estate Surveyors and Valuers) who exhibit similar competence, and are bound by the same ethics.

Common pedagogies that are appropriate to the teaching of contemporary techniques of property investment valuation include presentation, group work, and collaboration

(Westbrook et al., 2013); lecture-based instruction, tutorials or challenge-based instruction (Osborne, Miller, & Farabee-Siers, 2008), where training is directed towards solving valuation exercises; physical/video/virtual demonstrations (Raman, 2013; Westbrook et al., 2013); practical exercises and case studies directed towards solving real live valuation problems (Udoekanem et al., 2013), including the use of computers/spreadsheets applications; and field trips to relevant organizations where they can experience the practical applications of classroom activities (Ali & Alias, 2006). Furthermore, pedagogies that facilitate professional practice include apprenticeship and role-playing. While the former is driven by experiential learning of the student, the latter can be organized by the lecturer or tutor to assess readiness of the student to practice what has been learnt in the course of the degree or diploma programme. In order to obtain desired results from the application of these pedagogies, studies have shown that optimal class size and adequate infrastructure for teaching and learning must be put in place otherwise the purpose of teaching and learning would be defeated (Atchoarena & Gasperini, 2003; Westbrook et al., 2013). This underscores why proprietors of educational institutions are expected to avail such institutions with the requisite atmosphere and infrastructure that can drive innovation and scholarship.

Emphasis on Spreadsheet Applications

The layout of contemporary property investment valuations in term and reversion makes it possible to applying computerized spreadsheets. Within the context of computer applications, spreadsheets are software designed to handle the analysis of alphanumeric data arranged in rows and columns (Morley & Parker, 2011), an example of which is Microsoft® Excel® (Dixon, 2007; Harvey, 2006). While teaching spreadsheet applications to contemporary techniques of property valuation, the lecturer assumes that all enrolled students are beginners in the use of Excel®. Prior to handling advanced operations in Excel®, students are taught basic steps of launching the program, data entry and editing, and saving of worksheets.

CONCEPTUAL FRAMEWORK

The conceptual framework for this study is captured in Figure 2, which is essentially a social constructivism of student-centred learning (Westbrook et al., 2013). According to Ball (2002), institutions of higher learning confer reputation for competence on students while imparting knowledge. With the application of appropriate pedagogies, a student would be able to develop sound conceptual skills. Within this context, conceptual skill implies the creative ability of the student to use and manipulate data that applies to specific model of contemporary property investment valuation.

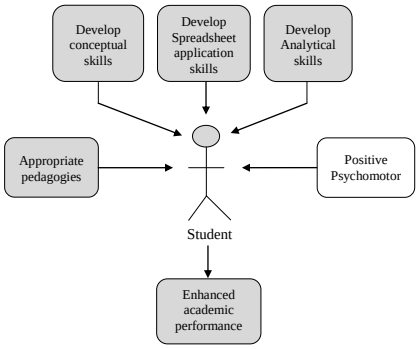

Figure 2: Conceptual representation of the study

Secondly, Figure 2 further underscores the need for the student to develop analytical skills in order to successfully solve problems on the use of contemporary models of property investment valuation. This conception aligns with findings from a related study which emphasized the teaching and learning of quantitative aspects of property investment valuation

(Udoekanem et al., 2013). While Advanced Valuation courses might emphasize manual analysis of data and determination of capital values, appropriate pedagogies for the computer application course would develop spreadsheet application skills of the student in that regard.

Although outside the scope of this study, psychomotor (emotional and mental wellbeing) of a student exerts impact on his/her ability to derive benefits from learning activities and must be accounted for. Given that student-centred learning would avail the student with deep understanding of a topic (Entwistle, Skinner, Entwistle et al., 2000; Postareff, Lindblom-Ylänne, & Nevgi, 2007; Trigwell, Prosser, & Waterhouse, 1999), it is envisaged that when all these concepts are articulated in a student-centred learning, the end product would include sound knowledge of the application of spreadsheet to property investment valuations and an enhanced academic performance of the student.

METHODOLOGY

This study adopts a mixed methodology comprising narratives and the explanatory case study. Narratives essentially imply the use of stories as basis for data collection and analysis (Golsteijn & Wright, 2013). Within the context of this study, the stories were drawn from experience of the lecturer for the course: EST 418- Computer application to real estate as well as inputs from the co-author who taught the same students the rudiments of contemporary techniques of property investment valuation. Secondly, the explanatory case study seeks to examine the relationship among variables (Creswell, 2003; Singh, 2006). The variables in this context are the elements of the conceptual framework identified in Figure 2. Data for this study include the examinations questions on the subject for the 2007/2008- and the 2013/2014 academic sessions respectively; as well as students' scores in those questions.

Students who enrolled for EST 418 in the 2013/2014 class were availed the advantage of using the sufficient departmental computing facilities compared to their colleagues who enrolled for the same course in 2007/2008 (seven years earlier). Currently, the available teaching resources for the course includes magic board, projector screen, multimedia projector, the departmental computer laboratory (which is fully equipped with micro computers), and copies of manual of spreadsheet exercises made available to students. Students were mainly taught how to use Excel® to value property investments with recourse to the Rational/Short-cut DCF-, and the Real value/ Equated yield hybrid models respectively. Prominent among the pedagogies adopted include multimedia presentations, lecture-based instruction, tutorials and case studies. Through demonstrations, the course lecturer further encourages student-centred learning whereby the student independently avails himself/herself the opportunity to try out and master the various computerized exercises in the practical manual.

The total assessment score for EST 418 is 100%, out of which the examination attracts 70%; active participation in computer practical (including spreadsheet exercises) attracts 20%; and a short essay test constituting 10%. Notwithstanding, a compulsory examination question is designed to test the students understanding of the theory and practice of spreadsheet application to contemporary property investment valuation. Data analysis in this paper (measures of central tendency, dispersion, and t-test for difference in mean score) focuses on the compulsory question in the examination, and compares students' performance in the subject during 2007/2008- and the 2013/2014 academic sessions respectively.

FINDINGS AND DISCUSSIONS

Impact of the Pedagogies on Students' Academic Performance

For both the 2007/2008- and the 2013/2014 academic sessions, examination questions in Excel® formula audits were designed to test students' knowledge of spreadsheet applications

to Real value/ Equated yield hybrid- and Rational/Short-cut DCF models of property investment valuation (Figures 3A and 4A). In addition, Figures 3B and 4B are the solutions to the exercises in Figures 3A and 4B respectively.

2007/2008 FIRST SEMESTER EXAMINATION

Study the spreadsheet-extract below for the valuation of a leasehold interest and use it to calculate the variables attributed to each formula in the cell. Thereafter, reproduce a complete spreadsheet for the valuation. [11 marks]

	A	B	C	D	E	F
1	Data	Head Rent per annum	45,000.00			
2		Net rent received per annum	120,000.00			
3		Current net rental value per annum	150,000.00			
4		Rent review periods	3	Yearly		
5		Period to the next rent review	2	Years		
6		Unexpired term of leasehold property	14	Years		
7		Inflation risk free yield	7.424%			
8		Equated yield	23%			
9						
10			VALUATION			
11		Term				
12		Rent received per annum			=C2	
13		Y.P. for 2 years @ 23%			=((1+C8)^-C5)/C8)	=E12*E13
14						
15	Add	Reversion				
16		Current net rental value per annum			=C3	
17		Y.P. for 3 years @23%×Y.P. for 12 years @7.424% Y.P. for 3 years @7.424%		=((1-(1+C8)^-C4)*(1-((1+C7)^-(C6-C5)))/(C8*(1-((1+C7)^-C4)))		
18		× P.V. of ₦1 in 2 years @ 7.424%		=(1+C7)^-C5	=D17*D18	=E16*E18
19		Capital Value of Rent received				=F13+F18
20						
21	Less	Capital Value of rent payable				
22		Head rent per annum			=C1	
23		Y.P. for 14 years @ 23%			=((1-(1+C8)^-C6)/C8)	=E22*E23
24		Capital Value of Leasehold Property				=F19-F23

FIGURE 3A: COMPULSORY QUESTION ON SPREADSHEET APPLICATION TO REAL VALUE/EQUATED YIELD HYBRID MODEL

2013/2014 FIRST SEMESTER EXAMINATION

You are provided with spreadsheet specimens for property investment valuation comprising Formula Audit 1.1 and Workbook 1.1 respectively. Study the Formula Audit 1.1 and do all accompanying calculations in your answer booklet provided. Thereafter, you are required to complete the Workbook 1.1, and attach it to your answer booklet. [11 Marks]

Formula Audit for Property Investment Valuation

	A	B	C	D	E	F
1	Data	Net rent passing per annum	420,000.00			
2		Current net rental value	550,000.00			
3		Equated yield	21.50%			
4		All risk yield	4.95%			
5		Implied rental growth rate	17.8%			
6		Interest in Commercial Property	Freehold			
7		Rent review period	5	years		
8		Period to the next rent review	3	years		
9						
10		VALUATION			₦	₦
11		*Term*				
12		Net Rent passing per annum			=C1	
13		Years purchase for 3 years @ 21.5%			=(1-(1+C3)^-C8)/C3	=E12*E13
14		*Reversion*				
15		Current net rental value per annum			=C2	
16		Amount of ₦1 in 3 years @ 17.80%			=(1+C5)^C8	
17		Projected Current net rental value			=E15*E16	
18		Years purchase in perpetuity @ 4.95%		=1/C4		
19		P.V. of ₦1 in 3 years @ 21.5%		=(1+C3)^-C8	=D18*D19	=E17*E19
20		Capital Value				=F13+F19

FIGURE 4A: COMPULSORY QUESTIONS ON SPREADSHEET APPLICATION TO SHORT-CUT DCF TECHNIQUE

2007/2008 FIRST SEMESTER EXAMINATION

	A	B	C	D	E	F
1	Data	Head Rent per annum	45,000.00			
2		Net rent received per annum	120,000.00			
3		Current net rental value per annum	150,000.00			
4		Rent review periods	3	Yearly		
5		Period to the next rent review	2	Years		
6		Unexpired term of leasehold property	14	Years		
7		Inflation risk free yield	7.424%			
8		Equated yield	23%			
9						
10			VALUATION			
11		Term			₦	₦
12		Rent received per annum			120,000.00	
13		Y.P. for 2 years @ 23%			1.4739903	176,878.84
14						
15	Add	Reversion				
16		Current net rental value per annum			150,000.00	
17		Y.P. for 3 years @23%×Y.P. for 12 years @7.424% Y.P. for 3 years @7.424%		5.99852371		
18		× P.V. of ₦1 in 2 years @ 7.424%		0.86555745	5.1980654	779,709.81
19		Capital Value of rent received				956,588.65
20						
21	Less	Capital Value of rent payable			45,000.00	
22		Head rent per annum			4.10816330	184,867.35
23		Y.P. for 14 years @ 23%				771,721.31
24		Capital Value of Leasehold Property				

FIGURE 3B: SOLUTION TO SPREADSHEET APPLICATION TO REAL VALUE/EQUATED YIELD HYBRID MODEL

2013/2014 FIRST SEMESTER EXAMINATION

	A	B	C	D	E	F
1	Data	Net rent passing per annum	420,000.00			
2		Current net rental value	550,000.00			
3		Equated yield	21.50%			
4		All risk yield	4.95%			
5		Implied rental growth rate	17.8%			
6		Interest in Commercial Property	Freehold			
7		Rent review period	5	years		
8		Period to the next rent review	3	years		
9						
10		VALUATION			₦	₦
11		*Term*				
12		Net Rent passing per annum			420,000.00	
13		Years purchase for 3 years @ 21.5%			2.0579825	864,352.66
14		*Reversion*				
15		Current net rental value per annum			550,000.00	
16		Amount of ₦1 in 3 years @ 17.80%			1.63469752	
17		Projected Current net rental value			899,080.46	
18		Years purchase in perpetuity @ 4.95%		20.2020202		
19		P.V. of ₦1 in 3 years @ 21.5%		0.5575337	11.2633082	10,126,620.34
20		Capital Value				10,990,973.01

FIGURE 4B: SOLUTION TO SPREADSHEET APPLICATION TO SHORT-CUT DCF TECHNIQUE

Besides the difference in these questions, manual worksheets were distributed to students who sat for the examination in 2013/2014 session contrary to the 2007/2008 session. Questions in Figures 3A and 4A were allotted a total of 11 marks respectively.

Table 1 is the frequency distribution of scores earned by students who enrolled for the course and attempted the questions on spreadsheet applications to contemporary techniques of property investment valuation. During the 2013/2014 session, 57% of students who attempted the question in Figure 4A scored below 6 marks, compared to 63% of students who attempted cognate question in the 2007/2008 session (Figure 3A). This implies that over 50% of students in both cases still have problems grasping and tackling valuation exercises in contemporary techniques notwithstanding improvements in teaching and learning aid. However, 6 out of 71 students scored the maximum of 11 marks allotted to the compulsory question in 2013/2014 session compared to 1 out of 46 students in the 2007/2008 session.

Table 1. Frequency distribution of students' scores for the questions

Band of score	2007/2008		2013/2014	
	Frequency	Percentage (%)	Frequency	Percentage (%)
11	1	2	6	8.5
10.0 -10.5	2	4	3	4
9.0 - 9.5	3	7	3	4
8.0 - 8.5	1	2	5	7
7.0 - 7.5	3	7	8	11
6.0 - 6.5	7	15	6	8.5
5.0 - 5.5	7	15	2	3
4.0 - 4.5	4	9	9	13
3.0 - 3.5	7	15	8	11
2.0 - 2.5	3	7	8	11
1.0 - 1.5	7	15	9	13
< 1.0	1	2	4	6
Total	**46**	**100.0**	**71**	**100.0**

Students' performances in these examination questions were evaluated using measures of central tendency and dispersion (Table 2). Compared to the 2007/2008 session for which the mean score for the question in Figure 3A stood at 4.88 ± 0.41; there was an improvement in 2013/2014 session with mean score of 5.10 ± 0.39. With reference to the 2007/2008 session, the 95% confidence interval of mean score for 2013/2014 session increased marginally by 0.25 and 0.18 for the lower and upper bounds respectively.

Table 2. Descriptive statistics of students performance

Variables	Session	
	2007/2008	2013/2014
Observation	46	71
Mean	4.88	5.10
Median	5.00	4.00
Mode	5.00	4.00
Standard deviation	2.79	3.32
Standard error of mean	0.41	0.39
Minimum score	0	0
Maximum score	11	11
95% confidence interval (lower limit)	4.03	4.28
95% confidence interval (Upper limit)	5.73	5.91

It can be narrated that as at 2007/2008 session when the department was confronted with dearth of useful learning resources, students' overall performance in EST 418 was adversely affected compared to the 2013/2014 session which witnessed an improvement in average score of students in the compulsory question where students were expected to deploy spreadsheet theory to solve simple problems in contemporary property investment valuation.

Besides the application of pedagogies (comprising multimedia presentations, lecture-based instruction, tutorials), the provision of self-study manual of spreadsheet exercises and a fully equipped micro computer laboratory prior to academic activities in 2013/2014 might have contributed immensely to foster student-centred learning and a fairly thorough understanding of spreadsheet application to contemporary valuation of property investment among these students compared to the 2007/2008 session when the department was confronted with dearth of these resources.

Result of the t-test for difference in mean score for both sessions indicated $p > 0.05$, implying a marginal improvement in students' performance in 2013/2014. This result aligns with similar studies conducted by Entwistle et al. (2000) and Trigwell et al. (1999) on the use of student-centred learning; as well as the positive impact of available resources to support teaching and learning (Westbrook et al., 2013). In spite of this marginal improvement, more efforts are desired to ensure that over 60% of prospective students that enrolled for the computer application course (EST 418) are given the ample opportunity to study hard with a view to grasp the concept, theory, and practice of spreadsheet applications to contemporary techniques of property investment valuation.

DISCUSSION OF RESULTS

This section examines the extent to which each research objective has been addressed within the context of the results. In consonance with the first objective, the curriculum for teaching of spreadsheet skills in valuation was found to be embedded in the second year HND course tagged "EST 418" with title designated as "Computer Applications to Real Estate". Specifically, the teaching of spreadsheet applications to contemporary techniques of property investment valuation was drawn from the topic pertaining to the use of packaged application software of relevance in real estate. This current practice within the department aligns with the curriculum of other higher educational institutions offering similar programmes leading to academic qualifications in general practice surveying across the globe (Ali & Alias, 2006; Callanan & McCarthy, 2003; Kampamba et al., 2015).

Secondly, the success of teaching and learning of spreadsheet applications to contemporary techniques of property investment valuation was found to be facilitated by classroom facilities comprising magic board, projector screen, and multimedia projector. Aligning with the norm that the teaching of property investment valuation should be complemented with computer-aided practical (Udoekanem et al., 2013), the study has shown that the successful exercise of relevant pedagogies in this context was anchored on adequately equipped computer laboratory designed to facilitate student-computer interaction, thereby availing students the opportunity to try out and master the various computerized exercises in the practical manual. The implication of this in practice is that the emerging graduate would have been imparted the requisite skill to help bridge the knowledge gap in the application of spreadsheets to contemporary techniques of property investment valuation. Notwithstanding, expereicne shows that majority of the HND students in the department do not have the means to own a low-priced laptop; implication of which is the tendency to lose grip of frequent practice of what they had been taught in the computer application course when access to the computer laboratory become restricted upon their graduation from the polytechnic.

Thirdly, pedagogies within the context of this study predominantly revolves around student-centred learning, which is a social constructivism of how the student can make concerted effort to use available resources to develop conceptual- and analytical skills; and above all, develop spreadsheet application skills for contemporary valuation of property investments (See Figure 2). In consonance with related studies on pedagogies for student-centred learning comprising Westbrook et al. (2013), Raman (2013) and Udoekanem et al. (2013), it was

found that lecturers teaching the course - EST 418 have deployed demonstrations and case studies to deliver the practical content of the curriculum with the intent of encouraging students to independently attempt and master the various computerized exercises in the practical manual. On the other hand, these lecturers have used multi-media presentations, lecture-based instruction, tutorials, practical exercises and case studies to deliver the theoretical content of the curriculum in line with pedagogic practices outlined in related studies credited to Osborne et al. (2008) and Raman (2013). The combination of these pedagogies provides a balance in the teaching of practical- and theoretical content of spreadsheet application to contemporary techniques of property investment valuation.

Pursuant to the deployment of a combination of these pedagogies outlined above, data analysis was concluded with a comparison of students' performance in the compulsory examination question designed to test their knowledge of the concept, theory, and practice of spreadsheet applications to contemporary techniques of property investment valuation. Results indicate a significant improvement in mean score of students who attempted the compulsory question on the subject matter in 2013/2014 ($p > 0.05$) compared to those who attempted similar question in the 2007/2008 session. This finding generally underscores the positive impact which the availability of educational resources could exert on students' academic performance (Westbrook et al., 2013). Notwithstanding the improvement in teaching and learning aids in 2013/2014, over 50% of students (who scores below the average mark) were found to have a weak grasp of the solution to the compulsory question - a phenomenon which might be attributed to weak efforts and poor learning habits.

RECOMMENDATIONS

The following recommendations are put forward in connection with the results discussed above:

i. It is expedient that lecturers of valuation and computer application to real estate at all levels of higher education in Nigeria should adopt these appropriate pedagogies with the intent of stimulating and sustaining the interest of their students towards learning how to apply spreadsheets to contemporary techniques of property investment valuation; and
ii. Proprietors of educational institutions should take a cue from the experience narrated in this study and sustain the provision of nascent academic resources that would enhance the teaching and learning of computer-aided valuation of property investments.

CONCLUSION

Motivating this study was the knowledge gaps of valuation lecturers in Nigeria pertaining to the relevant pedagogies for the application of spreadsheets to contemporary techniques of property investment valuation. With emphasis on the experience of the authors in the teaching of spreadsheet applications in this aspect of valuation, it has been discovered that multimedia presentations, lecture-based instruction, demonstrations, tutorials, and independent learning are important pedagogies capable of enhancing the academic performance of students in this context. For the study area, the marginal improvement in students' scores within this context might be sustained through a synergy of these pedagogies with student's mental and physical effort towards applying spreadsheets to contemporary techniques of property investment valuation.

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Drawing Pre-knowledge and Design: A Case Study of Year Two Undergraduate Architecture Students of Ahmadu Bello University

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ABSTRACT

Pre-knowledge is the potential skill acquired before entering school or before its relevance is put to use, which aids, enhances or augments education. Drawing is an inevitable aspect of the architectural education and design and the ability to graphically present cognitive design proposals to physical entities is an essential skill for all architects. This research assesses the drawing pre-knowledge of 53 year two undergraduate students in Ahmadu Bello University. The survey provided information on the students' ability to convey cognitive and physical realities on paper via drawing. A relationship was also sought between grades in design related courses/tasks, preferred techniques for graphical representation as well as demographic data through questionnaire responses. Study findings reveal that many students are yet to achieve mastery in free-hand drawing as a technique for representation. No relationship was observed between their semester grades in design related courses/tasks to their inherent ability to draw. It was also observed that, although some of the students didn't find free-hand drawing as the most suitable technique for representation, they engage in it because it is required of them by the curriculum. The implication of these findings on architecture education and design is that the sample set of students surveyed lack satisfactory drawing pre-knowledge prior to entering the School of Architecture. The paper recommends that Schools of Architecture need to emphasize the need of free-hand drawing exercises as part of admission entry requirements and in early formative years of training in order to improve the cognitive design skills requisite for quality architecture education of future architects.

Keywords: Drawing, pre-knowledge, architecture education

INTRODUCTION

Foreknowledge/Pre-knowledge "is the awareness of something before it happens or exists." (Oxford English Dictionary, 2003). In architecture, having foreknowledge of the profession means to have burgeoning understanding of the design ideas, representation techniques and artistic inclinations that would supplement the formal education to be received in the classroom. In the case of prospective architecture students, it is adequate that such, has a synoptic idea on the rudimentary knowledge of the course and the architectural skills that may aid in the pursuit of his/her professional career.

The core course in an architectural curriculum is design (Cikis, 2009). If any student be unsuccessful in this course, both peers and educators may perceive he/she as being architecturally blunt. Both students and educators perceive this as the central aim of being in the professional course (Adedapo, 2012). The essential method of designing is drawing, either in virtual reality or on crude surfaces.

Bhzad (2013) explains that, the extent of ingenuity expressed by any student, depends partly on the student's ability to conceive a new idea or approach to solving a problem and not necessarily produce a wholly creative one. (Yi-Do & Gross, 1996) says design requires reasoning, expressing ideas, making decisions, evaluating and verifying proposals and finally proving decisions, a similitude in all problem-solving activities. Because architectural education depends greatly on ideas, the backbone for the interpretation of these ideas are usually visual representations and verbal expressions, which the former takes preeminence. In addition, Adedapo (2012) explains that, the various elements of architecture within their local

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environment would most likely creep into their own design performance and expression unconsciously.

Rationale

Other literature have tried to ascertain the role of drawing; by highlighting the cognitive complex development of the students' mind and their relationship with individuals gender, Cherney (2006). While others have discussed on the characteristics associated with drawings (and other media), and it's figures' relationship in relation to its designers socio-cultural environment. Others have investigated the effect of pre-knowledge and their enthusiasm in graphical representations and the total architectural education (Nazan Kirci, 2013). It is however not clear the extent pre-knowledge of drawing skills play in architectural design output of students.

Purpose of the Study

This research would try to highlight an important architectural representational skill: free-hand drawing, which is essential to succeed for an architecture student in his/her pursuit. This research aims to assess and establish the impact of foreknown drawing skills on individual architecture students of the Department of Architecture, Ahmadu Bello University Zaria as a case study.

Research Questions

So this research would try to answer:

i. What relationships exist between the cognitive realities perceived in the mind, the physical realities, and the drawing capabilities of architecture students?
ii. What roles drawing foreknowledge have on graphically oriented architectural courses of undergraduate architecture students?
iii. What other factors could affect the architectural design of students?

Research Objectives

i. Determining the possible relationships that drawing foreknowledge and architectural design and graphics may share and;
ii. Determining the relationships that may exist between the architectural cognitive realities, architectural physical realities and its influence/s on students drawing capacity.
iii. Investigating any other factor that could influence architectural design.

LITERATURE REVIEW

Pre-knowledge

The term Pre-knowledge a synonym for fore-knowledge has a generic meaning. It isn't a technical term in architecture nor does it have any direct relationship to architecture. (Oxford English Dictionary, 2003) explains foreknowledge as, "the awareness of something before it happens or exists". This meaning only delineates foreknowledge as an aforehand premonition of an event prior to its occurrence.

In architecture, for a student to be considered as being trained in this honourable profession, design is inevitable. Architecture student's design is defined by (Schneider et al, 2013), as "architects putting themselves in the perspective of a buildings future users to predict the likely patterns of use in these buildings, concurrently generating shapes and forms that corresponds to the expected users' needs." This definition highlights the property of an architect: that is, one's ability to dabble with one's imagination; an ability to create a virtual imagery of his/her creative reality and exist in it, while juxtaposing the users convenience in such virtual reality. This quality of an architect; if found in any student, gives such an

upperhand over others. This argument is also supported by (fallingwater, 2015), defining architecural design as, "necessary step to take in designing any structure… been able to imagine such structure in the mind before transmitting it to paper…". Not to deviate, Cahtarevic (2008) describes representation as '…the act of producing virtual reality and involving the spectator into the pictorial space (…) Providing some kind of psychological involvement and transfer of the spectator into the space in the picture.'. Likewise (Yee) says; architectural "renderings" (representation) are the composition of various linear elements of a building to provide an imagery that could better relate to the three dimensional environment that is appreciated by everyone. To support this; while discussing on the necessary tools necessary for future professional architects, (Alagbe, 2014) says,"…they must have adequate hands-on experience on manual drafting to enhance their design creativity…".

Architectural Design

Adedapo (2012) says within the architectural educational curriculum, architecture students' design is given paramount importance; that's why it is a major form of assessment by jury. This is often because, design is a major course taken by students, which exhausts most of the lecture hours of the student.". Graphical/Visual representation, (Yi-Do & Gross, 1996) explains that, its role in design problem solving is of paramount importance. Representations are the fruits of perception. In order for raw data to be shaped into a coherent whole, they must go through the process of filtering and organization, yielding a structured representation that can be used by the mind for any number of purposes (David J. Chalmers, 1991).

Graphical Representation

Sketching is still the quickest and the most direct means to produce visual representation of ideas" (Ellen, 1996). This aspect of the architectural training is so important as it was also part of a questionnaire set in a somewhat similar study, which asked first year architecture students if they had pre-knowledge of any representation technique prior to entering the university? 78% responded in negation to this p.620 (Nazan Kirci, 2013). This caused the researcher conclude that, "the language of architectural practice is a little known subject among architecture students prior to studying architecture" pp.620-621 (Nazan Kirci, 2013). We would in this study focus on sketching as a means of representation.

Grading drawings

It is a norm to find grading of artworks like drawings impossible. No wonder (Linda, 2008)says 'Many have assumed its judgement to be subjective, because the different drawings are produced by unique individuals with a personal understanding in their perception of art'. Because the educators themselves are human, they follow different rubrics in judging artworks. Stating also that,certain sundry efforts have been made to ascertain and lay down certain paradigms for grading drawings, by assessing the qualities of the work such as:

i. Choice of subject .
ii. Handling of media
iii. And control of the composition

But one bane that (Cikis & Cil, 2009.) says pertaining assessment by numerous mentors is the use of "a particular conceptual framework", and any deviation from the stipulated criteria is often poorly rewarded. Likewise, the framework may be ambigiuos, giving room for hidden criteria to operate during assessment, discouraging ideas outside this framework. So for the case of this research, the method of assessing drawings would be chosen from one below;

i. *Limitless members of jury*: where decision is based on arbitrary choice from a sample of public opinion. No particular rubric is provided as a guideline, except the quality observed by the viewers in response to personal choice (bias).
ii. *Sole jury:* this is observed in single classroom settings, where a particular educator is assigned to a number of students to educate them in a particular subject or subjects; where such is left with the sole responsibility of grading, assessing and assigning tasks to them.

METHODOLOGY

Sample selection

Students of architecture department Ahmadu Bello University, Zaria are the case study for this research. The following criteria for sample selection was considered to achieve the best stock,

i. Offered a graphical course either in the university or before coming to the university.
ii. Seen one or more of their semester results on architectural design or graphics.
iii. Current drawing skill from their pre-university education.
iv. The lowest influence in design by their school of architecture.

The only category of students to have fit into these criteria was the second year undergraduate (200 level) students. They were the only category of students who had surface alterations in their design concepts or understanding, compared to their immediate juniors who were, as is in line with the department's curriculum still taking majorly science related courses. Their senior colleagues were doubtful a choice because, their years of consistent mentoring with the architectural precepts would have permeated them.

Questionnaire

A questionnaire was the medium of survey that was used to obtain information of the respondents' level in school, age, and graphical subjects taken while in secondary school; if it was technical drawing or fine art. Also, information concerning the respondents' present level of familiarity with architectural software. It also obtained what method of representation they may prefer, either free hand or technical drawing, sculpting out in 3-Dimensional forms or painting/drawing in 2D forms, likewise previous grades on architecture design and graphical oriented courses were obtained. The respondents were asked to draw a realistic perspective of their observed space and an abstract façade, in order to relate both results. To support this, another practical example was given: they were asked to assume most accurately the height of the researcher and the headroom of the space they were in, in the familiar measurement: which is millimeters. To verify what aspect of design they were passionate about, they were asked if they preferred working drawing to presentation drawing. All these was taken to assess their inclination to generic aesthetical graphics, and note if any coherence existed between their ability to relate proportionally reality viewed on to surfaces. For other subsidiary factors to be considered, they were required to indicate if they were right-handed or left-handed. Other questions include, their personal preference to what aspect of the design process seemed most difficult. Understanding user functions within space and implementation in their designs; adopting an abstract concept and implementing it into design was also enquired. Similarly, it enquired if they (the students) were satisfied personally with their present level of design creativity and those of their colleagues; and if the school of architecture was making the design process easier for them to express themselves using the graphical skill they found most familiar with.

Grading drawings

The questionnaire required assuming the physical height of the researcher, so the researcher stood at a conspicuous position in front of the class. In addition, the researcher was hands on

to collect the filled questionnaires and answer any other questions they may have concerning filling it. Only 53 respondents were assessable. Seven senior colleagues within the department were chosen to grade the respondents' drawings on a scale of ten, because of their obvious exposure to architectural precepts over the sample population, guided by its obedience to proportionality; balance; graphical prowess and ability to emphasis depth, height and contrast as well as to follow the principles of drawing/design.

Analyzing Questionnaire

The questionnaires were analyzed and converted into information. The collected information was collated, produced and represented using figures and tables showing a brief summary of the entire provided data. These information were interpreted aided by literature to support or negate the provided study's assertion.

FINDINGS

Sample Population

As we have stated above, based on the criteria given, our choice of sample population was obvious. The second year undergraduate class---that is the 200 level students---based on reliable information from statutory personnel of the department, as at the time of this research stood at 86 students. Nevertheless, as is a norm: the amount of questionnaires given do not usually come back perfectly assessable. The overall acceptable and assessable questionnaires that were returned stood at 53, which is 61.6% of the 86 questionnaires handed out.

Results

It was obtained that 77% of the students had undertaken a graphical course; based on this study: fine art or technical drawing which could better enhance their graphical capacity. Thus, a high probability for the students to have a good foundation in graphics representation, which makes graphical courses easier for students to engage in. So it was observed that 54% of the students, were satisfied or had gained mastery with the technique of representation that they had taken as a course in their pre-university education. In essence, they were satisfied with their pre-university graphical exposure. It is also observed that 23% of the students were not interested or had not attained mastery in the graphical technique they took as courses while in Secondary School. Meaning: the graphical technique they preferred to engage in were not the same graphical subjects they were taught back in Secondary School. For example, a student who took fine art as the only graphical subject in secondary school would prefer to use technical methods rather than an arbitrary method such as a free hand drawing to illustrate their cognitive ideas or representations. Also results showed that 45% of the students partook in the drawing exercise, highlighting the fact that not all the students who are free hand artist are always ready to draw when the need arises. Another observation was that, among these students that partook in the drawing exercise, only 20% of these students who received fine art training partook in this exercise: an anomaly. Meaning that 80% of these students were available to draw even though it may not be their strong points. This finding reinforce formerly iterated literature that, free-hand drawings still maintains its basic role as the fastest and easiest way to relate realities on surfaces.

It was observed that 60% of the students that took part in the drawing exercise would most likely draw with free hand when availed the opportunity, contrary to the technical courses they undertook while in Secondary School. This implies that, since drawing by free hand is of public demand, the school of architecture should imbibe fine art or its relative as prerequisite for admission. Further information revealed that despite the students' inadequacy in free hand graphics, they are getting trendy with application software that are useful for graphical representations.

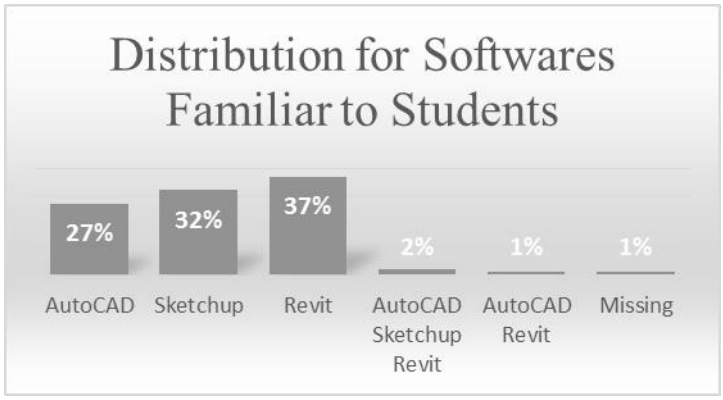

Figure 1. Distribution for Software Familiar to Students

Results revealed that at 96% of the total number of students have gained some level of familiarity with at least an architecturally inclined software. This further proves that, although their capacity to adopt the fastest way of representation, which is drawing, they have sought to adopt other modes of representation that appeals to them. From both instances, they seem to have fallen short of expectations.

As shown in Figure 1. Average scores obtained by students' interior perspective was 2.08 and in building's façade was 2.72.

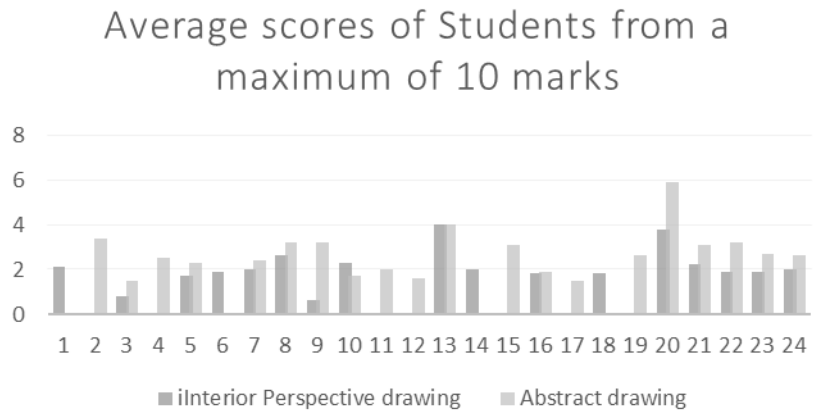

Figure 2. Distribution illustrating students' average scores in drawing task

This insinuates that, the students would have a greater edge in drawing cognitive abstract views rather representing visual realities unto paper. Implying that, any of the students from this sample population if picked at random, cannot fully represent architecturally or otherwise, realities either in the cognitive or real on to surface for others to appreciate its full context. So, this particular set of students inclined to free hand and those that claim mastery in this skill are not impressive drawers as they claim to be. From research it was also observed as shown in Figure 2. That in their curricular course; architectural design, almost all the students of this class are averagely good, while in architectural graphics, there are two extreme divisions of students: those that pass it with distinction and those that fail it woefully. If this result is compared to former results, there seems to be a correlation. Implying that the grading method adopted by this school of architecture at present is dependable when compared to the other methods of grading drawings.

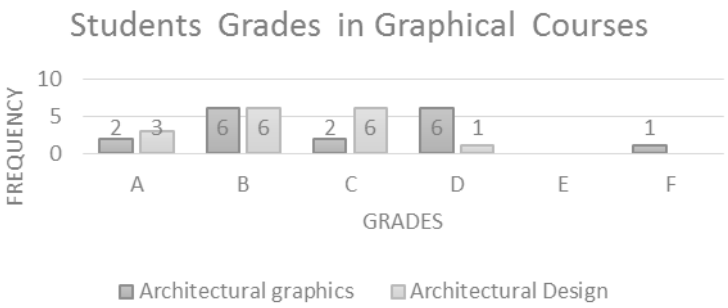

Figure 3. Distribution of frequency for Students' grades in architectural courses requiring graphical representation

The students indicated that they preferred presentation drawings than working drawings, given a consistency in their average scores in the drawing exercise. The students maintained a neutral stand when asked what their capacity to relate physical realities on to paper was; implementing abstract concepts in to their design and appropriating the users' need within the design.

Other results showed that the students were able to determine proportionately what dimensions their physical realities were, but unable to represent this dimensions relative to other elements of the physical reality on to surfaces through sketches.

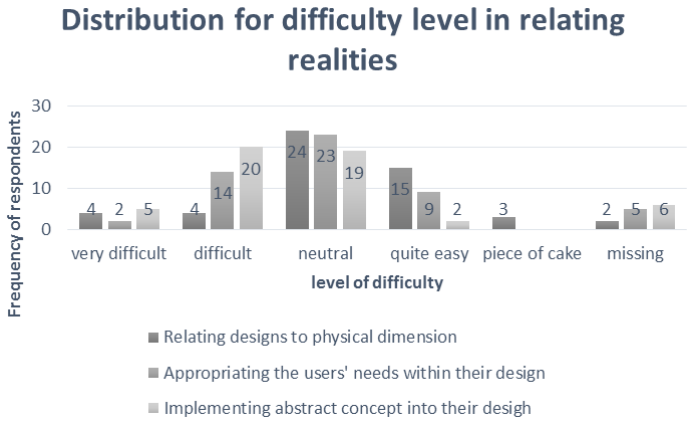

Figure 4. Distribution for difficulty levels in relating realities

Also, their ability to assume proportionately the sizes of animate and inanimate elements within their physical environment was tested and it provided the results Figure 5. It revealed that a larger sample of the class would assume almost exactly the dimension of an animate element than the other.

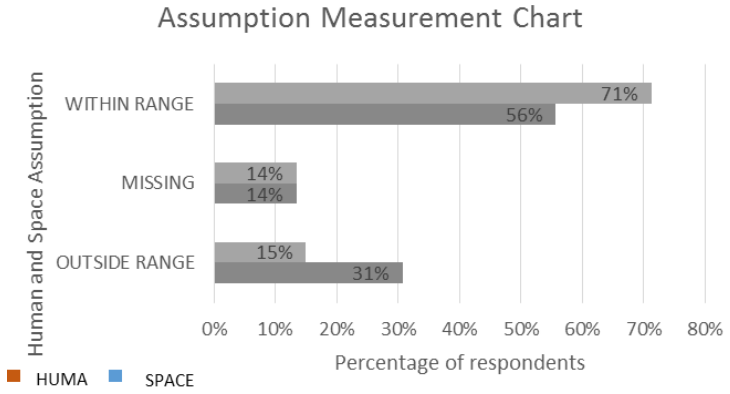

Figure 5. Assumption Chart

An awesome fact obtained from the research indicates that left handed students preferred presentation drawings and were able to relate elements within their physical realities proportionately. But data for right-handed students did not give a particular assessable pattern.

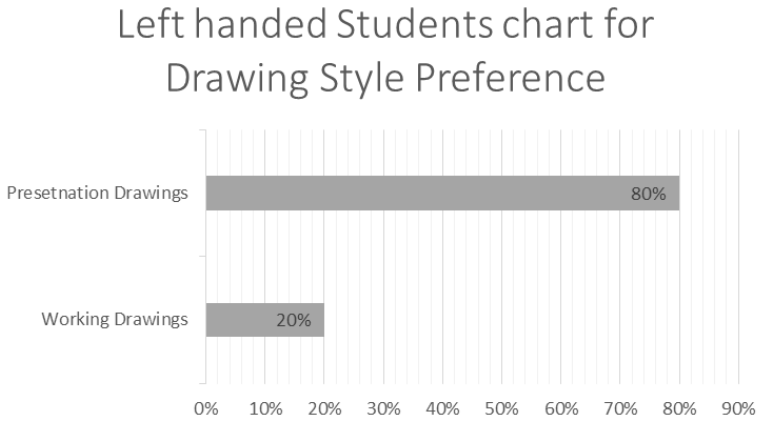

Figure 6. Left-handed Students Chart for Drawing Style Preference

The students were asked to state their level of satisfaction pertaining their state of creativity. Their response as shown in figure 7. Their classmate's level of creativity and the level of freedom to express themselves architecturally, their response was that of dissatisfaction and satisfaction: which I wish to denote as a state of confusion.

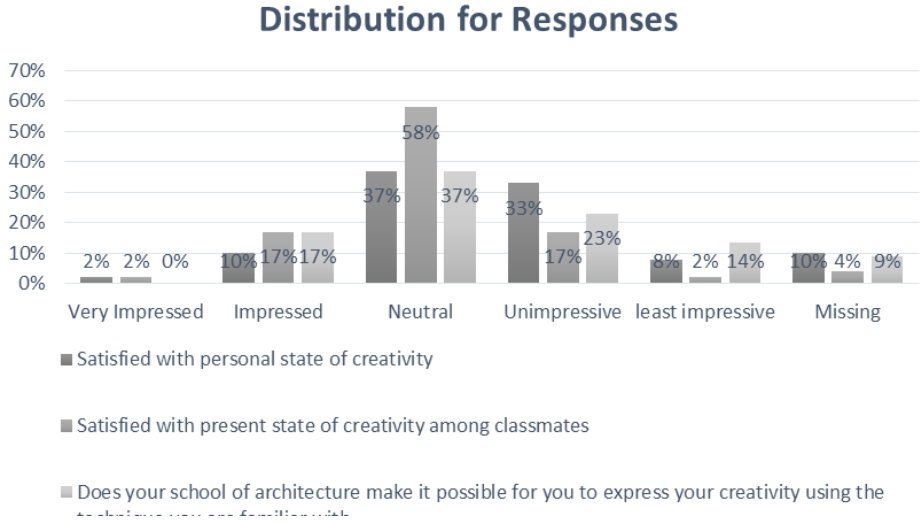

Figure 7. Distribution for Responses

Therefore, in relation to the objectives we set out with from the beginning; we could see that drawing as a pre-knowledge for entering an architecture school is integral and the students know this. But in its relation to the two graphically oriented courses: architectural graphics and design, their individual grades seem not to follow any pattern when collated and analyzed with their drawing capacity. Likewise, the research showed that students were unable to relate their physical realities on to surfaces through drawings but had good *photometric* capabilities. When posed with an opportunity to express their thoughts or physical environment graphically, they will find it difficult.

CONCLUSION

From the onset, we sought to answer questions as regards students drawing pre-knowledge and one of these was "what relationships exist between the cognitive realities perceived in the

mind, the physical realities and the drawing capabilities of architecture students?" The research showed that the students found it difficult to translate cognitive or physical realities on to paper, and were well aware of this fact. This was observed in the students' defiance to perform a sketch, although, quite a number of the students claimed to have attained mastery in a particular representation technique. The study showed that a number of students that had taken a graphical subject while in secondary school were unwilling to adopt the learnt technique in tackling any drawing exercise. The research also highlighted the fact that the students were able to presume dimensions by sight, but were incapable of representing these perceived dimensions on to paper proportionally. Regarding the research question that seeks to determine "what roles drawing foreknowledge has on graphically oriented architectural courses of undergraduate architecture students?" From study, we noticed that students were well below average in architectural representations in relation to commendable graphics and design, but felt they were twice as good in these courses. Approximately 80% of the students claimed to have obtained some form of formal training in at least Fine Arts or Technical Drawing, thus enforcing the role that any technique for representation would play in augmenting the received architectural education. Likewise, other factors that could affect the architectural design of students within this research, was that students would very well prefer arbitrary graphical works than they would architecturally essential working drawings. Thus, students would prefer an uncoordinated format for representing their drawings than the stiffened method for architectural representation. And it was observed that left-handed students preferred free-hand graphically oriented tasks than coordinated technical drawings.

Alternate Interpretations

The population used in this study were only a sample of the many levels of the undergraduate students. If this research were to be carried out on other levels of architecture within the institution, we may obtain a contrary result or confirmation. Talk more of other sample students within the global architecture schools. Criteria such as socio, cultural, religious or educational backgrounds may play very strong roles in determining the end results of the research.

The results provided may yield quite different results, if aspects of the questionnaire such as the drawing were graded by other persons within the society who had little or no affiliations to the architecture field and perception. Their unconscious individual bias for standards in accepting a drawing as obeying proportionality; balance; graphical prowess and ability to emphasis depth, height; and this ability is dependent on the individuals understanding of these terminologies.

Based on the method of assessment chosen to analyze the provided data within respondents questions, like the drawings made by the students. The grades supplied by the graders could be challenged on several fronts such as; drawings have no standard rubric to be followed during grading.

Also, the students may have misinterpreted the need for the questions contained in the questionnaire. The provided information may have been flawed by the respondents due to misinterpretation of the entire purpose of the research. Students may have filled the questionnaire through public/peer choice or in a bid to impress or downplay the research process, thereby reducing the potency of the entire purpose of the research.

Likewise the students' predisposition to presentation drawings than working drawings may not suggest their inclination to engage in the former than the latter. As it is not everything that a person admires that such can engage in.

Study Limitations and Recommendations

There seemed to be scarce literature to support in direct terms most of my terminologies in relation to architecture. As little has been done in this field. During the process of dispensing questionnaires, a few of the students were initially unwilling to fill my questionnaires. Likewise, some of the students found engaging in a drawing exercise quite rigorous. Therefore, unless the drawing exercise is extremely relevant, do not proffer it in a questionnaire survey. In terms of analyzing the data, I had difficulty getting appropriate personnel that would grade my questionnaire drawings. As most lecturers whom I first reached out to, declined involving in giving grades to enhance the instrument of grading. When undertaking a survey, guarantee the commitment of personnel that would grade the drawings prior to handing out the questionnaire.

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APPENDIX

Figure 8. Interior perspective of classroom to be sketched

Sample student 1

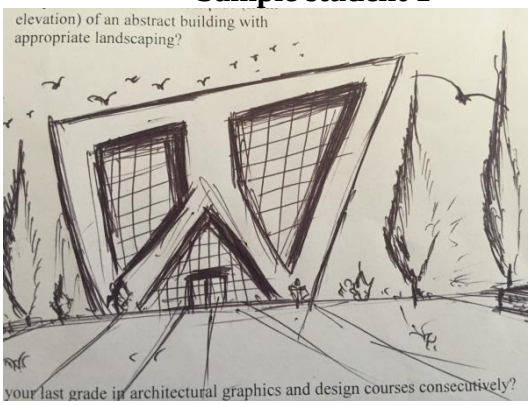

Figure 9.1. Illustration of an abstract façade

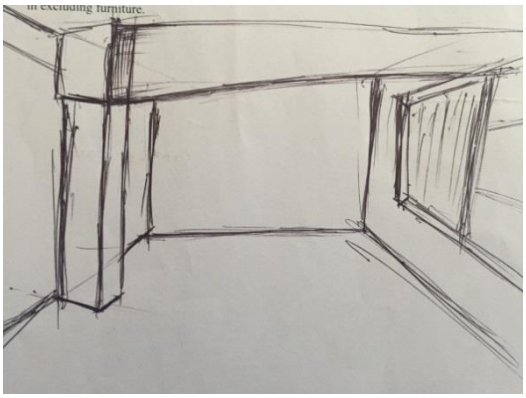

Figure 9.2. Illustration of interior perspective

Sample student 2

Figure 10.1. Illustration of an abstract façade

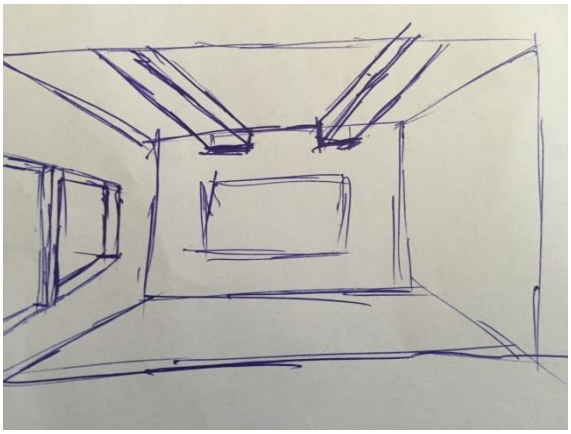

Figure 10.2. Illustration of interior

Impact of School Environments on Academic Performance: Feedback from Senior Secondary School Students

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ABSTRACT

A school is an environment where knowledge is acquired at various levels. The buildings or environment where this knowledge is acquired is as important as the knowledge itself. With the prevalence of secondary schools established often within residential quarters to cater to the needs of the Nigerian populace, it has become imperative that research explores the impact of building typology/environments on academic performance of students. This study evaluates this relationship within two schools in Sabon Gari Zaria; First Baptist High School and Top Spring School. A survey of 232 senior secondary school students as well as physical measurements/documentation of both schools was used to obtain the students' view of their school building, how it affects them and if their school building was built for school purposes or not. Interviews were also conducted to get more information from the students on the subject matter. The data was analyzed using IBM SPSS® 21 for descriptive statistics from questionnaire responses. Study findings reveal that performance of students would improve with the provision of adequate and conducive school environment with emphasis on facilities such as classrooms and toilets. It further revealed that good indoor air quality, good visual comfort and sufficient space within and outside learning spaces are factors that affect performance of students amongst others. The implication of these findings to designers is that the building typology (be it originally residential or institutional) plays a significant role in the overall academic performance of students in the study area.

Keywords: School environment, Academic Performance, Building Typology, Senior Secondary School Students

INTRODUCTION

With the increase in the population of Nigerians there is high demand on infrastructure, social amenities, housing needs, schools, jobs etc. to cater for the growing population. The educational sector being one of the many sectors in economic development of a nation has evidently felt a lot of pressure in seeing to it that education is served to all (Olaniyi nd). Secondary schools being an intermediate institution as a point of emphasis have increased overtime from the past and presently we have more than 11000 secondary schools as at 2013 in the country with a greater percentage been private schools (Federal Ministry Of Education, 2014). Overtime research has explored the maintenance of the facilities within school buildings like classrooms, libraries, laboratories, workshops, assembly halls, toilets, sickbay etc. and how their deterioration affect the students and have identified problems such as inadequate funding, inadequate facilities, low staff morale, poor supervision of schools, frequent changes in policies, environment etc. as major factors that affects students' performance (Timilehin, 2010 and Matthew, 2013). Little has been done to ascertain the number of schools that are properly designed and have the minimum facilities required in a secondary school let alone its maintenance and policies to evade its deterioration.

In a bid to meet the educational needs of the people most school buildings are not really designed for institutional purposes and often times residential buildings are converted to schools as is the practice in Zaria. The main situation is that such building clearly lacks some of the basic facilities needed for proper learning which affects the performance of the users. In schools it is agreeable that the greater percentage of its users are the students but scarcely are their opinion sought on matters of this sort that affects them directly like how comfortable they are, what could be done better to help improve their performance etc. Winston Churchill

Okafor, C. A.; Maina, J. J.; Stephen, H. & Ohambele, C. C. (2016). Impact of School Environments on Academic Performance: Feedback from Senior Secondary School Students. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1175-1182

once said "we shape our building therefore our building shapes us". The school environment is shaped by designers and as such how comfortable and conducive the environment is, directly leaves an imprint on the performance of its users (Arong & Ogbadu, 2010 and Chukwuemeka, 2013).

Research questions posed by this study are:

i. What spaces and architectural design considerations would influence students' performance?
ii. Is there a difference in performance level of students from both schools with different building typology?

The paper is organized in six parts after the introduction. Section 2 reviews literature on spaces /facilities required in a secondary school building and design principles that would enhance comfort and improve students' performance. Section 3, 4 and 5 describes the methodology, findings/discussions and conclusion from the survey. References are contained in section 6.

SCHOOL BUILDING TYPOLOGY

School building typology refers to the type of school buildings obtainable in architecture. This could be classified either based on the evolution/period of construction or based of stages of education which is primary, secondary and tertiary either ways the needs, scales and sizes are different depending on the number of users. According to the Salford Centre for Research and Innovation (SCRI) report, it laid emphasis that school building typology explored three basic things: the plan and envelope of the building, the design principles for school buildings and the spaces required (Peter, & Yufan, 2009).

Plan and envelope

The plan and envelope of a school building describes the design of the building, its surrounding and the measures taken to ensure that the school is conducive for learning which enhances the academic performance of the students. Building envelope is a very important component which affects heat gain and transfer within a building and also the general comfort level in the building. The building envelope separates the internal and the external environment and serves as an outer shell to protect the indoor environment from adverse weather conditions. Mohammed (2010) emphasized that various design elements which includes wall colors, window surfaces, interior common spaces, courtyards etc. contributes to the aesthetics of the school environment which in turn creates a comfortable environment for the students and improves academic performance.

Space requirement of school buildings

Spaces in a school building refer to the usable space required for academic and extra curricula activities to function properly. The required spaces in school buildings are basically three they are instructional spaces, recreational spaces and facilities (Changu & Maida, 2005; Isaac & Musibau, 2009; Peter & Yufan, 2009). Instructional spaces are spaces where formal learning and training takes place; they are organized for that purpose and have special requirements for their design. They include classrooms, library, laboratory, school farm, workshop etc. recreational spaces involves spaces that allow for exercise, play, relaxation, extra curricula activities etc. they include well landscaped outdoor space, assembly hall etc. facilities are spaces that ensure that students are at ease in school this involves toilet, sickbay, canteen etc. all these spaces affects the users, as the need for a person to be well physically, psychologically and socially cannot be over emphasized.

Design principles for school buildings

Design principles for school buildings are considerations, fundamental sources and basis that guide the conceptual design and construction of school buildings in such a way that it (the building) achieves the following criteria; supports the users in terms of indoor/outdoor environmental comfort and ease of use of the facility, fits into the environment and supports the environment and finally promote economic growth in the intended vicinity. Peter, Yufan, Fay & Lucinda, 2015 proffered three principles to be considered in the design of school buildings they are; naturalness, individualization and level of stimulation.

Naturalness is associated with factors that affect the health, emotions and mood, visual, acoustic and thermal comfort of people within a space. Individualization involves factors that affect student's safety, privacy, free space, ease of use of spaces and satisfaction with their learning environment. Level of stimulation encompasses the factors that affect how the school environment supports its users by the serenity, balance, fitness, beauty and information it gives.

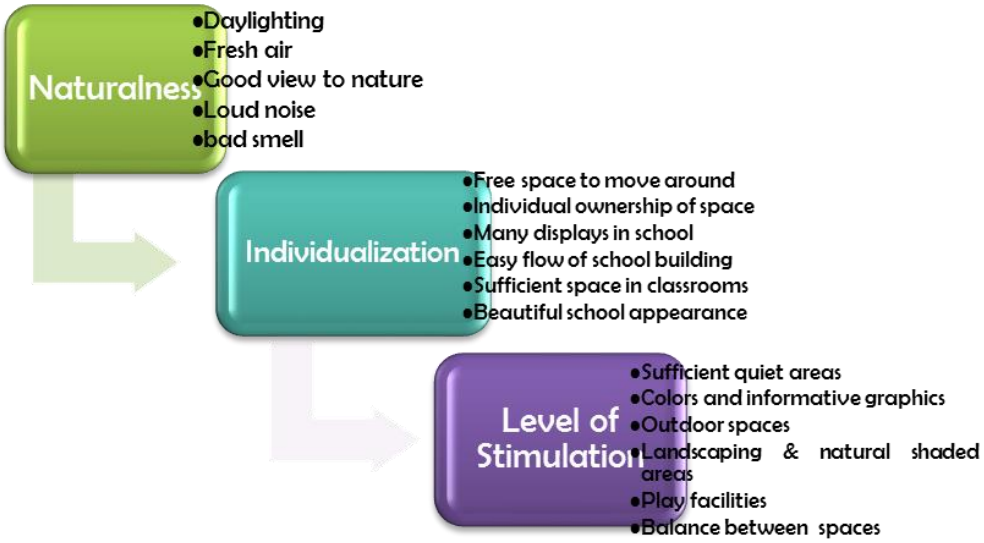

Fig 1 Principles to be considered in the design of school buildings source: Peter, Yufan, Fay & Lucinda, 2015.

Academic performance of students in secondary schools

The decline in the academic performance of secondary school students is on the increase (Arong & Ogbadu, 2010 and Moradeyo & Babatunde 2011), a lot has been put in research wise, on tackling the provision of good teachers, maintenance of provided facilities but so little has been put into enquires on the availability of the facilities and how its absence affects the performance of the students. Research in Nigeria is gaining a lot of recognition but it is quiet disturbing that student especially secondary school students are scarcely involved in the research process when it is done and eventually their grades and generally level of performance suffer. A great percentage of schools in Zaria are usually not designed for institutional purposes and the environment do not encourage academic success due to a number of reasons; absence of essential school facilities, absence of well-designed environment, change of use of building which in most cases do not have the facilities to cater for its users and schools situated in residential quarters.

METHODOLOGY

Case Studies and Study Population

The selected case studies are Top Spring School (TSS) and First Baptist High School (FBHS) located at Army Road and Benin Street respectively in Sabon Gari Zaria. They were selected on the following criteria; Sabon Gari is one of the largest residential areas in Zaria and the

research aimed at comparing performance level in a converted building and a designed institutional building which led to the choice of schools with Top Spring School a residential building from the onset and First Baptist High School an institutional building from the onset. The study population included all students from the senior secondary section of both schools classes I and II (equivalent to grade 10 and 11 in USA). A total of 255 respondents participated with 105 from TSS and 140 from FBHS.

Research Instrument

For the success of this research the following instruments were used: questionnaire, interview, physical measurement and for statistical analysis the IBM software SPSS® V 21 and Microsoft Excel were used.

Questionnaire

Well-structured questionnaires were administered to collect data relating to what degree the spaces and design factors would influence student performance and the type of building the school was using. These were based on previous school based research in USA and Nigeria by (Peter and Yufan) and (Isaac and Masibau) respectively. 255 questionnaires were issued with all retrieved and 232 analyzed. The questionnaires consisted of both open and closed ended questions with four sections. Section A with socio-demographics of the participants. Section B the degree of influence of required spaces on students' performance. Section C the degree of influence of design factors on students' performance. Sections B and C were designed according to Likert scale. Finally Section D explored information on the type of building used for school purposes either institutional or residential.

The principals and selected students were interviewed to further solidify the results. Also physical measurements of spaces like classrooms were done to get a grasp of the sizes of the spaces within the schools.

Statistical Analysis

Data from completed questionnaire were analyzed using IBM Software SPSS® v. 21. For means and frequencies which were achieved by running analysis of variance (ANOVA). Microsoft Excel was used to input data in tubular and graphical format. For research question 1 first the percentages of level of influence of spaces on performance were graphically represented and the RMI for the category of spaces and design considerations were computed for instructional, recreational and facility spaces and naturalness, indiviualisation and level of stimulation respectively. The RMI was obtained as a ratio of the sum of actual agreement scores (ASS_{ac}) and maximum possible agreement score (AS_{max}) on a five point Likert scale that each respondent would give for each question. (Ibem, Opoko, Adeboye and Amole, 2013). Mathematically, this is expressed as:

$$RMI = \frac{\sum ASSac}{\sum ASmax}$$

For research question 2 first different means of the various categories of both spaces and design considerations were computed. Next a test for normality was done as the means were observed to be different then nonparametric test Kolmogrov-Smirnov tests were done which showed that the distribution was normal, poisson and uniform. Finally Friedman's ANOVA was employed to statistically test the hypothesis that all the distributions of means for each category are equal.

Result and Discussion

Result From Questionnaire Survey (Research Question 1)

Results from the survey reveals that both schools participated in the survey and age range for senior secondary school students is from 12-19 with a greater percentage of the students from

SS1 in both schools. It also reveals that there are more male than females and had more classes with over 35 students.

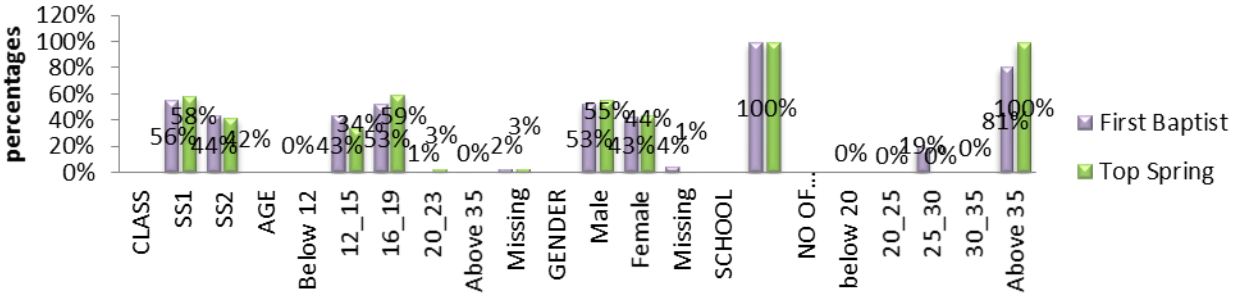

Fig 2: Demographics: Class, Age, Gender, School and Number of students

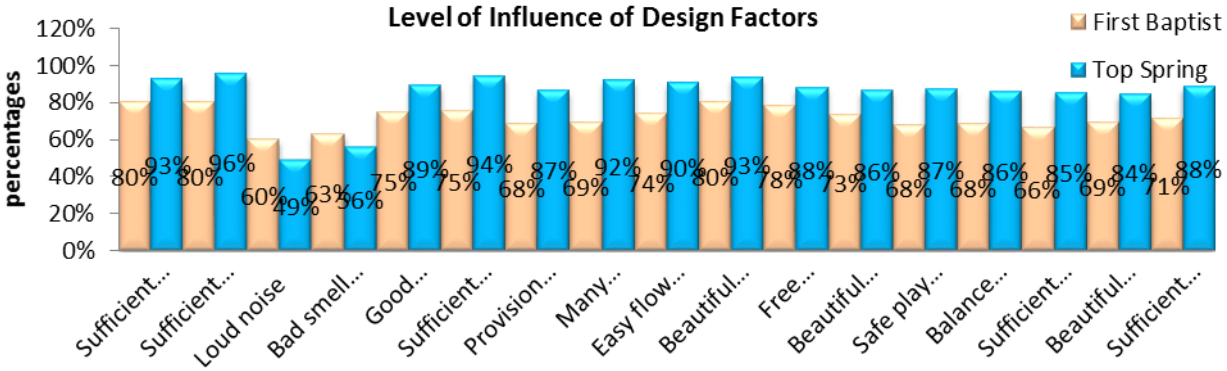

Fig 3: Influence of Design Principles on Academic Performance

Results from user perception on the influence of design principles on their academic performance as seen in Fig 3 shows that they attest to the influence of design considerations on their academic performance with more emphasis on indoor air quality, visual comfort, sufficient and ease of flow of spaces and aesthetics in the school environment as they ranked highest with fresh air having 96% and 80%, daylighting having 93% and 80%, sufficient space in class 94% and 75%, easy flow of building 90% and 74% and beautiful school appearance 93% and 80% for both schools. Results also show that the design consideration that would least affect their academic performance are noise and bad smell as they ranked least with loud noise having 60% and 49% and bad smell in school having 63% and 56%.

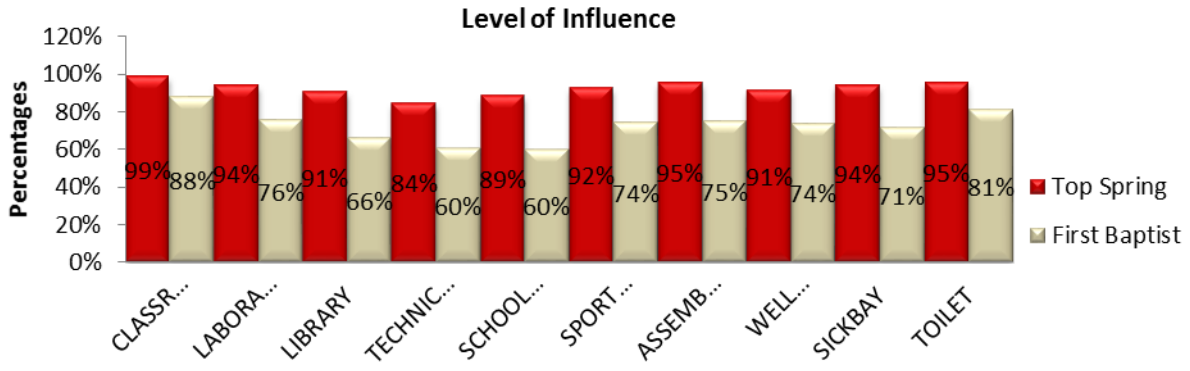

Fig 4 Influence of Spaces on Academic Performance

The results on the influence of available spaces on the academic performance of the respondents also shows that all the spaces will positively affect their academic performance with classroom having 99% and 88%, toilet 95% and 81%, assembly hall 95% and 75%, laboratory 94% and 76% and sickbay 94% and 71% ranking highest. The result also shows

that technical workshop with 84% and 60% will least affect their performance. This shows that due to the absence of some important spaces like technical workshop, library etc. the students did not know how important these are for their academic performance.

Table 1: RMI and ranking for categories of spaces from survey responses*

Spaces	Instructional spaces 1st					Recreational spaces 2nd			Facilities 3rd	
Question	1	2	3	4	5	6	7	8	9	10
$ASSac_{FB}$	597	514	448	410	408	505	507	500	486	549
RMI_Q1sf_{FB}	0.88	0.76	0.66	0.60	0.60	0.74	0.75	0.74	0.71	0.81
$ASSac_{TS}$	473	451	436	404	425	443	458	438	452	458
RMI_Q1sf_{TS}	0.99	0.94	0.91	0.84	0.89	0.92	0.95	0.91	0.94	0.95
$RMI^*_{FB,TS}$	3.496 , 4.561 **(1)**					2.224, 2.79 **(2)**			1.522, 1.896 **(3)**	

Table 2: RMI and ranking for categories of design principles from survey responses*

Design Factors	Naturalness 3rd					Individualization 1st						Level of Stimulation 2nd					
Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
$ASSac_{FB}$	547	544	409	428	508	512	464	468	503	546	531	496	461	465	452	469	483
RMI_Q1sf_{FB}	0.80	0.80	0.60	0.62	0.75	0.75	0.68	0.69	0.74	0.80	0.78	0.73	0.68	0.68	0.67	0.69	0.71
$ASSac_{TS}$	444	449	234	269	429	451	416	441	434	448	421	414	419	411	409	404	424
RMI_Q1sf_{TS}	0.93	0.96	0.49	0.56	0.89	0.94	0.87	0.92	0.90	0.93	0.88	0.86	0.87	0.86	0.85	0.84	0.88
$RMI^*_{FB,TS}$	3.581 , 3.895**(3)**					4.447 , 5.44**(1)**						4.156 , 4.837**(2)**					

The result above based on user responses reveals that, the category of spaces that would most influence their performance are instructional spaces such as: classrooms, library, laboratory etc. with RMI^* 3.496 and 4.561 followed by recreational spaces and then facilities. And the category of design principles that would most affect their academic performance are individualization such as sufficient space in class, easy flow of building, individual ownership of space etc. with RMI* 4.447 and 5.44 followed by level of stimulation and then naturalness. This depicts that both schools are relatively small and the students are overpopulated within small spaces it also shows the necessity for users to have a sense of privacy, safety and organization in their environment (Table 1 and 2). The need for proper design consideration and provision of adequate spaces in schools cannot be overemphasized as this rests on the shoulders of the design professionals such as architects, landscape architects etc. to ensure that the built environment supports its users.

Result From Statistical Analysis (Research Question 2)

From the statistical analysis below for space category the means are ranked with facilities with 4.17 as the space with the greatest influence recreational spaces with 4.14 and instructional spaces with 3.97 the least mean. And for the design factors category individualization ranked highest with 4.12 followed by level of stimulation with 3.87 and then naturalness with 3.71 as seen in Table 3. The mean result depicts that all the categories would influence performance as they are well above 3 the neutral level of influence.

Table 3 Ranking of variables (with means all above 3, the neutral level of influence)

Variables	Mean	Rank
Spaces: Facilities	4.17	1
Recreational	4.14	2
Instructional	3.97	3
Design Factors: Individualization	4.12	1
Level of stimulation	3.87	2
Naturalness	3.71	3

Due to the different in the means there was a need to run other tests to proof statistically that the variables above would affect the respondents performance. A Friedman test was carried

out and the result seen in Table 4 shows that there was no statistically significant difference between the mean ranks of both spaces and design factors suggesting that the variable would influence performance of the respondents with the Chi-Square value and degree of freedom (df) expressed as $X^2(9) = 200.471$ and significant level of difference $p = 0.000$. Further more Robust test of equality of means, ANOVA, Test of Homogeneity of Variance using Levene statistic, Friedman two way analysis of variance and Kolmogorov-Smirnov tests were all carried out they all confirmed that the means have no significant difference.

Table 4 Test Statistics [a]

N	213
Chi-Square	200.471
df	9
Asymp. Sig.	.000

a. Friedman Test

Table 5 (a): Independent Samples Test (Levene's Test and T-test)

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig.	Mean Difference
INSTRUCTIONAL SPACES	Equal variances assumed	77.994	.000	6.68	228	.000	1.098
	Equal variances not assumed			7.27	204.55	.000	1.098
RECREATIONAL SPACES	Equal variances assumed	62.320	.000	5.77	227	.000	.895
	Equal variances not assumed			6.37	206.25	.000	.895
FACILITIES	Equal variances assumed	60.67	.000	5.74	229	.000	.894
	Equal variances not assumed			6.34	207.55	.000	.894

Levene's test for equality of variances, Table 5: shows that the result was significant (F=77.994, 62.320, 60.67, p=0.000) for each space category. Results from the T test, confirmed means were not significantly different (N=232, t = 6.68, 5.77, 5.74, p=0.000).

Results from Interview and Physical measurements of spaces

From the interview with principals of both schools it was found that the spaces visibly present in the schools are as follows for First Baptist High School: conveniences, playground, laboratory, staffrooms and classrooms. While Top Spring School had: classrooms, staffrooms, playground and conveniences. About 15 students from both schools were interviewed on how their building has influenced their performance and their response was centered on factors that cause discomforts which were noise from the road and surrounding buildings, bad smell from homes and toilets, absence of important instructional, recreational and facility spaces like well-equipped library, laboratory, technical workshop etc. and thermal comfort. During the course of the survey measurements of the classrooms were taken for FBHS the classes were within the range of $18m^2$-$24m^2$ with 2.55 headroom housing 29- 41 students. For TSS the classes were two with $17m^2$ and $31m^2$ housing 50 and 63 students respectively. Furthermore, the classrooms especially in TSS appeared to be overcrowded (50–60 students per class) based on a Nigerian policy guideline an occupancy of ≤36 in six rows of six students in a floor area ≥19.4m with ≥2 m between the teacher and front row and have only one door.

DISCUSSION CONCLUSION AND AREAS OF FURTHER RESEARCH

The paper aimed at finding out if there is a relationship between school building typology and academic performance of students by engaging the students who are the major users and

beneficiaries of the institution. The major finding from this research is that students would study better and perform better once the conditions that would enhance comfort and serenity are provided. The above result revealed that both schools are operating at almost the same level relating to available spaces and infrastructure even though First Baptist High School was designed for school purposes and Top spring school was a residential building from the onset. It is also seen that availability of adequate and sufficient space is also a big problem as the classrooms were overpopulated in both schools. The result finally revealed that availability of spaces and proper design considering functionality, aesthetics, thermal, visual, acoustic comfort, indoor air quality, landscaping etc. all affect the users performance and should not be neglected in design. This therefore establishes a relationship between the building typology and academic performance of the students. It is important to note that change of use building is allowed but without proper considerations and the right authorities not consulted the building may be used in such a way that it affects it users negatively. Invariably this goes to say that with improperly designed school buildings and unsupervised changed use of building the expected level of comfort is likely to be the same which will not support the performance of users. It is therefore highly recommended that design professionals such as architects, landscape architects, planners etc. should pay closer attention to proper design of school buildings especially secondary schools as it has serious effects on the users' performance and authorities responsible for the permission to change the use of a building should be notified and advice given by the authorities adhered to. This research should be done on a larger scale as this was limited to two schools.

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User Perception of Comfort in Offices: A Case Study of Architecture and Quantity Surveying Departments, Ahmadu Bello University

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ABSTRACT

The concept of user comfort is very important to the office user. It affects the user's health and well being. Much work has been done in addressing the individual factors of comfort notably thermal comfort especially in residential buildings. Comparatively, little research exists addressing comfort in the new office structures of TETFund, using post occupancy evaluation, investigating how comfortable office users find offices. This study examines user comfort in offices by comparing office comfort levels through a survey of 36 staff of Architecture and Quantity Surveying Departments at Ahmadu Bello University, Zaria, Nigeria as well as physical surveys of both buildings. Questionnaire responses elicited information on how users felt about their office environment and what factors contributed to high comfort in offices of both departments. Results were analyzed using 〖IBM SPSS〗^® v. 21 and Microsoft Excel. Study results reveal that the ability of users to control the indoor environmental quality of their office is a strong variable in determining comfort in offices. Also, it was found out that offices in both departments are acoustically comfortable. However, user comfort overall is reduced by thermal comfort. This study recommends that policy makers, architects and other design professionals pay particular attention to the provision of more private (single user) spaces, building orientation and zoning away from public facilities, when designing future offices especially within academic environments.

Keywords: Comfort, User Perception, Offices, Post Occupancy Evaluation, ABU

INTRODUCTION

Each year, large funds are being spent on office structures in tertiary institutions. In 2014, the Tertiary Education Trust Fund (TETFund) allocated ₦912million to each public university in Nigeria up from ₦303million in 2010, ₦661million to public polytechnics in 2014 up from ₦180million in 2010 while public colleges of education received ₦581million in 2014 up from ₦157million in 2010. These figures were presented by the then Minister of Education, Mallam Ibrahim Shekarau at a public presentation, 'Consolidating the Transformation in the Education Sector: A Strategy – July, 2014 – May, 2015' (Oyedele, 2014). These figures tell that the Federal Government of Nigeria is in a bid to improving the standard of education in tertiary institutions and large funds are spent to erect new office structures and learning environments. However, there is little feedback, using post occupancy evaluation (POE), investigating how comfortable office users find these new offices.

According to research, office users not exempted, people spend up to 90% of their time indoors in the developed parts of the world (Klepeis, et al., 2001). Studies have also shown that conducive working environments impact on health and well being. When the conditions that make the working environment conducive or comfortable work are absent, the morale, productivity and performance of employees can deteriorate (Emuze, Mashili, & Botha, 2013). Office occupants, while carrying out tasks assigned to them, are often disrupted by the thermal, visual and acoustic conditions within the workplace (Simons, Koranteng, & Adinyira, 2014). Results include delay in undertaking tasks assigned to them, absenteeism, tardiness and complaints amongst others. In academic environments, the results mentioned above impact on academic performance. According to Ajayi, Awosusi, Arogundade, & Ekundayo (2011), lecturers absent themselves and rush lectures when exams are near and students complain of delay in exam results.

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Much work has been done in addressing the individual factors of comfort especially in residential buildings, these include; Acoustic comfort (Navai & Veitch, 2003), air quality (Wargocki, Wyon, Nielson, & Fanger, 2002), thermal comfort (Monteiro da Silva & Guedes de Almeida, 2010), visual comfort (Galasiu & Veitch, 2006). However, little research exists addressing comfort in the new office structures of TETFund, using POE, investigating how comfortable office users find their new offices.

This study aims to examine user comfort in offices based on user perception of indoor environmental conditions using offices of the Departments of Architecture and Quantity Surveying, ABU Zaria as case studies and thereafter, proffer solutions based on problems identified so that similar future buildings can be improved upon in terms of indoor environmental quality (IEQ). The study presents two research questions. First, is there any difference between user perceptions of comfort variables from the sample? Second, is there any difference between general comfort levels across the two departments?

This paper is outlined in 8 sections; abstract, introduction, literature review, methodology, results and discussion, conclusion, recommendations and references pertinent to the study.

LITERATURE REVIEW

User Comfort

Comfort is a very subjective topic. Abbaszadeh, Zagreus, Lehrer, & Huizenga (2006) suggest that comfort in the office is achieved through satisfaction of the indoor environmental quality. However, this research is restricted only to acoustic, thermal and visual comfort, indoor air quality and office cleanliness, as outlined by the Green Building Council of Australia (released as an innovative challenge in August, 2013).

Thermal Comfort

This is the condition of mind which expresses satisfaction with the thermal environment (ISO 7730, 1984). It means that an employee wearing a normal amount of clothing feels neither too cold nor too warm (Elaiab, 2014). An environment achieves reasonable thermal comfort when at least 80% of its occupants are thermally comfortable (Abodunrin, 2014). Indoor thermal comfort is affected by physical and environmental factors. Thermal comfort improves happiness and productivity, health and well-being and reduces the energy demands of a building (Autodesk Sustainability Workshop, 2011). One of the best ways of determining whether a group of people are comfortable is by asking them. The simple (seven-point) scale below is often used in laboratory experiments, to the integration of techniques into questionnaires for practical surveys as well as behavioural measures.

Table 1. Scales of Warmth Sensation. Source: (ASHRAE, 1966; Bedford, 1936)

Bedford comfort scale		ASHRAE sensation scale	
Much too warm	7	Hot	7
Too warm	6	Warm	6
Comfortably warm	5	Slightly warm	5
Comfortable	4	Neutral	4
Comfortably cool	3	Slightly cool	3
Too cool	2	Cool	2
Much too cool	1	Cold	1

Acoustic Comfort

Acoustic comfort means having the right level and quality of noise to use the space as intended (Autodesk Sustainability Workshop, 2011). Noise in office buildings could be as a result of too much noise outside the building or from adjacent spaces and lack of sound control in the space. Designers are obliged to design buildings that include acoustic materials, in order to minimise noise in the office and/or other building environments (Emuze, Mashili,

& Botha, 2013). Paradis (2014) states that acoustic comfort can be achieved by good site selection, proper glazing and sound masking. Also, the ABC rule (Absorb, Block & Cover) is a principal method used by acoustic professionals to achieve effective acoustics. Acoustic comfort increases concentration of the mind on work, reduces headaches and improves health and well-being.

Visual Comfort

Means ensuring that people have enough light for their activities, the light has the right quality and balance, and people have good views (Autodesk Sustainability Workshop, 2011). It can be associated to the absence of glare caused by the presence of excessive luminance in the field of view. Most design professionals fail to include lighting requirements at the initial stage, forgetting the fact that this oversight will affect productivity in the workplace if lighting requirements are not met (De Carli & De Giuli, 2009). According to Laforgue, Souyri, Fontoynont and Achard, Glare can be categorized into: The uncomfortable glare and the disturbing glare, both reduce visual performance. The availability of daylight is an important requirement, especially for office buildings. Poor quality of lighting in the workplace causes eyestrain, which leads to dizziness and stress. Occupants become disgruntled because of their dissatisfaction with the lights in the building, which will result in reduced productivity as occupants will start spending long periods away from work to consult a medical expert for treatment of their eyes and/or vision problems (Samani, 2011). Also, one of the main source of dissatisfaction in offices is lack of the physical connection with the outside: the contact with the natural environment is important because it brings dynamism to the indoor and a sense of relax for people (De Carli, De Giuli, & Zecchin, 2008).

Indoor air quality (IAQ)

IAQ deals with how well the indoor air satisfies the occupants of the building. Inadequate ventilation increases indoor pollutants by not allowing sufficient outdoor air to dilute the emissions from indoor sources (Emuze, Mashili, & Botha, 2013). Environmental Protection Agency (EPA) and others show that indoor environments sometimes can have levels of pollutants that are actually higher than levels found outside. These Pollutants increase the risk of illness, making people uncomfortable, unproductive, and unhappy. Fresh air helps people to be alert and productive. The factors that affect air quality in the indoor environment result from the interaction of the site, climate, building system, potential contaminant sources (e.g., furnishings, moisture sources, work processes/activities, and out- door pollutants), and building occupants (OAR, 1997). Also, these symptoms of poor IAQ may cause health problems such as irritations of the eyes, mental fatigue and headaches. Constant failure to regularly evaluate the building's performance leads to poor indoor environmental quality (IEQ), which may negatively affect the quality of life of the occupants, who will ultimately have to resort to medical treatment (Cho & Lee , 2010).

Office Cleaning

A comfortable office environment is a building or room in which workers can generate their work properly as it is clean (Parveen, Sohail, Naeem, Azhar, & Khan, 2012). Research has shown that there is indeed a direct connection between a clean and healthy work environment and worker productivity levels. The results of an unclean office include headaches, lethargy, eye, nose and throat problems. Dirt and dust in an office also pollute the air, this polluted air when inhaled by the office worker makes the worker vulnerable to respiratory problems. Also, the linkage of sick building syndrome to poor IAQ creates a more critical need for a clean indoor office environment (Wargocki, 2000).

Tertiary Education Trust Fund (TETFund)

The Tertiary Education Trust Fund (TETFUND) was established by an Act of the National Assembly in June 2011 which replaced the Education Tax Fund Act Cap. E4 laws of the Federation of Nigeria 2004 and Education Tax Fund (Amendment) Act No 17, 2003. The Fund was set up to administer and disburse education tax collections to the Federal and State tertiary educational institutions in Nigeria. The main source of income available to the Fund is the 2% education tax paid from the assessable profit of companies registered in Nigeria. The levies are collected by the Federal Inland Revenue Service (FIRS) (TETFUND, 2014). TETFund intervenes through: provision of essential physical infrastructure for teaching and learning, provision of Instructional materials and equipment, research, book evelopment and publication, academic staff training and development, and any other need, which in the opinion of the Board of Trustees is critical and essential for the improvement of quality and maintenance of standards in the educational institutions.

The Board of Trustees (BOT) of the Fund is statutorily charged with the responsibility of administering, managing and disbursements of these funds to beneficiaries in the public tertiary educational institutions under established guidelines (TETFUND, 2014).

TETFund Interventions Categories can be categorized as follows:

i. normal (Regular) Interventions
ii. special intervention
iii. special high impact intervention

The Normal Intervention is yearly for all beneficiaries of TETFund. The Special Intervention is usually at the discretion of the Board of Trustees. The Special High Impact Intervention however seeks to massively inject funds into selected tertiary institutions to achieve a major turnaround through programme upgrade and improvement in the teaching and learning environment. (TETFUND, 2014)

Table 2. Performance Of Beneficiaries In Access To Funds For Normal Intervention Projects; 2007-2011. Source: (Abu, 2012)

Sector	Total Allocation	Total Disbursement	% Access	Balance Outstanding
Universities	34,577,700,000.00	11,551,508,000.00	33.41%	23,023,192,000.00
Polytechnics	20,136,660,000.00	7,656,511,400.00	38.2%	12,480,148,600.00
Colleges of Education	21,132,860,000.00	8,481,841,100.00	40.14%	12,651,018,900.00

Post Occupancy Evaluation (POE)

POE is a general term for a broad range of activities aimed at understanding how buildings perform once they are built, and the level of satisfaction of building users with the environment thus created (Hewitt, Higgins, Heatherly, & Turner, 2005). POE is vital, as it reminds corporate executives of the needs of employees that affect their productivity (Kooymans & Haylock, 2006), such needs are not limited to privacy, lighting, storage and thermal comfort. Providing feedback through POE can also assist the organisation when new ideas and knowledge are put forward for continuous improvement purposes (Lackney & Zajfen, 2005). A POE study conducted at the new location of a 174-person Architectural firm in Boston, USA by Sheply, Zimmerman, & Boggess, (2009) revealed that occupants were more satisfied with a new building when compared with an older building, although concerns were raised about the impact on indoor air quality, thermal comfort, lighting, noise and office layout. POE therefore is an evaluation tool that is perceived as a subprocess of building performance evaluation and can be defined as the act of evaluating buildings in a systematic manner after they have been built and occupied for some time (Preiser & Vischer, 2005). The benefits of POE include; Identification of and finding solutions to problems in buildings,

response to user needs, improved space utilisation based on feedback from use, understanding of implications on buildings of change whether it is budget cuts or working context, Informed decision making. There however seems to be a gap or lacking of literature as it concerns POE studies of TETFund buildings in Nigerian tertiary institutions.

METHODOLOGY

Case Study

Two buildings were selected for this research; the Departments of Architecture and Quantity Surveying (Q/S), ABU Zaria. Both are multi-use buildings with functional office spaces spread across all floors. Also, one aim was to compare comfort levels in both departments, the criteria was to select a building that was recently built through TETFund intervention (Q/S) and an old building (Architecture). The Dept. of Architecture building has 3 floors and a pent floor with 32 office spaces that spread across the entire building while the Dept. of Q/S building has 3 floors with 26 office spaces also spreading across the entire building. From a visual survey, it is noted that there is a conscious effort to make offices comfortable, buildings are oriented in the north/south direction, use of shading devices, use of a courtyard (Q/S), zoning of offices away from noise sources, use of mechanical cooling units, window blinds, and furniture arrangement.

Plate 1: Dept. of Architecture

Plate 2: Dept. of Quantity Surveying

Questionnaire Survey

Use of Questionnaires for this research was influenced by literature, POE studies seen in literature review that made use of questionnaires, physically issued to individuals generated great feedback. These include POE studies by Emuze, Mashili, & Botha (2013) and Sheply, Zimmerman, & Boggess (2009). Questionnaires were therefore issued to staff of both Departments and were retrieved over a period of one week. A total of 47 questionnaires were distributed, 36 (77%) were retrieved and analyzed. Confidentiality & honesty was enhanced by keeping participants anonymous throughout the study. Questionnaire responses elicited information on how users felt about their office environment and was designed in 5 sections;

Section 1 with demographics (providing information on age, gender, work description etc.), section 2 was designed according to the Likert scale to help evaluate satisfaction with the buildings IEQ. It addressed IEQ in the selected buildings with respect to whether the air in the building was fresh, stale, and stuffy or had any odour, control of ventilation, temperature, noise, artificial lighting and the rate of air circulation. Section 3 questions demanded a yes or no answer, they provided information on whether occupants offices had certain features that contributed to comfort of their offices including artificial lights and artificial means of cooling/heating. Section 4 was based on the ASHRAE comfort scale (see Table 1.) and section 5 was designed to provide information on work interruption and office cleanliness.

Data Analysis and Presentation

Data was analyzed using IBM SPSS® v. 21. This software addresses the analytical process in conducting a research, from planning, to data collection to analysis and reporting. Numerical data obtained from questionnaires was analyzed using frequencies and means which was achieved by running the Analysis of Variance (ANOVA).

Research question 1, Methodology/steps:

i. First, different means of the five variables were computed i.e. acoustic, thermal & visual comfort, indoor air quality and office cleanliness. We observe from the descriptive summaries that means are different.
ii. To test whether distributions were significantly normal or not, we tested for normality (Table 3) considering the sample was generally small (less than 50).
iii. Table 3 Kolmogorov-Smirnov and Shapiro-Wilk tests suggestted non normal distributions for all variables except acoustic comfort (values less than 0.05, highlighted). Because we were testing the hypothesis that there were no significant differences between the distributions of all means, it was safe to assume non normal distributions. We therefore employed non parametric tests/ANOVA. The QQ plots confirmed the dots did not all fall on the line for all the variables (if they did, the distributions would be considered normal).

Table 3: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Thermal Comfort	.177	33	.010	.881	33	.002
Acoustic comfort	.139	33	.105	.965	33	.361
Visual comfort	.163	33	.026	.941	33	.075
Cleanliness	.232	33	.000	.922	33	.021
Indoor Air Quality	.196	33	.002	.940	33	.067

iv. Because the distributions were non-normal, we employed Related samples Friedman's ANOVA to statistically test the hypothesis that all the distribution of means for the 5 variables were equal. The test confirmed that means were significantly different (N=33, dof=4, p=0.023 which is less than 0.05)

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distributions of THERMAL COMFORT INTERFERENCE, Acoustic comfort, Visual comfort, Cleanliness and Indoor Air Quality are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.023	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 1: Hypothesis Test Summary

Research question 2, Methodology/steps:

i. We computed means for the variable "Satisfaction with general Comfort (SC)" using responses from the two departments, Architecture and QS (Table 4). Analysis confirmed $Arch_M$=2.74, QS_M=3.57
ii. To test whether these were significantly different, we employed the independent samples T-Test in two ways
iii. Levene's test for equality of variances (Table 5a/5b): this was non-significant (F=0.402, p=0.531 as p was greater than 0.05). So we made use of the T test results equal variances assumed from Table 5a-c
iv. Results from the T test confirmed that means were significantly different (N=33, t=-2.226, p=0.033, less than 0.05) see last column Table 5b, Table 5c all figures in green text.
v. We then concluded that satisfaction with general comfort was significantly higher based on perceptions from QS users than from users in Architecture.

Table 4: Group Statistics

	Department	N	Mean	Std. Deviation	Std. Error Mean
Satisfaction with general comfort	Architecture	19	2.74	.991	.227
	QS	14	3.57	1.158	.309

Table 5a: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Satisfaction with general comfort	Equal variances assumed	.402	.531	-2.226
	Equal variances not assumed			-2.173

Table 5b: Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Satisfaction with general comfort	Equal variances assumed	31	.033	-.835
	Equal variances not assumed	25.467	.039	-.835

Table 5c: Independent Samples Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
SATISFACTION WITH GENERAL COMFORT	Equal variances assumed	.375	-1.599	-.070
	Equal variances not assumed	.384	-1.625	-.044

RESLUTS AND DISCCUSSION

Results from the Survey Questionnaires: Research Question 1

Results from questionnaires show that based on user perception, staff in both departments had more satisfaction with acoustic comfort and less satisfaction with thermal comfort. The reasons are because more offices belonging to academic staff were located on the last floor of

both buildings, this means academic staff do quiet focused work in their offices, because there are less noise interruptions from people walking, interacting or carrying out other activities on other floors. Also, presence of window blinds in offices of Q/S contribute to acoustic comfort, and in Architecture Dept., large trees, planted around the building act as noise buffers. Next, office cleanliness is ranked second because more staff acknowledge that their offices are cleaned by workers on a weekly basis (on the average) all through the year. However, a few staff complained that their offices were never cleaned (Architecture Dept.). Indoor air quality and visual comfort have the same ranking (third), reasons why indoor air quality is ranked third include; offices within the buildings of both departments are zoned away from public facilities (student toilets), as a result, more staff report clean air in their offices. Also, ceiling fans provided in the Architecture department and stack ventilation, aid movement of air so that there is no stale/stuffy air in offices. Although trees planted around the Dept. of Architecture contribute a great deal to acoustic comfort, they however, disturb visual comfort, connection with the exterior space is important, these tress prevent office users from getting good views of the exterior space and also buffer against daylight coming into the office space. The courtyard system employed in the Q/S Dept. building hinders good views, as well interior offices on the ground floor are not well lit because of obstruction of daylight by other spaces built above. Questionnaire responses noted users are not affected by glare in both departments. Thermal comfort is ranked the least although offices are well oriented, with shading devices and mechanical cooling systems, more staff have little control over thermal comfort, and this is because there are shared offices so while a user would want a mechanical cooling unit on, the other user might not and the office becomes uncomfortable for that user.

Table 6: Ranking of variables (with means all below 3, the neutral mark for satisfaction)

Variable	Mean	Rank
Acoustic Comfort	2.91	1
Office Cleanliness	2.83	2
Indoor Air Quality	2.64	3
Visual Comfort	2.64	3
Thermal Comfort	2.55	4

Results from the Survey Questionnaires: Research Question 2

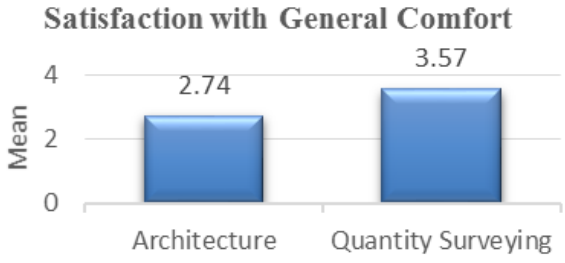

Figure 2: Satisfaction with general comfort

According to figure 2 above, staff of the Dept. of Q/S have more comfortable offices than staff of Architecture Department. This is true, staff have more control over comfort conditions in Q/S than in Architecture because they have more single user offices. The building is properly oriented in the north/south direction, staff report daily and weekly cleaning of offices, good daylighting, less noise interruptions. More staff report clean air in offices. This is unlike the Dept. of Architecture where staff complain of stale/stuffy air,

obstructed views, no consistent cleaning and more shared offices in this department means less control over indoor comfort conditions.

Discussion on Findings

One major finding is that the ability of users to control the indoor environmental quality of their office is a strong variable in determining comfort in offices. This is one reason why more staff prefer the private (single user) offices because they are able to control the conditions that make their offices comfortable, unlike the shared office where there is less control over comfort conditions e.g. one/more staff in a shared office might prefer to work with artificial lights switched on while the other staff might not. Also, it's seen that user comfort is affected by the five variables but to different degrees. While more acoustic comfort has been achieved, users are not thermally comfortable.

CONCLUSIONS

Comfort in the office is important for better work and productivity and there are factors that interfere with work when offices are not comfortable for users. Architects play an important role in making sure offices are comfortable for users. The extent to how comfortable an office is can be determined by the Architect by considering those factors that cause discomfort in offices. If offices are designed to provide good indoor air quality, satisfy thermal, visual, and acoustic comfort, and cleanliness, then to a large extent, they become comfortable for work. The factors that contribute to high comfort conditions in offices (in the Depts. of Architecture and Q/S) include; Ability of office users to control the indoor environmental quality of their office, building orientation, presence of window blinds, shading devices, trees used as sound buffers, window openings, location of offices (zoning). Also, it was confirmed that the TETFund building selected for this research was more conducive to work in. It satisfied the IEQ requirements of its users with less employee complaints. However, better offices can be provided if future TETFund projects improve on IEQ requirements of users through post occupancy evaluation.

RECOMMENDATIONS

Offices should be cleaned more frequently and effort should be made to improve thermal comfort. Comfort and environmental friendliness should be the focus when constructing future office buildings making sure to meet the IEQ requirements of users. Architects and other design professionals should take into consideration the following at the planning phase; building orientation, trees and plants improves the IEQ, room should be given for more private (single user) offices, offices should be zoned away from public toilets, offices should be located on upper floors in storey buildings where work interruption is not needed. Also, Managements should endeavor to carry out POE of their buildings and further research on a larger scale on user comfort in Nigerian offices should be carried out to provide feedback that will improve Nigerian offices and add to knowledge.

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Assessment of the Relatedness of Quantity Surveyor's Skill Requirements for Diversification of Practice Firms in Nigeria

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ABSTRACT

The coherence of a firm in terms of the relatedness of its activities is often considered an important performance factor to exploit competence and explore new technologies and markets to gain competitive advantage. However, the competitive advantage of firms is crucially dependent on the capabilities of the workforce and specific to the job of an individual while the revolution of ICT and innovative construction disciplines has caused a serious mismatch of skill requirements for professional service delivery. Therefore, this paper focuses on measuring the relatedness of quantity surveyors' skill requirements for diversification of professional services. The paper adopted questionnaire survey on the population of registered quantity surveying firms (principal partners) that have diversified their practices using snowball sampling technique. The questionnaire was structured on the rubrics of quantity surveyor's skill requirements for diversification and relatedness of skill areas to future growth. The data collected were analysed using Dendrogram of data cluster analysis and Pearson correlation to establish the relatedness of skill areas. This paper showed that quantity surveying firms in Nigeria diversified in the areas of arbitration and other dispute resolution; project management and other business development related to core competence and concluded that business opportunities abound in the areas of taxation, insolvency, valuation, insurance and property investment. This paper recommendsthat principal partners should encourage professionals to diversify in these marketable areas of optional competence for quantity surveyors to ensure business sustainability.

Keywords: Competence, diversification, quantity surveying firm, relatedness, skill requirements, Nigeria

INTRODUCTION

Growing the business of professional service firms required serving more clients/customers with a wider array of services, thereby broadening the scope of the business. This implies learning about new technologies, markets and customers that borders on the challenge of measuring diversification in services; not only in terms of scope of these firms but also the relatedness or unrelatedness of service diversification. Corroborating this submission, Shahin *et al* (2014) noted that advanced technology, fast transportation, convenient communications, effective knowledge transfer, integrated markets and trade liberalization has made professional service firms to have grown in scope and scale. They have diversified vertically and horizontally into a wide range of professional services. Thus, firms can exploit the latent capacity of their employees to work in related industries by diversifying to activities that are related to the firm's current activities. Neffke and Henning (2012) submitted that relatedness is a key notion in corporate strategy. The coherence of a firm in terms of the relatedness of its activities is often considered an important factor in its long-term performance. To be successful, firms, on the one hand, need to exploit their core competence, while on the other hand, they must explore new technologies and markets as well as adapt their production to new economic conditions. The tension that exists between exploiting core competence and exploring new technologies can be overcome by developing new activities that are related to a firm's core activities, thus combining both exploration and exploitation.

Studies abound in the literature that highlighted and described core competency of quantity surveyors (Dada and Jabgoro, 2012; Perera *et al*, 2011 and Oyediran, 2011;). However, Boyatzis (2009) described competence as the sum of experience, knowledge, skills, values

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and personal qualities of a professional during lifetime while RICS (2005) categorized competence standard of quantity surveyors into three as basic; core and optional competence with optional competencies as areas of future diversification of professional quantity surveyor. Therefore, this paper focuses on measuring the relatedness of quantity surveyors' skill requirements for diversification into areas of optional competencies.

LITERATURE REVIEW

Firm's Diversification

Industries are often depicted as a groups of firms that compete among each other for a greater share of the same market. However, large firms seldom operate only on a single market; as innovations developed in one industry often find its ways into the products and processes of other industries. Hence, interconnected industries form geographically collocated clusters, and many firms switch industries at some point in their career development (Olivier and Root, 2014). This suggests that the boundaries of an industry are permeable especially in terms of technological innovations. This view was corroborated by Talli and Dovev (2013) that the consequence of the porous nature of inter-industry boundaries, diversification is an important phenomenon in a range of economic entities. Firms diversify into new industries to expand their product ranges or to engage in higher margin activities. Thus, a diversification strategy should focus on identifying new activities that require resources that a firm already possesses but that are currently underleveraged. Stefan and Dodo (2013) noted that diversification strategies are used to expand firms' operations by adding markets, products, services, or stages of production to the existing business.

The purpose of diversification is to allow the company to enter lines of business that are different from current operations. When the new venture is strategically related to the existing lines of business, it is called concentric diversification while conglomerate diversification occurs when there is no common thread of strategic fit or relationship between the new and old lines of business; the new and old businesses are unrelated (Talli and Dovev, 2013). These were separately described by Olivier and Root (2014) as internal and external diversification. Diversification strategies can also be classified by the direction of the diversification. Vertical diversification occurs when firms undertake operations at different stages of production. Involvement in the different stages of production can be developed inside the firm (internal diversification) or by acquiring another firm (external diversification). Horizontal diversification involves the firm moving into operations at the same stage of production. Vertical diversification is usually related to existing operations and would be considered concentric diversification while horizontal diversification can be either a concentric or a conglomerate form of diversification (Olivier and Root, 2014).

Skill Relatedness

Qian *et al* (2010) noted that human capital and skills are the prime resources in modern economies while the competitive advantage of firms crucially depends on the capabilities of the workforce. This human capital is often specific to the job of an individual. When changing jobs, an employee often has to accept that a significant part of his or her acquired skills will become obsolete. However, such destruction of human capital can be limited by moving to related industries. Neffke and Henning (2012) proposed the concept of skill-relatedness to measure the degree to which sets of industries have similar human capital requirements. The skill-relatedness among industries is inferred from cross-industry labour flows, relying on the fact that employee are likely to switch to jobs in industries that value their previously acquired work-related skills to avoid rendering large parts of their human capital redundant.

The study of Neffke and Henning (2012) differentiated among three types of relatedness measures. The first type measures relatedness as the distance between the industry codes within the hierarchical structure of the industry classification system. The second type of measures, co-occurrence or outcome-based relatedness measures, assumes that the composition of industrial portfolios of productive units (e.g., firms, plants, or even countries or regions) reflect economies of scope. The third type, resource- or input-based indicators, directly investigates the similarities of industries in terms of their resource use. This paper focus on resource-based view of the firm with emphasis on human capital. An important antecedent to the resource-based view (RBV) literature is Penrose (1959). The study argued that firms possess resources from which they derive services that the firms use in their productive processes and has incentive to grow as long as some of its resources are left idle in its current activities. However, firm's resources can often provide different services, and the amount and quality of these services grow as the firm gains more knowledge about them through learning-by-doing. This view were corroborated by Gathman and Schoenberg (2010) and Nedelkoska and Neffke (2010) that human resources is strongly specific to the tasks that are carried out. As a consequence, individuals who change jobs risk rendering part of their human capital redundant. In order to limit this kind of human capital destruction, individuals will switch to jobs in industries that value the same kind of skills as their previous employer. Summarily, individuals will predominantly switch jobs between industries that are skill-related.

Quantity Surveying Professional Services

Oyediran (2011) emphasized the importance of quantity surveyors as members of the design and construction teams in both private and public sectors of a nation. Their pivotal roles in construction project development and delivery are well acknowledged by literature while Ajanlekoko (2012) described quantity surveying as the amalgamation of several other disciplines such as law, accountancy, business management, information management and construction technology within the unique context of the built environment. However, Phoya and Kikwasi (2008) noted that in the course of reviewing the development of quantity surveying that there has been a shift in the emphasis from cost to value with many quantity surveying firms expanding the horizons of services offered. Quantity surveyors are becoming increasingly involved in project management, value engineering, risk and facilities management, life cycle costing among other new innovations. Also, in the United Kingdom, some quantity surveying firms carry out insolvency and corporate restructuring, survey on hazardous materials and environmental audit; but in Nigeria; the growth rate from the traditional core competence areas to new directions is steady and slow. This view was corroborated by Ajanlekoko (2012) that quantity surveying practice is still in the mainstream areas in Nigeria.

Professional service firms are noted to play a key role in the knowledge economy by acting as sources of new knowledge for client and by mastering the intricate process of both producing and using knowledge (Qian *et al*, 2010). Yet, the reasons why certain professional service firms turn out to be more successful than others remain poorly understood. Traditionally, professional service firms have been defined as human capital-intensive activities; indeed, the success of developing and delivering customized services to clients is directly linked with the skills of firm employees. Hence, Babalola (2009) considered the uniqueness of services offered by quantity surveying firms in the areas of financial probity in the execution of construction projects and noted that the major concern of the client is for the project to be completed to cost, quality and schedule. However, it has been observed that it is not all executed projects that the clients are satisfied. This dissatisfaction brings to focus the quality of services rendered by construction professionals. Phoya and Kikwasi (2008) corroborated

that the demand for quality, accountability and efficacy of professional services has highlighted the need for quantity surveyors to demonstrate that they are keeping abreast of new knowledge, techniques and developments related to their professions while the proliferation of knowledge in the construction sector, combined with the impact of technology in the workplace, means that construction professionals must maintain the currency of their qualifications by learning about such advances and developments. This will enable the service firm to identify sources of quality, discover quality problem and offer possible courses of action.

Quantity Surveyor's Competence Standard

Nuran *et al* (2010) noted that with the growing levels of competition across industries, competence is increasingly viewed as crucial for businesses to maintain long-term competitive advantage. The study opined that the notion of competence is rooted in the resource-based view, dynamic capability and knowledge-based theories. The development of a resource-based view provides a clearer understanding of when resources and capabilities are likely to have positive effects on new product outcomes and developing and maintaining competitive advantage. The dynamic capabilities view underlines that competence need to change over time to respond to changing environment while the knowledge-based view suggest that organizations can play a critical role in articulating and applying different types of knowledge through transfer or replication as well as integration and coordination efforts to attain competitive advantage. Therefore, Madter *et al* (2012) suggested a meta-list competency model that described the functional dimensions of professional competence as cognitive function (acquiring and using knowledge to solve real-life problems); integrative function (using professional reasoning); relational function (communicating effectively with clients and colleagues); affective/moral function (the willingness, patience and emotional awareness to use skills judiciously and humanely); and habits of mind.

Table 1: Competency Required of Professional Quantity Surveyors

Basic competence	Core competence	Optional competence
Personal and interpersonal skills	Construction contract practice	Arbitration and other dispute resolution procedure
Business skills	Construction technology and environmental services	Development appraisal
Data management and information technology	Economics of construction	Facility management
Professional practice	Procurement and financial management	Insolvency
Law		Insurance
Measurement		Project management
Mapping		Property investment funding
		Research methodologies and techniques
		Valuation
		Taxation allowance and grant

Source: RICS (2005)

The definition of competence has been widely discussed in literature (Boyatis, 2009; Dada and Jagboro, 2012). These studies described competence as the demonstration of an integration of knowledge, skill, personal attributes and value orientation. However, a justification for the competencies required of quantity surveyors is the ability of that quantity surveyor to meet differing and changing client's needs and; to expand the horizon of market for quantity surveying services depends on the knowledge base of the profession. Studies have identified Quantity Surveyors are key professionals in the construction industry that are involved in cost planning, cost management, project procurement, contract administration, feasibility studies and financial management of any developmental project. This wide array of responsibilities means that they have to be educated, trained, and highly skilled in diverse

subjects. Hence, RICS (2005) categorised competence of a professional quantity surveyor on three bases as follows:

Inference from the three categories of competency implied that basic competence are applicable to all professionals in the built environment; core competence are peculiar to professional quantity surveyors while optional competence are areas of future diversification and further development for professional quantity surveyors. Therefore, this paper focuses on measuring the relatedness of quantity surveyors' skill requirements for diversification of professional services.

Table 2: Membership of Allied Professional Bodies

Allied Professional Bodies	Category of Membership	Frequency	Percentage	Cumulative	Aggregate Cumulative Percentage of Membership
Nigerian Institute of Construction Arbitrators	Not Affiliated	46	69.70	69.70	
	Member	20	30.30	100.00	30.30
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Nigerian Institute of Building	Not affiliated	55	83.33	83.33	
	Member	10	15.15	98.48	16.67
	Fellow	1	1.52	100.00	
	Total	66	100.00		
Nigerian Institute of Estate Valuers	Not affiliated	62	93.94	93.94	
	Member	4	6.06	100.00	6.06
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Nigerian Institute of Project Managers	Not affiliated	62	93.94	93.94	
	Member	4	6.06	100.00	6.06
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Nigeria Bar Association	Not affiliated	62	93.94	93.94	
	Member	4	6.06	100.00	6.06
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Nigerian Institute of Town Planners	Not affiliated	63	95.45	95.45	
	Member	3	4.55	100.00	4.55
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Nigerian Institute of Facility Managers	Not affiliated	63	95.45	95.45	
	Member	3	4.55	100.00	4.55
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Nigerian Institute of Auditors	Not affiliated	63	95.45	95.45	
	Member	3	4.55	100.00	4.55
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Others (Foreign Professional Bodies)	Not affiliated	63	95.45	95.45	
	Member	3	4.55	100.00	4.55
	Fellow	0	0.00	100.00	
	Total	66	100.00		
Nigerian Society of Engineers	Not affiliated	65	98.48		
	Member	1	1.52		1.52
	Fellow	0	0.00		
	Total	66	100.00		

RESEARCH METHODOLOGY

The paper adopted questionnaire survey on the population of diversified registered quantity surveying firms (principal partners) in Nigeria using purposeful snowball sampling. The

questionnaire was structured on the rubrics of quantity surveyor's skill requirements for diversification and relatedness of skill areas to future growth. This entailed coding the identified eighteen skills requirement of optional competencies. A total of eighty quantity surveying firms were surveyed using structured questionnaire out of which sixty-six were returned representing 82.5 % response rate that is above the usual rate of 20 - 30% for questionnaire survey in construction management studies (Kline, 1994). The data collected were analysed using percentile and Dendrogram of data cluster analysis to establish the relatedness of skills necessary for diversification of quantity surveyor's services.

Table 3: Areas of Business Diversification

S / N	Business areas	Frequency	Percentage
1.	Project management	20	25.64
2.	Other Business development	16	20.51
3.	Facility management	14	17.95
4.	Arbitration and other dispute resolution	10	12.82
5.	Valuation	8	10.26
6.	Property development appraisal	4	5.13
7.	Property investment	4	5.13
8.	Insurance	2	2.56
9.	Taxation	-	-
10.	Insolvency	-	-
	Total	**78**	**100.00**

Data Presentation and Analysis

Table 2 indicates areas where principal partners have acquired additional skills and competence. This shows that 30.30% and 16.67% are members of Nigerian Institute of Construction Arbitrators and Nigerian Institute of Building respectively. Also, 6.06% are members of Nigerian Institute of Estate Valuers; Nigerian Institute of Project Managers and Nigerian Bar Association respectively while 4.55% are members of Nigerian Institute of Town Planners; Nigerian Institute of Facility Managers; Nigerian Institute of Auditors and foreign professional bodies respectively. This also indicated that 1.52% are members of Nigerian Society of Engineers. However, it is noted that among the respondents, none are members of the Nigerian Institute of Architects and Institute of Chartered Accountants of Nigeria.

Table 3 shows the areas of business diversification by quantity surveying firms. This revealed that 25.64%; 20.51% and 17.95% have diversified into project management; other business development and facility management respectively while opportunities in business area of insurance; insolvency and taxation has not been explored.

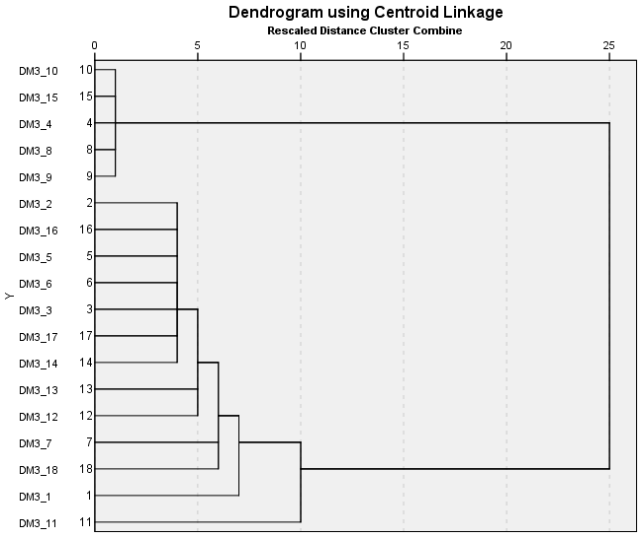

Figure 1: Dendrogram of Multiple Hierarchical Skill Clustering

Table 4: Agglomeration Schedule of Multiple Skill Clustering

Stage	Cluster Combined		Squared Euclidean Distance Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	10 (Organisational learning)	15 (Taxation)	0.000	0	0	2
2	4 (Compliance issues)	10 (Organisational learning)	0.000	0	1	4
3	8 (Insolvency)	9 (Insurance)	0.000	0	0	4
4	4 (Compliance issues)	8 (Insolvency)	0.000	2	3	17
5	2 (Auditing	16(Quality assurance)	1.360	0	0	7
6	5 (Cost information database)	6 (Development Appraisal)	1.694	0	0	7
7	2 (Auditing)	5 (Cost information database)	1.334	5	6	8
8	2 (Auditing)	3 (Business management)	1.525	7	0	9
9	2 (Auditing)	17 (Technical due diligence)	1.589	8	0	10
10	2 (Auditing)	14 (Research and development)	1.437	9	0	11
11	2 (Auditing)	13(Property investment funding)	1.855	10	0	12
12	2 (Auditing)	12(Risk management)	1.854	11	0	13
13	2 (Auditing)	7 (Facility management)	2.249	12	0	14
14	2 (Auditing)	18 (Valuation)	2.378	13	0	15
15	1 (Arbitration)	2 (Auditing)	3.002	0	14	16
16	1 (Arbitration)	11 (Project management)	4.108	15	0	17
17	1 (Arbitration)	4 (Compliance issues)	10.986	16	4	0

Table 4 shows the skills requirement for diversification in areas of optional competencies for quantity surveyors through the use of agglomeration schedule of cluster analysis while Figure 1 indicated seven levels of hierarchy of skill groupings or relatedness. This was further interpreted by Dendrogram grouping in terms of skills requirement necessary for diversification under each hierarchical groupings as shown in Table 5.

Discussion of Results

Table 2 shows that a high majority of the respondents (95.46%) have diversified skills to supplement their competence as a professional quantity surveyor. This finding corroborated the recommendation of Perera *et al* (2011) that commercial quantity surveying is necessary for corporate sustainability. Table 3 shows quantity surveying firms have diversified into project management; other business development and facility management respectively while opportunities in business area of insurance; insolvency and taxation has not been explored. This new business/service area are in conformity with the findings of Jewell *et al* (2014) as required to minimize the risk of over reliance in a single domestic market with a cyclical and fluctuating demand. The Centroid linkage of Dendrogram in Figure 1 reveals seven different levels of relatedness among the eighteen skills requirement of optional competencies of quantity surveyors. This implied that Valuation (18) is related to Compliance issues (4); Project management (11) is related to Facility management (7). Also, Arbitration (1) is related to Risk management (12); Compliance issues (18) is related to Research & development (14) and Risk management is related to Business management (3). This implied

that quantity surveying firms need to explore these new marketable areas where relatedness of service provision could lead to competitive advantage and business growth. This finding is in tandem with Stefan and Dodo (2013) that diversification strategies are used to expand firms' operations by adding markets, products, services, or stages of production to the existing business.

Table 5: Interpretation of Dendrogram Skills Cluster

S/N	Skills Requirement	Hierarchical Level	Dendrogram Grouping	Interpretation of Relationship
1.	Organisational learning (10); Taxation (15); Compliance issues (4); Insolvency (8) and Insurance (9)	1	Compliance issues	Compliance issues is related to Valuation
2.	Auditing (2); Quality assurance (16); Cost information database (5); Development appraisal (6); Business management (3); Technical due diligence (17) and Research & Development (14).	4	Business management	Business management is related to Compliance issues
3.	Business management (3); Technical due diligence (17); Research & development (14); Property investment funding (13) and Risk management (12).	5	Research & development	Research & development is related to Business management
4.	Research & development (14); Property investment funding (13); Risk management (12); Facility management (7) and Valuation (18).	6	Risk management	Risk management is related to Research & development
5.	Risk management (12); Facility management (7); Valuation (18) and Arbitration (1).	7	Facility management	Facility management is related to Risk management
6.	Facility management (7); Valuation (18); Arbitration (1) and Project management (11).	10	Project management	Project management is related to Facility management
7.	Valuation (18) and Compliance issues (4)	25	Valuation	Valuation is related to Compliance issues

CONCLUSION

The future challenges and opportunities facing the professional service firms have been hinged on cutting-edge services which is flexible, innovative and internationally focused. Quantity surveying service firms in Nigeria had to cope with irregular businesses thereby necessitating diversification in the area of arbitration and other dispute resolution; project management and other business development such as such as supplies and business ventures to sustain the firm. Hence, this paper concluded that business opportunities abound in the areas of taxation; insolvency; valuation; insurance and property investment. It is therefore recommended that principal partners should encourage professionals to diversify in these marketable areas of optional competence for quantity surveyors to ensure business growth and sustainability.

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Assessing the CAD Proficiency Level of Architecture Graduates in Selected Architectural Firms in Akure, Nigeria

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ABSTRACT

The level of Computer Aided Design (CAD) proficiency of graduate architects in architectural firms needs critical assessment. The reason is because many schools of Architecture in Nigeria produce graduates with little or no skills in CAD. This paper assessed the CAD proficiency level of graduates in selected Architectural firms in Akure. The study explored the quantitative method of data collection and analysed the proficiency levels of architecture graduates in selected architectural firms in Akure. Findings from the study revealed the comparative CAD proficiency level of graduates from various schools in Nigeria as well as the impacts of CAD design tools in architectural firms and the basic requirements of the firms. It further revealed that architectural firms in Akure only employ graduates with the knowledge of CAD, at least basic 2D and 3D modeling software as against the manual drafting skills acquired from their various schools. The firms that conduct formal training programs for fresh graduates before or after given employments are infinitesimal. The study concludes that professional bodies should champion concerted effort to improve existing CAD training programs both in institutions and firms.

Keywords: Architectural Education, CAD, Graduates, Nigeria, Proficiency

INTRODUCTION

The advancements in Information and Communication Technology (ICT) are reshaping the Architectural design studio, Architecture pedagogy and design practices all around the world. Reffat (2007) stated that the digital imperativeness to switch from analogue to digital mode has already begun to manifest itself in various schools of Architecture and Design. It is common knowledge that the profession of Architecture is currently undergoing enormous strains as it battles to keep abreast of trends and developments in a period of series of rapid advancement in Science, Technology and Management (RIBA, 1992). The Architecture programs in Nigerian schools of Architecture, though fashioned after the British and/or American model, are tailored to meet the nation's socio-economic needs and cultural values within the general context of the Nigerian National Policy on Education (Olotuah, et al, 2007).

The relationship between the knowledge derived in educational institutions and work experience is of utmost importance in the practice of Architecture. Over the years, the practice of Architecture has evolved from the use of pen and paper to the use of computers. Despite the changes in practice, Architecture schools in Nigeria have not adopted the adequate changes necessary to enable graduates to adequately cope with the changes the practice of the profession is subjected to. Olotuah and Adesiji (2005) likewise opined that Architectural education in Nigeria has not seen many changes in its programs from the inception of the first school of Architecture in 1952. According to Olotuah (2000), schools of Architecture are struggling to keep up with issues that have transformed Architecture practice in other parts of the world. Consequently, it can be inferred that the laxity in our Educational system have resultant effects on our graduates. According to Sa'ad (2001), this trend has not only negatively positioned our graduates to gain from the wider knowledge and market offered by globalization in the industry in this 21st Century, but has equally diminished their knowledge. The use of CAD (Computer Aided Design) for Architectural drawings and

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analysis is the trend in Architectural practice nowadays and Architecture graduates are usually faced with this reality, among others, once they are actively involved in practice. CAD software is computer based design software used in the field of architecture for two-dimensional and three-dimensional drawings as well as modeling and analysing the proposed buildings. This paper assessed ways in which Architectural education in Nigeria has had impact on the CAD proficiency of graduates and Architects in selected Architectural firms in Akure.

The issue of manual drafting preference to the use of CAD by Architecture students in some universities in Nigeria has not been sufficiently cleared and understood. Students are not allowed to use CAD for their Architectural designs in schools and yet Architectural firms expect CAD proficient graduates. It becomes pertinent to assess the CAD proficiency level of Architecture graduates in firms and comparatively review the course curriculum of some universities.

The main aim of this study is to examine the CAD proficiency level of employed Architects in selected Architectural firms in Akure. This will be achieved by investigating the roles schools of Architecture have to play in the CAD proficiency of graduates, as well as fashion out strategies by which CAD knowledge can be improved amongst Architecture graduates.

CAD SYSTEMS IN ARCHITECTURAL EDUCATION

Bilalis (2000) defined Computer Aided Design (CAD) as the use of Information Technology (IT) in the Design Process. He further described CAD system stating that it consists of IT hardware, specialised software (depending on the particular area of application) and peripherals, which in certain applications are quite specialised. The requirements for Architectural education are yet to fully forge a coherent strategy for the implementation of CAD/IT in the curriculum of schools of Architecture. In almost every other field, including Engineering, Medicine and the Humanities, Computing Application to problem-solving and decision-making CAD/IT has been seen as a way forward as we moved into 21st century. Architectural education must integrate CAD/IT into the teaching of core modules that give the Architect distinctive competence: studio design. That is one of the best ways of doing justice to the education of the Architect of today and the future. Some approaches to the teaching of CAD in schools of Architecture have been touched upon in the recent past.

Yakubu, (2015) examined ways of maximising the benefits of CAD systems in Architectural education and of bringing Computer Aided Designing into the studio, not only to enhance design thinking and creativity, but also to support interactive processes. In order to maximise or optimise any function, one approach is to use the hard systems methodology which utilises analytic, analogic and iconic models to show the effect of those factors which are significant for the purposes being considered. The other approach is to use the soft systems methodology in which the analysis encompasses the concept of a human activity system as a means of improving a situation. The use of soft systems methodology is considered more appropriate for dealing with the problem of design which is characterised by a flux of interacting events and ideas that unroll through time.

The Practice of Architecture and the Use of CAD in the Contemporary World

Architectural design is a complex process that takes into consideration various parts that make the whole. In contemporary Architectural practice, flat sections and plans drawings are no longer a primary means of representation and communication with clients. Nowadays the widely used media in Architecture include visualisations, animations and three-dimensional models. (Guzik, 2009). Ogunsote and Prucnal-Ogunsote (2002) identified CAD Software to

include 2D and 3D modeling software, rendering software and animation software. Examples are shown in Table 1. Proficiency in this software should be acquired directly in departments.

Table 1: Examples of CAD software.

Category	Examples of Software
2D and 3D architectural modelling software	3D Home Architect, AutoCAD, Autodesk Architectural Desktop, Autodesk Revit Building, ArchiCAD, Form-Z, TurboCAD.
Rendering software	3D Studio Viz, AutoDesk 3D Studio Max, Accurender, AutoDesk Architectural Desktop, ArchiCAD, AutoCAD, Form-Z, TurboCAD.
Animation software	Amorphiurn , AutoDesk 3D Studio Max, Autodesk Architectural Desktop, Blender, Bryce, Corel Photo Paint, Flash, Poser, Ray Dream Studio, SoftImage XS1, True Space.

Source: Ogunsote, et al (2006)

Elegant software such as Lumion, Edificius, SketchUp Pro, Microstation, Softplan, ConceptDraw Pro, Arcon Evo, Envisioneer, DataCAD, Easy Blue Print, Domus Cad, Vector Works and Chief architect are also recommended for architectural designs.

COURSES REQUIRED FOR CAD PROFICIENCY

Ogunsote (2006) suggested some basic skills that should be acquired by all students of Architecture, planning and engineering. These skills can be acquired through common courses. The more advanced skills should however be taught within the department. CAD is best taught directly by each department, but there are circumstances where it is more efficient to offer some courses as service courses to several departments. CAD proficiency requires expertise in the following areas:

i. Basic computer literacy
ii. CAD concepts and theory
iii. Graphics software
iv. 2D CAD
v. 3D CAD and visualization

CAD Concepts and Theory

There are several concepts and theoretical constructs that form the basis of CAD software. While these concepts are best understood when demonstrated on a computer, it is important to teach these concepts in a classroom environment. Good understanding of these concepts is essential in understanding and using CAD software.

A workshop environment where theory can be discussed and concepts demonstrated is best. However, these concepts can still be taught successfully where there are very few computers.

Courses covering these concepts can be offered centrally to several departments with mainly lectures, practicals, assignments and written examination as components. The courses may for example be named Introduction to Computer Aided Draughting, CAD Concepts and Methods, Advanced CAD Concepts and Methods, et cetera. While examples should be given using a popular package like AutoCAD, the course content should be generally applicable to most CAD software.

Graphics Software

Even the best CAD design will lose its impact if poorly presented. Many aspects of students' training also require advanced skills in report writing, sketching, formatting and presentation. A good knowledge of graphics software such as Adobe PageMaker, Adobe Photoshop, Corel Draw, Corel Photo Paint, Harvard Graphics, Micrografx Designer, MicroGrafx Picture

Publisher, Microsoft Paint, Microsoft Power Point and Microsoft Publisher is essential. These courses are best offered as common courses.

2D Cad

Proficiency in two-dimensional (2D) Computer Aided Draughting includes the ability to independently produce basic drawings such as plans, elevations, sections, details and schedules at a professional level. Mastering CAD software such as AutoCAD is essential. This course can be offered at departmental level or as a common course depending on student population and facilities available.

STUDY LOCATION AND RESEARCH METHODOLOGY

The study was carried out in Akure, Ondo State. Akure town is the capital of Ondo State in South-western Nigeria. It lies in the southern part of the forested Yoruba Hills and at the intersection of roads from Ondo, Ilesha, Ado-Ekiti and Owo. Akure is an agricultural trade centre for food crops like yam, palm oil and kernels and cocoa as the major commercial crop, with a population of 484,798 people according to 2006 population census. (National Population Census 2006). Akure is the site of The Federal University of Technology, Akure" (founded in 1981). In order to gather information on the status of architectural firms in Akure and how CAD proficient their employed staff are, questionnaires were administered to the firms and various interviews were also conducted. Questions were asked on the level of CAD usage in the firms, the types of software used in the selected firms, availability of CAD personnel in the firm and how often they conduct training for staff. Questions were also asked on the criteria considered before employment is given to any graduate as touching CAD literacy and the level of knowledge/skills gained during training in their various schools.

A semi-structured questionnaire was developed and standard open-ended interview was carried out in selected architectural firms in Akure. A total of Ten (10) architectural firms were randomly listed to be examined out of which only six (6) representing 60% were successful being the very few registered architectural firms entitled to architectural practice, with employed architecture graduates and registered principal architects. The research questions were aimed at having details on the CAD proficiency of the architecture graduates and to also determine if the CAD software they know were taught in their respective schools or learnt individually.

REVIEW, FINDINGS AND DISCUSSIONS

The response on the level of software literacy in architectural firms showed that high priority given to manual drafting in schools should be equally given to CAD knowledge as the firms employ just proficient graduates and not just an amateur. A total of 24 (Twenty-four) questionnaires were administered to staff which including various level of qualification ranging from HND holders to Master's degree holders in the selected firms and only 19 (Nineteen) were duly returned representing 79% of the total questionnaires.

Number of Staff in the Architectural Firms

The study examined the number of staff that work in each firm. The results show that 2 firms have up to 5 employed graduates comprising HND, B.Tech and M.Tech holders representing (33%) of the sample. Three (3) firms have 2 fully employed graduates which measures (50%) of the sample. Just one (1) firm has a total number of 3 architectural graduates representing 17% of the total selected architectural firms.

The above number of staff provided information on employed architectural graduates alone as some of the firms have other professionals working in the firms, such as Quantity

Surveyors, Civil engineers, Electrical and Mechanical engineers and others. The firms as well have other staff such as secretary, receptionist, Industrial Training Students and Draftsmen.

Qualifications of Staff

Table 2: Analysis of the qualifications of staff in firms.

	Frequency	Percent	Valid Percent
HND	7	36.8	36.8
PGD	1	5.3	5.3
B.TECH	8	42.1	42.1
M.TECH	3	15.8	15.8
Total	19	100.0	100.0

(Source: Author's field survey 2015)

From Table 3, the study examined the qualifications of the staff in the sampled firms. The result of the analysis shows that 36.8% of the staff are HND holders, 5.2% are PGD holders, and 42.1% of the staff are B.Tech holders while 15.8% are M.Tech holders. This results shows that the highest percentage of qualifications are the B.Tech holders followed by HND holders while the lowest percentage is the PGD holders which confirmed the response of some staff during the interview that most HND and B.Tech holders have acquired CAD skills before graduating from school either through personal tutorial or they were taught in schools.

CAD Proficiency Level of Newly Employed Staff

Information gathered from certain personnel in some of the selected architectural firms revealed that no firm is ready to waste resources on employee that cannot deliver and this propelled the motive of these firms not employing architectural graduates without at least a 2D drafting software skill. The table below shows the proficiency level of Staff against the various CAD software they can use.

From Figure 3, 52.6% of the staff use AutoCAD architecture majorly for 2D drafting. The software dominates the chart as it is very flexible compared to other drafting software. 26.3% of the staff used Revit Architecture, 15.8% of the staff are ArchiCAD proficient, 5.3% are averagely skilled at using Google SketchUP and none of the staff is proficient at using 3D Studio Max. It was observed that most of the firms are currently into solely 2D drafting and any further request by the client for 3D presentations attracts extra fees as it will be contracted out to experts that are not member of staff. This suggests that more attention is paid into 2D presentations. Depending on the clients, some are interested in 3Ds but firms do not see reasons to fully employ just 3D modelling experts. The staff were asked to state means by which they gained proficiency in the CAD software of their choice.

Means of Learning Cad by Staff/Graduates

Table 3. Staff means of learning CAD software of their choice.

	Frequency	Percent	Rank
Self-learning	9	47.4	1
Self-learning & Private Tutor	6	31.6	2
Private Tutor	4	21.1	3
Part of School Curriculum	0	0	4
Total	19	100.0	

(Source: Author's field survey 2015)

From Table 4, 47.4% of the staff learnt CAD on their own, some when they were still in school and some after leaving their various institutions, while 31.6% of the staff acquired their CAD skills through both self-learning and private tutor. Due to the complexity of some of these software. According to some of the respondents, even after learning individually through either downloaded online tutorials or trial and error methods, the attention of more

proficient architects in that particular CAD were still needed, while 21.1% of the staff learnt CAD through solely private tutor. The knowledge was acquired under the tutelage of their colleagues both in the institution and in their respective firms. None of the staff had CAD as part of their school curriculum. This revealed that to be CAD efficient as an architectural graduate or staff in a firm, it all lies on the individual as none of the institution has fully adopted CAD into their training programme.

Some of the respondents affirmed that they were allowed to present some certain percentage of their school projects and course works in CAD, yet it is not part of their departmental curriculum but a major condition for employment by architectural firms in Nigeria.

Staff Training Programmes by Firms

The study unveiled the non-existence of formal staff training programmes in architectural firms in Akure. Instead staff engaged in one-on-one method, a more proficient staff in the firm trains less proficient staff irrespective of their position in the firm. This method is also adopted for students undergoing their Industrial Training Programmes at the firms. There is no strict measures towards IT students, even if they do not have prior knowledge of any CAD they will be trained at the firms starting with AutoCAD Architecture. Interviews sessions with some of the staff also revealed that most of them developed personal skills in software proficiency through online materials, book and constant practice.

General Challenges Faced by Staff in the Firms

To improve the CAD proficiency of graduate architects and staff in architectural firms, there is need to examine the possible barriers to the increase of CAD proficiency level in both schools and firms. The table below shows the challenges encountered by staff at their various firms in Akure.

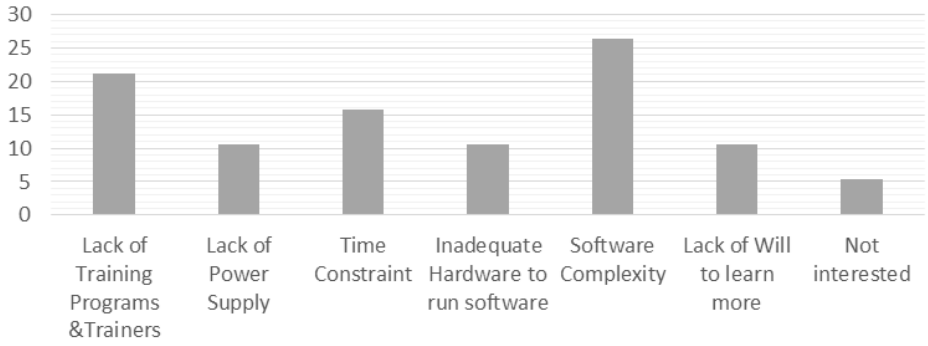

Figure 3: Barriers to CAD proficiency in firms
(Source: Author's field survey 2015)

From figure 5, 26.3% of the respondents attributed complexity of the software as their major barrier to being proficient in CAD usage. This has highest frequency of respondents followed by Lack of intensive training programme and CAD proficient personnel having 21.1% of the total percentage, while 15.8% of the staff said they do not have the time to improve their proficiency level in CAD. However, 10.5% of the total staff said lack of power supply was the major challenge, 10.5% also said inadequate hardware to run the software was their drawbacks, also 10.5% also said they are not interested in learning some other software aside the ones they already know since their firms do not even make use of other software apart from 2D software such as AutoCAD. However, 5.3% of the staff said they do not have any challenge. This suggests that staff in these firms are interested in learning and improving their proficiency level but along the way they encounter difficulties with the software which will require the help of an expertise in the field. This training/trainer is what is missing in these firms.

SUMMARY OF FINDINGS

The main aim of this study is to examine the CAD proficiency level of employed staff architects and suggest ways of improving the CAD knowledge of architectural graduates. The findings of the study are summarised below:

i. In the selected architectural firms in Akure, the major architectural CAD software they use is AutoCAD architecture to produce just 2D designs for clients and if there is need for 3D modelling, it is contracted out to a 3D expert not necessarily employed in the firm. Almost all the staff in the selected firms are more proficient with AutoCAD as this is the major software used in the firms.
ii. Before employment is given to any architectural graduates in selected firms, the person must have the basic knowledge of AutoCAD for 2D presentation drawings. However, it was realised that even if the person does not have site experience but knows how to use AutCAD, he or she will still be employed.
iii. There are no formal training programmes organised by the firms for staff at any level. Instead a more proficient CAD personnel trains staff with less knowledge of CAD. This has nothing to do with age, position or hierarchy as even principal architects in firms learn from lower ranked staff.
iv. None of the schools that produced these graduates have CAD as part of their curriculum instead students engaged themselves in personal training through online tutorials, books and constant lunching and learning techniques.
v. Staff that see the complexity of these software as the major barriers to their CAD proficiency level have the highest percentage. The complexity of the software interface and slower rate of assimilating the ideas behind the software require the expertise of a more proficient personnel.

CONCLUSION AND RECOMMENDATIONS

The issue of balancing the traditional drafting method and the use of Computer Aided Design in architectural schools is yet to be properly established resulting in architectural graduates not enjoy the full benefits of CAD even at their early years in schools. However, a basic knowledge of CAD has to be acquired from school before employment is given to graduates in architectural firms. With the circumstances and challenges faced by employed staff, graduates and students in institutions, to be CAD proficient may be quite challenging but it can be achieved and technology is really advancing in this age so a lot is expected of architectural graduates. The following are some recommendations with the intent that they serve as models to improving the CAD proficiency levels of staff in firms and student architects.

i. In order to improve the proficient level of staff in architectural firms, intensive formal training should be conducted perhaps yearly where experts in different digital design technologies and software application train the staff as this increase the efficiency of the firm.
ii. CAD proficiency should be integrated into architectural curriculum thus exposing architects to the rudiments of CAD at an early stage. Curriculum should be dynamic not static and is expected to be reviewed every five years for continuous updating.
iii. Architectural staff with less CAD knowledge should be encouraged to learn from more proficient ones and not rely on the training programmes by the firms.
iv. Architectural firms should also encourage staff to go for conferences and seminars with subsidised funding by the firms.

v. Various forms of interactive education systems such as video tutorials, electronic handbooks and so on should be adopted in the teaching of CAD. The creation of a CAD studio well stocked with high-end computers that should at least conform to the minimum specification for teaching and learning of CAD software both in institutions and firms should be encouraged.

vi. The criteria for employing architectural graduates in firms should not be limited to just 2D software but also 3D modelling and other software.

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Sustainable Architectural Education: Perceptions from University of Jos Post Graduate Students

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ABSTRACT

Sustainable education has been acknowledged to promote the future of sustainable development (SD), and one of the key factors for achieving SD in developing countries is driven by contributions from professionals and future practitioners within the built environment. This study presents the perceptions of postgraduate students of architecture from the University of Jos on the role of sustainable architectural education and the future of sustainable architectural practices for Nigeria. An inductive survey was employed to sixteen (16) students from the two arms of the postgraduate classes, representing 30% of the students. Results from the survey show that, about 50% of the students are well aware of the concepts of sustainability. Yet, sustainability as a course in not taught in the department, beyond the expiration of the UN Declaration- which declared 2005-2014 as the decade of sustainable education. This study aims at promoting the SD practices and skills application through sustainable architectural training for the future practitioners. The study's relevance is hinged on the global concern for sustainable practices, especially within the built environment. This study's recommendations include; new and common pedagogical curricula for all schools of architecture, continuous professional sustainable training and its application in practices. This study is also intended to spur future studies on sustainable architectural education in Nigeria.

Keywords: architecture, built environment, education, Nigeria, sustainable development

INTRODUCTION

Buildings, architecture and sustainability are linked. Globally buildings contribute about 50% to the causal processes of climate change due to their high consumption of energy and carbon emissions (IPCC, 2007). In the Sub-Saharan Africa buildings consume about 90% of energy (Earth Trends, 2005). The continuous negative impact of climate change to the built environment (IIPC, 2007) and the global concern for sustainable development (Ebohon et al., 2013) have necessitated the changes in industries and societal expectations (O'Rafferty et al., 2014). As a follow-up there was also an immediate reciprocal shift in the curricula of many western universities and particularly the architectural education agenda (Zuo et al., 2010; Iulo et al., 2013). The shift is primarily to accommodate the principles and practices of SD design solutions (Altomonte, 2009; Allu and Ebohon, 2015).

Other studies have also acknowledged and linked sustainable architectural design to link technology, businesses, people and social solutions for societal problems (European Commission (EC), 2009; O'Rafferty et al., 2010; Rasmussen, 2011). Furthermore, Botha et al. (2013) in their study concluded that one of the key drivers of promoting SD in developing countries is driven by the contributions of professionals and future practitioners from the built environment. The above discourse underpins this study's pursuits as presented in the following sections. Therefore, the aim of this study is to promote sustainable skills acquisition and applications for SD practices through sustainable architectural training of future practitioners. The UN 57th session declaration of 2005 – 2014 as the Decade of Education for Sustainable Development (DESD) is examined and recognised the importance of integrating sustainable development into architectural education. The UN DESD Report also stated that, "Education is motor for change" and further stated that "...education is the

Allu, E. L. (2016). Sustainable Architectural Education: Perceptions from University of Jos Post Graduate Students. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1211-1218

key to sustainable development" (UN DESD 2014, Report, p. 4 and 6). Consequently, this study presents the place of UniJos in actualizing the DESD resolution and the ways forward for architectural training in Nigeria are highlighted.

SUSTAINABLE DEVELOPMENT AND EDUCATION

Education and learning have influence on its recipients beyond the period of training. University values are guided by government and policy makers, while professional institutes and accreditation boards have control over its curriculum (Dunbly et al., 2007; Cockrell, 2010). On the other hand, university education also influences an impact on its products, their practices and the society (Thomas and Day 2014). Furthermore Haines (2011) asserts that education and training are the cheapest and most effective way to realign the thinking of future practices. This assertion is most likely having a bearing on the DESD declaration which seeks to achieve a sustainable world, using education as the means as was captured in summation of UNESCO which spelt out what DESD is intended to achieve as follows:

> *...seeks to integrate the principles, values, and practices of sustainable development into all aspects of education and learning, in order to address the social, economic, cultural and environmental problems we face in the 21st century.*
>
> (UNESCO, 2010, p. 1)

The best practices are in this regard are therefore, linked with the ability to practice sustainably in the face of environmental challenges. The UNESCO interpretation also implies that sustainable education is a capacity building strategy. Education is therefore, identified as the necessary channel to ensure future of best practices in the face of the global climate change challenges on the environment. Earlier research has also observed that in some countries SD education starts at the primary schools (Tilbury et al., 2005) and later researchers argued that SD education is most effective at the university level (Lozano, 2006; Lukman and Glavic, 2007; Leal Filho and Manolas, 2012). The study supports the later argument because the study is professionally inclined.

Recent studies by Barth and Timm (2011) and Lozano et al. (2011) observed that in many western countries, Higher Education (HE) have embedded environmental education and Education for Sustainable Development (ESD) into their curriculum as a commitment towards actualising the future practices of sustainability. Notably, also is that architectural education has been pointed to lead in the global concern for a professional shift towards sustainability (Cortese, 2003). Current architectural education has also been emphasising environmental conscious design training (Zuo et al., 2010; Leslie, 2012). This shift According to Capuzocca and Sarni (2012) adds value to innovation and efficiency, particularly to design exploration and enhances the ability and skill application for future practices (Second Nature, 2011; Kamal and Asmuss, 2013). Another study observed the tendency for non-studio and studio courses in architecture to have conflicting priority and taught independently thus, creating a gap in knowledge transfer (Smith, 2011), however, a later study by Demirkan and Afacan (2012) notes that sustainable design education is a means to achieving value added design solutions and consequently bridging the gap between non-studio and studio courses.

The preceding discourse has established the advantages of mainstreaming sustainable education into the curricula of all HE and to architectural education in particular. It is also apparent that mainstreaming ESD into the curriculum of HE in architectural education within the period of DSED has been adopted in many countries and supported (UN DSED Final Report, 2014). Yet beyond 2014 there are universities that have not aligned with this global

agenda for change and the shift from the traditional ways of developmental developments towards achieving worldwide sustainability (Lozano et al., 2011; Allu, 2014). Thus, this study forms part II of the study carried out by Allu (2014) on the need for sustainable architectural education in the department of architecture at the University of Jos.

The University of Jos is one of Nigeria's second generation universities. The department of architecture is one of the leading schools of architecture in Nigeria established in 1979. The department like most schools of architecture runs both the undergraduate and postgraduate programmes. Unfortunately there is no known sustainable development course being run in this department, two years beyond the UN declared decade of sustainable education. Perhaps, the department's position is related to Bardaglio (2007) opinion which states that ...*the academic program is an area that traditionally has been most resistant to change."* The motivation for this study is derived from UNESCO (2014) Final Report which was developed after DESD period lapsed, this evaluation report states the UN resolve to continue the pursuit towards promoting sustainable development beyond 2014.

Given that relevance of mainstreaming sustainable development education and the role of HE in ensuring that future sustainable practices are enhanced through skill acquisition and the ability for its application. Reflecting on the aforementioned discourse architecture like other disciplines has also keyed into ESD. It is important to also identify approaches employed by architectural programmes in universities that have successfully embedded ESD in their curricula.

APPROACHES TO SUSTAINABLE EDUCATION IN ARCHITECTURE

Embedding ESD into the architectural education has multidimensional positive effects to the future architect. The importance of embedding ESD into architectural programmes has multifaceted advantages including; harmonised training and qualification, employability, professional competence, mobility, value added curriculum, capacity building and promotes global sustainability (Lipscombe et al., 2008; Cadima, 2009; Tilbury, 2011; Thomas and Day, 2014). It is worth noting that these advantages are also to the profession and the society at large because sustainable education provides the opportunity for holistic approach to design solutions. Barth and Timm (2011) also noted that embedding ESD into HE does not only bring an educational change but introduces new approaches to teaching. While the study undertaken by Iulo et al. (2013) on "Environmentally conscious design: educating future architects" examined the curricular-based programmes on architectural programmes in the US. Their finding reveals that there are four approaches to curriculum based approach to ESD architectural programmes. These four approaches are: core value, technological domain or systems-focused, choice, and specialization.

Table 1 highlights the four approaches at a glance, what they entail, actions required and remarks. In the overall, the 'core value' approach covers all aspects of learning unlike the 'specialization' which is mainly for the postgraduate students however, 'technological' and 'choice' approaches restricted to specific technologically focused and the choice approaches is seen as an elective course. Based on the investigation with ESD educators in some American Universities Iulo et al. (2013) summation was that a composite approach should be adopted and their study also suggested the need for future studies to examine the perceptions of the student on the four approaches. Their suggestion agrees with an earlier conclusion that students' perceptions are important to the success of ESD (Barth and Timm, 2011). Hence this study attempts to gauge the perceptions of the postgraduate students on the most suitable approach of ESD to introduce to the architectural programme at the University of Jos.

Table 1 Approaches Sustainable Education (SE) in Higher Education

S/N	Approaches	Actions	Remarks
1	Core value: sustainable education is seen as a "core value" course	Included in the content of all courses	Addresses sustainable conscious design
2	Technology domain: contained in environmental systems courses	fulfil the sustainable education needs of architecture students	Specific to technology courses only
3	Choice: sustainable education optional	students select sustainability-related courses by choice	Seen as an elective course only
4	Specialist knowledge: sustainable education is a specialty course	Occurs mainly at the graduate level and in concert with centres or institutes also focused on sustainable research.	Limits future career of student who may not pursue graduate research opportunities

Source: Adopted from Iulo et al., 2013

METHODS

The four approaches to ESD identified in Table1underpins the inductive inquiry of this study. In line with the Myers (2009) assertion that face-to-face group interviews are; comprehensive, provide in-depth information and suitable for any qualitative research. Thus, this study adopts a face-to-face group interview for collecting its primary data. 16 (n= 16) post grads, 8 from each arm of the MSc programme (MSc 1 and MSc 2) were engaged in the interview session. Five (5) main Semi-structured interview questions guided the interview sessions. The interview questions were as follows:

i. Are you well aware of the concept of Sustainability?
ii. What is your understanding of Education for Sustainable Development? What about the UN Decade of Education for Sustainable Development?
iii. Which of the four approaches earlier discussed would you recommend to your department? Please explain.
iv. Why do you think your department is yet to embed ESD into its curricula?
v. Do you think ESD has the potential to promote sustainable practices beyond the university training period? Please explain?

Some follow-up questions are highlighted in italics.

The interview sessions were conducted in September, 2015 and the session lasted about 90 minutes. Secondary data were robustly sought from relevant literature. Ethical research considerations were sought and obtained for this study and participation was voluntary.

Descriptive analysis was employed to analyse the primary data. The data are set to provide a baseline for the choice of the most suitable approach to adopt in the architectural programme for the University of Jos and other programmes within the context of this study.

FINDINGS

This section presents the summary of key findings from the qualitative survey. At the start of the interview session the study's subject was introduced and a sheet of paper with Table 1 was given to each participant. The interview invitation letter had also relayed the study's focus to the interview. Thereafter, the interview session was arranged in one of the post grads studio.

Responses for Question I

Only a total of 8 (50%) of the 16 interviewees were confident and are able to explain the concept of sustainability, while the others claim that sustainability is a familiar term. This

finding translates to an average result and being familiar to sustainability does not in itself translate to skill acquisition. By implication it means these set of post grads and not well informed about sustainability and therefore, they are not well prepared for sustainable practice after their education.

The Responses to Question II

About ESD were unsurprising as many of the respondents thought it was an academic discipline. One of the response was "... just like special education, education for sustainable development is a specialised field." The closest response was "It is about the education aspect of sustainable development." At this point about 7 minutes was used by the author to explain what ESD means. Furthermore, only two students claimed to have read a journal article that referred to DESD. Surprisingly, a respondent said he perceived DESD would commence in 2016. Otherwise other interviewees had no opinion on what DESD is supposed to achieve.

There were divergent **views on question III**

As each participant was only allowed to choose the approach that seems the most suitable. 7 (44%) of the interviewees chose the first approach "core value" and their reasons included:

i. It is a continuous process of learning
ii. Unified curricula to all students
iii. Non selective
iv. Offers equal opportunities

Views expressed for the choice of the other 3 approaches revealed that, for the 'Technology domain' the views expressed by the 2 (13%) interviewees who preferred the approach was that sustainable development seem technically inclined and secondly, that it is likely to be taken more seriously by students. The 3 (20%) interviewees who opted for "Choice" as the most suitable approach were of the opinion that; since there is no compulsion with the approach, students who are interested would learn faster with this approach. Another 2 (13%) chose the "specialist knowledge" for the reason that it would offer them an opportunity to diversified and likely to enhance their chances for employment. Although the views are at variant, it does portray negativity but that each of the four approaches to ESD has their merits. The views expressed also reveal that the students are interested in learning more about sustainability.

Question IV

Again this question also attracted different opinions and some selected verbatim responses were as follows:

i. It is likely that the university administration is not informed of about ESD as I am until now.
ii. Maybe the lecturers are not qualified
iii. ... it may not be part of the accreditation criteria for National University Commission (NUC) and for Architects Registration Council of Nigeria (ARCON).
iv. It is possible that much funds are required to introduce the curricula for all the levels
v. It may be in the pipeline for the curriculum review
vi. NUC may be test-running the ESD curriculum in another university before it is adopted by the commission.

The above responses have validated and re-echoed some of the underpinning theoretical discourse in the preceding sections. Particularly, it is wake up call for the university of Jos governing board, NUC, ARCON and the department to align their architectural programme with the global agenda for sustainable practices.

Question V: the interviewees who seem not too excited at the commencement of the interview session suddenly came alive and provided many positive responses on the potentials of ESD. Their responses are highlighted below to include:

i. It would set the department at par with other architecture programmes international
ii. Introducing ESD into our curriculum is most likely to improve our university rating
iii. It means we can compete professionally with architects from other countries
iv. ESD would knowledge and understanding of sustainability
v. More students may prefer UniJos to other universities running architectural programmes
vi. It would be relevant and timely, considering information this interview session provided me.

These positive comments by the students further validates the arguments for the mainstreaming ESD into HE architecture programme. Some of the many advantages of ESD have also been stated by these post grads who have not formally been introduced to ESD. It is deducible to note that amongst the interviewees, that a new interest has been reawaken and it is most likely for each of them to want to pursuit this new interest and seek further knowledge in the context of sustainable architecture.

CONCLUSION

This study has presented theoretical arguments to demonstrate that embedding ESD in every country's architectural education systems promotes harmony of architectural qualification, standards and practices. The relevance of ESD has also been established and the importance for architectural programmes to key into the global agenda for sustainable practices is not questionable. As much as some universities may not be susceptible to change, however, in order for these universities to have a positive impact to the profession of architecture and the global society would require their active participation in the sustainable drive through ESD.

As noted by the study conducted by Barth and Timm (2011) students' perceptions are important for ESD to succeed. Although the students whose perceptions formed the data for this study have no formal ESD learning experience, the data collated from them is informative to the study and the future considerations by the architecture programme at the University of Jos. Beyond the architecture programme in the university of Jos, the findings from this study can be considered relevant to other schools of architecture. In addition, students who participated in this study recognised its potentials and the knowledge the 90 minutes interview session provided. This attempt is likely the first in this regard from the sub-Saharan region of Africa and has the potential to spur future studies from allied professions within the built environment in Nigeria.

Consequently, this study recommendations that new and common pedagogical curricula for all schools of architecture, continuous professional sustainable training and skill acquisition, and the application of sustainable practices.

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Appraisal of Stakeholder Management Practice in Tertiary Education Trust Fund (TETFund) Construction Projects

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ABSTRACT

Several studies have identified the importance of managing stakeholders as major criteria for determining project success, thus stakeholder management is an important aspect of project management. In Nigeria, studies conducted in the research area have not assessed the adoption of stakeholder management. Therefore, this study explored the levels of awareness of Stakeholder Management practice and how stakeholder analysis is conducted in TETFUND construction projects. Interviews were conducted with ten (10) project managers that have managed at least two (2) TETFUND construction projects in tertiary institutions. Comparative content analysis method was used to analyse the interview responses. The result shows that there is awareness of the concept but no proper adoption of stakeholder analysis guidelines as stated in literature within the firms. The study recommends that proper adoption of stakeholder analysis guidelines should be embraced by consulting project management firms in managing project stakeholders. This study will further help subsequent project managers toward recognising the importance of carrying stakeholder analysis and employing more resources to conduct it in managing projects.

Keywords: Project Stakeholders, Stakeholder analysis, Stakeholder Management, TETFUND

INTRODUCTION

The importance and role of the construction industry to other sectors of the economy makes it to have different stakeholders with wide range of interests that need to be managed. Farinde and Sillars (2012) described the construction industry as a complex and huge industry with several key players with different interests. Therefore, a project can be successful in its entirety when the construction organisation is able to effectively manage all human and non-human resources; this is done in order to deliver a facility that satisfies and exceeds the needs of the client at the time it is required and within considerable budget range.

Traditionally, construction projects are deemed to be successful if they were delivered within the set of objectives of budget, schedule and quality (Chua et al., 1999). However, the planning and construction of a facility can affect many interests due to the different people involved from different backgrounds and disciplines. Also, construction projects involve many phases, and at each phase/stage, there are key people that are needed to act. Dosumu and Onukwube (2013) further recommended that for construction projects to be successful, attention must be paid to user's related factors, professionals' factors and organisation's factors. Looking at the users, professionals involved as well as the organisations all constitute the project stakeholders.

Newcombe (2003) defined Project stakeholders as groups or individuals who have a stake in, or expectation of the project's performance and include clients, project managers, designers, subcontractors, suppliers, funding bodies, users and the community at large. Stakeholders either affect or are affected by the accomplishment of the project (Freeman, 1984). Satisfying stakeholders need is one of the criteria for project success (Turner, 1999; Smith et al., 2001) and their buy-in and support is important aspect of Project Management (Takim, 2009).

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Adequate involvement of stakeholders in construction projects will help in accommodating different interest towards realizing the project success.

Onarinde (2011) identified the importance of stakeholders and their management to successful projects before, during and after construction process in Nigeria. However, the question that still lies is how the concept is applied in Nigeria. Therefore, this research seeks to further appraise the practice of stakeholder management in the Nigerian Construction Industry using TETFUND construction projects.

STAKEHOLDER MANAGEMENT AND STAKEHOLDER ANALYSIS

The subject of project success criteria and its determination has enjoyed considerable discussion in project management practice. Success criteria are unique and cannot be generalized for all projects due to the nature and variability of all projects (Adinyira et al., 2012). However, there is a paradigm shift from the traditional perception of project success to the modern approach which uses tools that includes stakeholder management. Berk and Kartal (2012) pointed out that the key elements for success in construction projects are life cycle management and stakeholders.

Stakeholder management is an aspect under project management that deals with managing the relationships and interests of the different stakeholders involved in a project. Stakeholder management is now considered a key concept for the completion of construction project work (Atkin and Skitmore, 2008). Therefore, Stakeholder management is a significant component in managing a firm as well as a project.

In any project, and especially in construction projects, many different and sometimes discrepant interests must be considered (Olander and Landin, 2005). Successful stakeholder management can be achieved through conducting a careful stakeholder analysis. This is supported by Aaltonen (2011); Bourne (2009); Jepsen and Eskerod (2008); Rowlinson and Cheung (2008); and Yang et al. (2011) as they all assert the importance of stakeholder analysis. As such, it is important for the project manager/team to effectively carry out a stakeholder analysis which will subsequently help(s) in designing the strategy that will be used in managing the stakeholders involved in the project.

Yang et al. (2011) indicated that because of the uncertain and complex nature of construction, it is important that a proper stakeholder analysis and engagement process is carried out in order to successfully manage the process. They further went to explain stakeholder analysis as consisting of stakeholder identification; stakeholder categorisation; and stakeholder assessment based on influences and relationships.

Stakeholder analysis identifies all primary and secondary stakeholders who have a vested interest in the issues with which the project or policy is concerned. The goal of stakeholder analysis is to develop a strategic view of the human and institutional landscape, and the relationships between the different stakeholders and the issues they care about most.

According to Aaltonen (2011) conducting a stakeholder analysis helps project managers to attempt to paint a picture of the stakeholder environment which will be used to make decisions as regards management of stakeholders in the project. Stakeholder analysis should be a continuous process that spans throughout the process of a project life cycle to retain effectiveness and this should be done alongside stakeholder engagement which requires managerial skills and effective communication (Rowlinson and Cheung, 2008).

Therefore, it can be summarize that stakeholder analysis is the process of identifying all the persons, groups and institutions who may have an interest in a project and taking steps to manage their interests and expectations so that the project runs as smoothly as possible.

For the purpose of this research, Tertiary Education Trust Fund (TETFUND) construction projects were selected, being projects with the same scheme. The TETFUND was established as an intervention agency under the TETFUND ACT – TERTIARY EDUCATION TRUST FUND (ESTABLISHMENT, ETC) ACT, 2011; charged with the responsibility for managing, disbursing and monitoring the education tax to public tertiary institutions in Nigeria. One of the mandates of TETFUND is to administer and disburses the amount in the Fund to Federal and State tertiary educational institutions, specifically for the provision and maintenance of essential physical infrastructure for teaching and learning which includes construction projects.

METHODOLOGY

Qualitative approach was adopted for this study and semi-structured interview guide was used to conduct an interview among the respondents of the study. The interview questions were structured to provide information on the firm's background, its understanding/perception on project stakeholders and the approach use in conducting stakeholder analysis in TETFUND projects.

The sample of the study was drawn using purposive sampling technique by selecting only firms that managed more than a single TETFUND construction project to form the sample size. A total number of ten (10) firms that managed TETFUND construction projects were used to retrieve the data needed for the study. The samples for the research were selected from construction projects within tertiary institutions located within North-western region of Nigeria. The data obtained from the interview responses were analysed with using constant comparative content analysis method of analyzing.

FINDINGS AND DISCUSSION

Results and Discussions

The research conducted ten (10) interviews to representatives of the firms that form the sample size used for this research. Table 1 shows the general questions' section of the interview guide used which represents the details of the project management firms with regards to: the range of services offered, number of employees and those with project management qualification.

The details of the firms obtained showed that most of the firms concentrated on the provision of architectural, planning and project management services. However, three (3) of the firms venture into other services with two being multi-disciplinary firms (P1 and P3), while P5 extends it services beyond architectural and project management, by providing structural services. The two (2) other firms, i.e. P7 and P9 offer Quantity Surveying and Project Management services.

P1 has a unique organisational structure, because it only engages staff when the need arise as it does not keep permanent technical staff, although its present director is a well-qualified Project Manager. P5, P6 and P8 have more than ten (10) technical employees while the other six respondents all have less than ten (10) technical employees. Four (4) of the firms operate without any properly trained project manager. P4, P6 and P9 have qualified project managers with master's degree while P5 and P7 have employees that are certified chartered project managers. From literature, the responsibility of managing project stakeholders lies with the project managers. Therefore, there is the need to have well trained and qualified project managers in any firm that offers Project management services.

The different definitions obtained from the interview indicate that all the respondents have a good awareness and knowledge of the concept of stakeholder management. From Table 2, the

PMI (1996) definition is the most closely related definition referred to by the majority of respondents. This has further supported the findings of Onarinde (2011) that practitioners have a good knowledge of stakeholder management in the Nigerian construction industry.
The respondents were also able to mention the project stakeholders ranging from the sponsors, the beneficiary institutions' management and their technical units, other consultants, contractors, end users etc. The result agrees with the checklist of stakeholders included by Newcombe (2003) in his list. This further established the awareness and understanding of the concept of stakeholder management by the respondents.

Table 1: Respondents' Details

PM Firms	Ranges of services offer	Number of Employees	Number of Employees with PM qualification
P1	Multi-disciplinary consultancy	Dependent on nature of job	All
P2	Architectural and PM	3	None
P3	Multi-disciplinary consultancy	7	None
P4	Architectural and PM	7	3 (MSc. PM)
P5	Architectural, Structural and PM	20	4 (PMP)
P6	Architectural and PM	15	2 (MSc. PM)
P7	QS and PM	5	None
P8	Architectural and PM	15	2 (PMP)
P9	QS and PM	7	1 (MSc. PM)
P10	Architectural and PM	5	None

Table 2: Comparison between the definitions obtained in the Field Survey and Literature

Firm	Definition	Related in literature
P1	Anybody who can affect or can be affected by a project	Freeman (1984)
P2, P6	All interested parties that are committed to the execution of the project and its success.	Savage et al. (1991); McElroy and Mills (2000)
P5, P4,P3	Involves all the people that are involved in a particular project.	(PMI, 1996)
P9, P7	All those involve in a project	(PMI, 1996)
P8, P10	People involved directly in project either as an individual or a group.	(PMI, 1996);

All the respondents asserted the importance of stakeholders in successful project delivery and how very crucial it is in determining project success or failure. This is in line with the suggestions of Turner (1999) and Smith et al. (2001) that satisfying stakeholders' need is one of the criteria for project success. Another importance of stakeholders highlighted by the respondents is that they help in determining the project scope. Black (1995) attributed the tendency of poor scope and work definition due to improper engagement with stakeholders. Thus, stakeholders help project managers in determining the scope of a project. Also, the respondents agreed that the collective contributions of stakeholders make the entire project success. According to Bourne (2010), stakeholders have the ability to affect the outcomes either through action or inaction; therefore, they are the major determinants of project success or failure. This shows that all the respondents have acknowledged the relevance of stakeholders in a project which also indicates a good knowledge of the concept. Hence, the importance of stakeholders in project delivery is recognised by all the respondents.

The respondents see the stakeholder analysis as a pre-determined exercise stating that the management and technical unit of the various institutions have already carried out all the necessary exercise. The literature asserts that successful stakeholder management can be achieved through conducting a careful stakeholder analysis. Rowlinson and Cheung (2008) recommended that stakeholder analysis should be a continuous process that spans throughout the process of a project life cycle; hence, it is not just at the inception stage that the analysis is carried out. Aaltonen (2011) emphasised on conducting stakeholder analysis because it helps

project managers to make decisions as regards management of stakeholders in the project. This shows that it is the responsibility of the project manager to conduct the analysis which should be a continuous process. One of the respondents admitted that the analysis had really helped him in developing a project brief as well as breaking the project into phases in order to accommodate the stakeholders‟ needs and expectations in the project. Another respondent who had carried out an analysis posited that it was quite challenging. This is in line with findings of Jespen and Eskerod (2008) that stakeholder analysis is quite challenging and time consuming.

The three (3) respondents i.e. P1, P5 and P6 that carried out the stakeholder analysis could not follow the steps identified in the literature. The respondents do acknowledge the identification step as the first step which conforms to the existing literature. However, none of them was able to categorize them as suggested in literature, even though one of them insisted that they were able to assess the stakeholders' influences and relationships. According to Yang et al. (2011) the steps in conducting the analysis include: stakeholder identification; stakeholder categorisation; and stakeholder assessment based on influences and relationships. Thus, in conducting the analysis, it is important to employ all the identified steps in order to yield an effective result.

Summary of Major Findings

The following were found or derived from this study:

i. Some of the project management consulting firms offer the services of project management without any trained and qualified personnel in project management in their organisations.
ii. The firms have good awareness of the concept of stakeholder management, mostly acquired from their years of working experience.
iii. Stakeholder analysis is seen as a pre-determined exercise that does not extend beyond the inception phase of the project.
iv. The guidelines for stakeholder management provided in the existing literature seem too formal to be adopted by people who are not academically trained and oriented.

CONCLUSION

This study concentrated on projects with almost the same set up and project stakeholders' community so that the results could be comparable. Thus, the conclusion is that despite the awareness and acknowledgements of the importance of managing stakeholders, the survey discovered that there is no proper adoption of the guidelines for stakeholder management as stated in literature.

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Factors Affecting Academic Performance of Architecture Students in Nigerian Private Universities

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ABSTRACT

The role of higher education in the development of nations is well acknowledged. Successful completion of educational pursuits is usually determined by acceptable standard of academic performance. Poor academic performance will often lead to students' dropping out of school, waste of resources and frustration of both students and their parents. There have been serious concerns over the decline in academic performance of students in higher institutions in many parts of the world, including Nigeria. Consequently, the factors determining academic performance of architecture students in selected Nigerian private universities are investigated in this study. This has been necessitated by increasing number of private universities offering architectural training in Nigeria, the challenges they often face and their high financial burden on parents. The survey method was adopted to obtain quantitative data from students in selected schools using structured questionnaire. Data was subjected to both descriptive and principal components analysis (PCA) of factor analysis using the Statistical Package for Social Sciences (version 20). Results indicate that determinants of academic performance are multi-faceted and include learning environment, parents' characteristics and level of study, ethnic group, mother's occupation and source of counselling, students' personal characteristics, learning resources, parents' profession, gender of students and their receipt of counselling services. The paper thus recommends that institutions should strive to provide conducive learning environments including cordial student/lecturer relationships in order to enhance students' academic performance. Findings of the study will provide both government and the universities empirical evidence that will guide policies and reforms aimed at improving the academic performance of architecture students in Nigerian private universities.

Keywords: Academic performance, Architecture, Private universities, Students

INTRODUCTION

Education especially at higher levels plays a crucial role in the economic and social development of nations and individuals. Olotuah (2006) identified architectural education as an important tool in sustaining the health and general productivity of the populace and invariably the achievement of a great and dynamic economy. Unfortunately, the benefits of higher education have eluded many developing countries like Nigeria. Two main reasons adduced by Saint, Hartnett, & Strassner, (2003) include non-articulation of development strategies that link knowledge to economic growth and lack of capacity to do so. Building the requisite capacity has been constrained by several challenges which include poor funding, inefficiency, inequity, dwindling quality and poor governance (Saint, Hartnett, & Strassner, 2003). This is further complicated by poor academic performance of students thereby leading to growing student attrition rates and inability of graduating students to contribute meaningfully to nation building. Poor academic performance places doubts on the ability of graduating students to fit into the work environment, thus resulting in delayed employment or underemployment.

Over the years, there have been growing concerns over decline in the academic performance of students in higher institutions in many parts of the world, including Nigeria. Universities in Nigeria are classified into three namely the federal, state and private universities. Private universities are relatively new, being the latest entrant into the Nigerian university system. Nevertheless, they are projected to dominate the Nigerian university system landscape in the near future. Although a considerable amount of research exists on various factors

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contributing to students' academic performance in higher education the case is different for Nigeria especially for private universities. This paper investigates, from the perspectives of students in selected Nigerian private universities, factors determining academic performance of architecture students in Nigerian private universities. This study has been necessitated by several reasons. First, some authors have opined that the quality of education offered in Nigerian private universities is lower when compared to what obtains in federal and state universities. Second, there is increasing number of private universities offering architectural training in Nigeria. Third, architecture plays a pivotal role in the provision of infrastructure needed for the socio-economic development of any society and the wellbeing of its people. Finally, architectural training places huge time and financial burden on universities, parents and students alike. Consequently, any failed or truncated attempt will not only be wasteful but also frustrating to all stakeholders. Findings from this study could serve as a blueprint for improving academic performance of architecture students in Nigerian private universities in particular and other higher institutions in general.

In the following sections, the paper reviews past research on academic achievement of students; outlines the methodology (including analyses) adopted for the study; presents the findings and concludes with a discussion of the implications of the findings with regard to both future research and present policy.

LITERATURE REVIEW

Higher Education in Nigeria

University education in Nigeria can be traced back to 1932 when the colonial government established the then Yaba Higher College to meet the national need for medium level manpower. In 1948, the University College, Ibadan was established as an affiliate of the University of London (Enahoro & Badmus, 2013). Apparently in anticipation of the manpower need of a post-independent Nigeria, four regional universities emerged in Nsukka, Ife, Zaria and Benin between 1960 and 1970 in addition to a second federal university in Lagos. Following the oil boom of the 1970s, the federal government upgraded the existing regional universities to federal status and established seven new universities across the country. The third generation of universities comprised of both federal and state universities and universities focusing on specific areas of perceived national needs emerged between 1979 and early 1990s. Private universities did not emerge until the fourth dispensation of universities (1991 to date).

As at 1980, the Nigerian higher education system had attained international acclamation wining global recognition in areas like tropical health and agriculture (Saint, Hartnett, & Strassner, 2003). However, the tide turned in the 1980s with a decline which sadly has persisted to date. Reasons adduced for this include rapid expansion of the university system both in number and enrolment; erosion of autonomy of universities by government interference in leadership appointments; poor funding; decline in incentives and rewards for research productivity, teaching excellence and innovation; decay in infrastructure and loss of academic staff to brain drain. Between 1990 and 1997 funding for higher education declined by 27% while student enrolment rose by 79% and the recurrent expenditure /student dropped by 62% (Harnett, 2000).

Evolution of Private University Education in Nigeria

The first three Nigerian private universities were licensed in 1999 and by 2015 the number had risen to fifty nine (59) compared to forty (40) federal and thirty nine (39) state universities. As at 2013, private universities accounted for 10.4% of university admission in Nigeria. The share of private university admission is expected to steadily rise as new ones are licensed and existing ones consolidate and increase their carrying capacities. Other

contributions of private universities include introduction of market-driven programmes, maintenance of stable academic calendar, optimum balance between academic and non-academic staff ratio effective check on the menace of secret cults and increased female participation in university education (Omuta, 2010).

According to Akpotu & Akpochafo (2009), privatisation of education is a global phenomenon. The World Bank (1994) noted the efficiency and effectiveness of the private sector in responding to changing demands by offering broadened educational opportunities. In Nigeria, advocation for private sector participation in tertiary education has been premised on the insufficient carrying capacity of tertiary institutions due to inadequate, overstretched, dilapidated and sometimes improvised facilities (Rufa'i, 2013). Baskerville (1998) attributed emergence of private universities, driven by globalization to cultural change in pedagogy; realisation of importance of human capital in development; growth in international education; willingness and ability of private entrepreneurs to invest in higher education; and expected contributions of university graduates to economic development. Many of the above reasons hold true in the Nigerian context. In addition, scholars including Ige (2013) and Onwe (2013) have identified prolonged academic programmes due to strikes; excessive students population; unmet demand for admission; limited and decaying infrastructural facilities; student unrest and cultism; high teacher-student ratio; fall in the quality of graduates; general indiscipline among staff and students; ineffective resources management and low ranking of public universities;.

Apart from being late entrants into the Nigerian university system, private universities have certain distinguishing characteristics. According to Ajadi (2010), they are self-financing and generally profit-oriented. Many of them also have religious inclinations (Enahoro & Badmus, 2013). In addition, they tend to offer courses that have a premium both in the education and labour markets. Preference is also given to courses that require less investment in terms of infrastructure and equipment. This is in contrast to countries like India where some private universities opt for resource-intensive courses like Engineering and Medicine. Enahoro & Badmus (2013) pointed out the clandestine operation (without license and accreditation from regulatory authorities) of some private universities in Nigeria. Several of those operating legally are constrained with limited number of approved courses, staffing challenges, including high labour turnover and enrolment problems (Oloyede & Adekola, 2010). Staffing appears to be a major challenge as many of the private universities are only able to attract less qualified permanent academic staff. Consequently, staff strength is augmented by reliance on retired academic or sabbatical staff from public universities and adjunct lecturers. In addition, Obasi, Akuchie & Obasi (2014) highlighted the challenges posed by high costs of education and inadequate facilities in many Nigerian private universities.

The Private Universities Inspection and Monitoring Division of the National Universities Commission oversees the running of private universities in Nigeria. Specifically, the Division is responsible for the following: analyses of past accreditation results of private universities; inspection and monitoring visits to private universities; periodic review of the instruments for inspection and monitoring of private universities; database development for the activities of private universities; monitoring of compliance of private universities with the provisions of BMAS (Benchmark Minimum Academic Standards) and other quality assurance guidelines, as well as those of their individual Academic Brief, Master Plan and University Law; regular inspection of private universities to assess compliance with admission guidelines, carrying capacity, curriculum and staff mix and highlighting areas of remediation; participation in ad-hoc activities in the commission; and any other assignment from the Director or Executive Secretary from time to time.

Architectural Education in Nigeria

Architecture is one of the choice courses offered in Nigerian universities. Indigenous training of architects commenced in 1952 at the Nigerian College of Arts, Science and Technology (NCAST), Ibadan which was later relocated to Zaria in 1955 and metamorphosed to the Department of Architecture at the Ahmadu Bello University (ABU) Zaria in 1962 (Arayela, 2001). That same year a second school of Architecture was establishment as a pioneer course at the University of Nigeria, Nsukka in order to meet growing demand for architectural education in Nigeria. A third school of Architecture was established in 1970 at the University of Lagos, Akoka-Lagos. As at 2015, there are twenty seven (27) universities in Nigeria accredited by the Architects' Registration Council of Nigeria (ARCON) to offer Architecture (NIA, 2015). These include eleven (11) federal, eleven (11) state and five (5) private universities.

Many schools operate a two-tier (4-year and 2-year) under-graduate Bachelor of Science (B.Sc.) and postgraduate Master of Science (M.Sc.) degree structure. The universities of technology however adopt the B.Tech/ M.Tech structure with a 5-year/ 2-year structure. The curricula comprise of both practical and theoretical courses. The prerequisite courses however include architectural design, building components and building structures. The design studio and jury system are unique features of all architecture schools. Yorgancioglu (2013) opined that architectural education should cultivate in students values and attitudes along with knowledge, skills and understanding, covered in but not limited to a specific disciplinary area. Thus, architectural education requires scientific and creative approaches that help students acquire skills for logical thinking, analysis, synthesis, induction and deduction needed to effectively tackle design problems.

Academic Performance

Academic performance of students measures the extent to which a student has been able to achieve the set educational goal. It is used to ascertain the academic status of a student which may determine whether such student proceeds to the next level or not. Few literatures have investigated the academic performance of students in private higher institutions and even fewer have focused on students studying architecture in such institutions.

Kyoshaba (2009) investigated factors affecting academic performance of undergraduate students of Uganda Christian University. Variables investigated included admission points, parents' socio-economic status and previous school background. The study found significant relationship between students' pre-admission qualifications, parents' socio-economic status and academic performance, but there was no relationship between mature age points and academic performance. Ali et al (2013) found age, parents' social economic status and daily study hours as significant predictors of the academic performance of university students in a Pakistani university. Meltem (2004) found significant gender differences in academic performance among a sample of Turkish undergraduate students that included students studying architecture. The paper showed that female students outperformed their male counterparts even after controlling for the field of study. This was explained by the general tendency of females attaining maturity earlier than males.

Opoko et al (2014) used panel data to investigate the correlation between pre-admission qualification and academic performance of architecture students in a Nigerian private university. The study focused on a particular subject building structures - a core course for the study of architecture in Nigerian universities. Two conclusions emanating from this study were that: (i) pre-admission scores in mathematics and physics had insignificant impact on students' performance in Building Structures after the second year; and (ii) female architecture students generally performed better than their male counterparts in Building

Structures. Earlier, Adewale & Adhuze (2013) had carried out a similar study on architecture students from selected Nigerian polytechnics. Their study found low correlation between student's academic performance and their pre-admission aptitude in physics and mathematics. Koranteng & Essel (2013) also empirically demonstrated that for architecture students, those with pre-admission qualifications in creative areas like visual arts and technical drawing performed better than their peers. The study examined effects of educational background on students' academic performance in an architecture school in Ghana.

Several studies like Korir & Kipkemboi (2014) have suggested that the school type can influence students' academic outcomes. The study by Alimi, Ehinola, & Alabi (2012) examined influence of school type and facilities on students' academic performance in Ondo State. Although it found significant differences in facilities available in public and private schools, it did not find any significant difference in academic performance of students in both school types. This suggests that facilities may not affect academic performance. Their findings however are at variance with other studies (Oginni et al, 2013; Duruji, Azuh & Oviasogie, 2014) which concluded that facilities had profound influence on academic performance of students. Alos, Caranto, & David (2015) focused on nursing students found teacher-related factors followed by study habits, school-related, personal and home-related factors very significant.

Findings of Tomul & Polat (2013) indicate that school type more than family characteristics is an essential predictor of students' academic achievement. This is in line with literature review by Ali et al (2013) which explained that the educational environment of the school sets the parameters of students' learning outcomes. According to Buder (2000), conducive school learning environments include the physical environment of the school, physical setting of the classrooms, teaching aids/materials and the quality of the teachers. With reference to private schools Ali et al (2013) and Korir & Kipkemboi (2014) rationalize that better funding, small sizes, motivated faculty and access to resources such as computers provide more conducive learning environments which invariably enhance academic performance and educational attainment of their students. Okon & Archibong (2015) opined that stimulating school environments arouse students' desire to learn. Similarly, Ossai-Ugbah (2010) who investigated universities in Nigeria, including private universities concluded that access to modern facilities like automated electronic information services enhanced students' academic performance.

The foregoing review suggests that several factors influence academic performance of students. Variations in results from previous studies can be attributed to differences in the data sets and variables used (Lubienski & Lubienski 2006) as well as methodological and contextual differences. The current paper contributes to the existing body of knowledge by empirically examining the factors that affect academic performance of students enrolled to study architecture in selected Nigerian private universities.

METHODOLOGY

Respondents for this study were drawn from students in the Departments of Architecture in Covenant University, Ota and the Bells University of Technology, Ota. Both schools were chosen because they are the first private universities to commence training in architecture; their sizeable student populations and proximity. Data were collected through a self-reported questionnaire which elicited information on students' personal demographics, parents' socio-economic characteristics and students' evaluation of the learning environments in their respective schools. Hard copies of the questionnaire were distributed to students from the 2nd year through to the 6th year of study in the selected schools and retrieved by the research

team. The questionnaire was developed following a review of literature and feedback from pilot studies which investigated aspects of academic performance in one of the schools investigated. The academic performance of students was captured through the cumulative grade point aggregate, CGPA reported by the respondents. Most studies of this nature rely on the CGPA. A total of two hundred and sixty three architecture students from both schools participated in the survey on a volunteer basis. The collected data were processed using version 20 of the Statistical Package for Social Sciences (SPSS). The variables investigated are categorized into three as follows: students' personal characteristics (level of study; age on admission; gender; ethnic group; receipt of counseling before choosing to study architecture; source of counseling; city of residence), parents' characteristics (highest educational level attained by father; highest educational level attained by mother; profession of father; profession of mother; occupation of father; occupation of mother; family income group) and learning environment characteristics (library; hostels; classroom/studio/workshops; cafeteria; shopping facilities/buttery; relationship with other students; relationship with staff; campus environment).

The quantitative data obtained were subjected to principal components analysis (PCA) of factor analysis. The Kaiser Meyer-Olkin Measure Sampling Adequacy (KMO) value, the Bartlett's Test of Sphericity value and the correlation matrix were examined to ensure appropriateness of factor analysis. Nine factors were extracted based on examination of the Eigen values, the data screeplot and the component matrix. Identified predictor factors were further correlated with personal characteristics of respondents in order to identify any relationships.

FINDINGS AND DISCUSSIONS

Respondents' Personal Characteristics

Results of the data analysis on the personal characteristics of respondents are presented in Appendix 1. The results show that majority of students who participated in the survey were from the Covenant University. About a quarter each of the respondents (24.7% and 24.3%) are in their fourth and third years of study. While 55.1% of the respondents were males, 41.1% were females. Only 3% of respondents were aged over 25 years on admission. 16.3% of the students were below 16 years of age. The age of majority of the respondents ranged from 16 – 25 years. Majority of the respondents are Yorubas (48. 3%) and reside in Lagos (42.6%). Although 51.3% of respondents claimed to have received counseling prior to embarking on their architectural training, counselors differed. Many respondents (46.8%) declined to respond on who they sought counsel from. Main sources of counsel were parents (19.8%), architects (13.7%) and professional guidance counselors (13.3%).

Parents' Characteristics

Results show that respondents' parents are well endowed socio-economically. Most parents (75.7% of mothers and 86.3% of fathers) have university degrees and have some form of employment (91.6% of mothers and 91.3% of fathers). However, only 5.4% of mothers and 36.1% of fathers are professionals in the building industry. While fathers are reportedly mainly self-employed (45.2%) and civil servants (22.8%) mothers are mainly civil servants (38.8%) and self-employed (36.9%). Only 1.1% and 0.8% of respondents' households are classified as low or lower medium respectively. Other households were classified as medium (27.8%), upper medium (47.5) and high (16%) income. Majority of the respondents (47.5%) classified their households as Upper medium income. Others were classified as medium (27.8%) and high (16%) respectively.

Learning Environment Characteristics

To assess impact of learning environment on academic performance, respondents were asked to rate on a Likert scale how they felt various attributes influenced their performance. Results are presented in Appendix 2. While results for shopping facilities were mixed, majority of respondents claimed that the hostels, studios/classrooms and Campus environment played significant roles. Only 3.5% and 12.2% of respondents felt the studios/classrooms and hostels respectively had little or very little impact on their performance. Respondents also claimed that interpersonal relationship with their colleagues and staff significantly impacted on their academic performance.

Factors Predicting Academic Performance of Respondents

To determine the predictors of academic performance of the respondents, principal components analysis (PCA) of factor analysis using SPSS version 20 was carried out on the twenty-two variables earlier identified based on literature and presented in Table 2. Factor analysis also served to resolve multi-colinearity that may arise due to the intercorrelation of the variables. Kaiser Meyer-Olkin Measure Sampling Adequacy (KMO) value of .636 was above the recommended .6 while the Bartlett's Test of Sphericity (Bartlett 1954) reached statistical significance at p = .000. Extraction of factors was done automatically based on components with Eigen values of 1 or above. Nine components with Eigen values above 1 were identified and accounted for 61.21% of the variance. The choice of the nine factors was also supported by the data screeplot that revealed a clear break after the ninth component thus suggesting a nine-factor solution based on Catell's (1966) scree test.

The first factor that essentially captures the learning environment, accounted for 13.60% of the variance. It loaded on seven variables namely: campus environment, relationship with staff, cafeteria, shopping facilities/buttery, relationship with other students, classroom/studio/workshops and hostels. Four variables loaded on the second factor termed Parents' characteristics and level of study that accounted for 8.204% of the total variance. The variables are fathers' occupation, fathers' highest educational level attained, students' Level of study and mothers' highest educational level attained. Ethnic group of respondents was the third factor and accounted for 6.853% of the total variance. Accounting for 6.550% of the variance and loading on the fourth factor named mother's occupation and source of counseling were the occupation of respondents' mothers as well as persons who provided counseling to respondents. The fifth factor, students' personal characteristics accounted for 5.722% of the variance and loaded on age of respondents when they commenced their study and their places of residence. Loading on the sixth factor, learning resources and accounting for 5.390% of the variance was library. The seventh factor, parents' profession loaded on the professions of the mothers and fathers and accounted for 5.289% of the variance. The eighth and ninth factors, respondents' gender and receipt of counseling services accounted for 4.831% and 4.770% of the variance respectively. Description of the predictor factors is provided in Appendix 3.

DISCUSSIONS

The focus of this paper has been identification of factors that affect the academic performance of students of architecture in Nigerian private universities. The results of this study highlighted nine major factors that are believed to affect the students' academic performance. These include learning environment, parents' characteristics and level of study, ethnic group, mother's occupation and source of counseling, students' personal characteristics, learning resources, parents' profession, gender of students and their receipt of counseling services. These are areas that need major attention in any effort geared towards improving students' academic performance. Further examination of the results presented in

Table 6 reveals that many of the variables had values above .5 suggesting that respondents considered them very significant in evaluating their academic performance. The top six variables with values above .6 however were identified to be campus environment (.722), mothers' profession (.684), relationship with staff (.651), cafeteria (.632), fathers' occupation (.619) and Shopping facilities (.610). It is significant to note that income, which was captured in this study by respondents' income group classification of their families, was not considered significant at all. This appears attributable to the homogenous nature of the income composition of the respondents' families, most of who belong to upper medium and high-income groups. Because of the high fees charged in private universities, it is rare for students from poor families to study there. Relationship with other students, Classroom/studios and libraries though significant received less weighting. This suggests the dwindling importance of studio culture and peer review in the study of architecture in private schools. Traditionally, the studio is seen as a second home for architecture students, where they spend greater part of their time. Observations in both schools studied showed that the studio appears to have lost this unique place. Similarly, less importance given to libraries could be due to availability of information technology gadgets like computers, i-pad and internet which have erroneously taken the place of libraries. It may be pointed out here that these gadgets offer limited information compared to the wealth of knowledge available in libraries. The long term effect will be lack of depth of knowledge among students.

The role of learning environment is shown in the fact that four of the six top variables considered very influential in academic performance, namely, campus environment (.722), relationship with staff (.651), cafeteria (.632) and Shopping facilities (.610) are captured by this factor. Although many of the students reported transportation and movement on campus, availability of trees and shades, and aesthetics on their campuses, they considered availability of relaxation spots and gardens inadequate. A conducive campus environment is necessary for students of architecture to think and develop their creativity, a vital skill needed by architects. Ease of movement within the campus will also reduce travel time and create more time that can be dedicated to academic work. Students' relationship with staff in a course like architecture that requires high levels of mentoring and contact hours will no doubt enhance academic performance. Through such interactions and the high level *in loco parentis* observed in one of the schools, students are more relaxed and feel free to ask questions. Cafeteria and shopping facilities provide avenues for students to access their daily needs including food and refreshments needed to nourish their bodies. Several studies have indeed shown that consumption of good quality food is vital to maintaining a healthy body and mind. What is not very clear however is the nutritional quality of the items the students in this study consume.

The other important factors are mothers' profession and fathers' occupation. .8% of the mothers are architects, while 4.6% others are professionals in other building industry disciplines. Majority of the mothers are professionals in other disciplines. Results of cross-tabulation analysis between students' academic performance and their mothers' profession however revealed that there were no significant differences in performance of the students especially when the number of students in each group is accounted for. This suggests that architecture is not hereditary. Further analysis revealed that 45.2% and 22.8% of best performing students are self-employed and civil servants respectively. Children of civil servants and retirees performed averagely.

CONCLUSION

The desire for higher education by many students and their households who are willing to make sacrifices in order to achieve this goal have been sharpened by observed benefits and

imperatives of education over the years. Paramount to the realization of this dream is good academic performance of students. There is thus a need for university administrators to strike a balance between their institutional objectives and the expectations and preferences of their students. In this regard, realistic mechanisms for obtaining honest feedback from students are very crucial. This is more so for private universities offering premium and expensive courses like architecture. This study has identified nine critical factors that influence academic performance of architecture students in the private universities studied. These factors deserve attention from both the institutions and the government regulatory agency. Programme accreditation evaluations should be reviewed to include more robust criteria for evaluating components of the learning environment in line with the findings of this paper. In doing this, more creative and anonymous methods of obtaining students' views are critical.

The size and representative nature of the samples/respondents used in the study reported in this paper support the reliability of the analysis carried out. However, a major limitation of the study is the cross-sectional rather than longitudinal nature of the data set that did not allow for examination of the academic performance of the students over time. It is also likely that school characteristic differences including differences in course curriculum and pedagogical approach may have affected the students' academic performance assessment methods and outcomes. For instance grading criteria and weighting may vary from one school to the other. Another limitation of this study is reliance in respondents' self-reported CGPAs. Although this was done to ensure anonymity of the data collection process which was expected to allow respondents to be truthful in the provision of information, it cannot be ruled out that some respondents may hide under this cover to give fictitious information

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APPENDIX

Appendix 1: Respondents' characteristics

Respondents' Characteristics	Frequency (n)	Percentage (%)
Institution		
Covenant University	198	75.3
Bells University of Technology	65	24.7
Level of study		
200 Level	42	16.0
300 Level	64	24.3
400 Level	65	24.7
500 Level	17	6.5
MSc I	49	18.6
MSc II	22	8.4
No response	4	1.5
Current CGPA		
1.5-2.49	5	1.9
2.5-3.49	42	16.0
3.5-4.49	144	54.8
4.5-5.0	40	15.2
No response	32	12.2
Age of Student on Admission		
Below 16	43	16.3
16-17	65	24.7
18-19	63	24.0
20-25	73	27.8
Above 25	8	3.0
No response	11	4.2

Respondents' Characteristics	Frequency (n)	Percentage (%)
Ethnic group of student		
Ibo	36	
Yoruba	127	
Hausa	55	
Others	55	
No response	38	
city of residence		
Abuja	43	16.3
Lagos	112	42.6
Port-Harcourt	17	6.5
Kaduna	9	3.4
Ibadan	20	7.6
Others	55	20.9
No response	7	2.7
counseling prior to studying architecture		
Yes	135	51.3
No	117	44.5
No response	11	4.2
Source of counseling		
Guidance counselor	35	13.3
Professional in the field	36	13.7
Other professional in the construction industry	6	2.3
Parents	52	19.8
Teachers	8	3.0
Friends	1	.4
Others	2	.8
No response	123	46.8

Appendix 2: Rating of influence on academic performance

Rating of influence on academic performance	Very much	Much	Moderately	Little	Very little	No response
Library						
Frequency (n)	28	49	76	76	27	7
Percentage (%)	10.6	18.6	28.9	28.9	10.3	2.7
Cafeteria						
Frequency (n)	33	31	82	67	43	7
Percentage (%)	12.5	11.8	31.2	25.5	16.3	2.7
Classroom/studio/workshops						
Frequency (n)	130	70	48	7	2	6
Percentage (%)	49.4	26.6	18.3	2.7	.8	2.3
Hostels						
Frequency (n)	72	79	71	22	10	9
Percentage (%)	27.4	30.0	27.0	8.4	3.8	3.4
Shopping facilities						
Frequency (n)	31	41	82	60	41	8
Percentage (%)	11.8	15.6	31.2	22.8	15.6	3.0
Campus environment						
Frequency (n)	84	87	63	15	5	9
Percentage (%)	31.9	33.1	24.0	5.7	1.9	3.4
Relationship with other students						
Frequency (n)	95	90	60	8	4	6
Percentage (%)	36.1	34.2	22.8	3.0	1.5	2.3
Relationship with staff						
Frequency (n)	91	92	70	10	4	6
Percentage (%)	34.6	31.2	26.6	3.8	1.5	2.3

Appendix 3: Description of factors predicting academic performance of respondents

Variables	Factor Loading	Eigenvalue	Percentage of Variance	Percentage Cumulative
Factor 1: Learning environment		*2.992*	*13.600*	*13.600*
Campus environment	.722			
Relationship with staff	.651			
Cafeteria	.632			
Shopping facilities/ buttery	.610			
Relationship with other students	.576			
Classroom/studio/workshops	.564			
Hostels	.540			
Factor 2: Parents' characteristics and level of study		*1.805*	*8.204*	*21.804*
Occupation of father	.619			
Highest educational level attained by father	-.553			
Level of study	.525			
Highest educational level attained by mother	-.423			
Factor 3: Ethnic group		*1.508*	*6.853*	*28.657*
Ethnic group of student	-.470			
Factor 4: Mother's occupation and source of counseling		*1.441*	*6.550*	*35.207*
Whom counseling was received from	.546			
Occupation of mother	-.468			
Factor 5: Students' personal characteristics		*1.259*	*5.722*	*40.929*
City of residence	.452			
Age	.409			
Factor 6: Learning resources		*1.186*	*5.390*	*46.319*
Library	.566			
Factor 7: Parents' profession		*1.164*	*5.289*	*51.608*
Profession of mother	.684			
Profession of father	.420			
Factor 8: Gender of student		*1.063*	*4.831*	*56.439*
Gender	.478			
Factor 9: Receipt of counseling services		*1.049*	*4.770*	*61.209*
Did you receive counseling before choosing your course?	.564			

Mapping of Secondary Educational Institutions using GPS and GIS Technology in Shomolu Local Government Area of Lagos, Nigeria

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ABSTRACT

Mapping of schools as a technical exercise has become a relatively normalized and institutionalized practice in education micro-planning. Its function in offering technical input into any educational micro planning effort is virtually self-evident. Mapping of school is a tabular, graphical or cartographical representation of a particular space or place, school mapping involves the consideration and inclusion of various forms of technical data that impact and "populate" the physical and social context of analysis. In Nigeria, School databases are scattered all over the agencies, and there are those that are not integrated into digital format, thus comprehensive school location analysis using GIS has never been carried out. GIS data, and spatial information data are not available, or not open to the public. The application of GIS to the school mapping is very useful to find the appropriate sites of locating new school buildings efficiently. The major objectives of this paper are; identify and locate secondary educational institutions, determine the wards of educational institutions. Establish relation with educational statistics and its spatial analysis, ratio for population and schools, update of current data with future data needs. The spatial distribution of the schools was achieved and the location of the schools were determined and located in various wards. The wards that need the development of schools were also determined. School Mapping using GIS supports the careful conceptualization and implementation of educational micro-planning required to leverage the emerging global expectation of interactive user-controlled visualization.

Keywords: GIS, Mapping, GPS, School, Database

INTRODUCTION

Mapping of schools as a technical exercise has become a relatively normalized and institutionalized practice in education micro-planning. Its function in offering technical input into any educational micro planning effort is virtually self-evident. It should be noted that school mapping (a process) is not the same as a school map (one typical product of the school mapping process). More than simply being a tabular, graphical or cartographical representation of a particular space or place, school mapping involves the consideration and inclusion of various forms of technical data that impact and "populate" the physical and social context of analysis. As a process that produces specific functional products, SM is fundamentally an educational micro-planning effort focused on increasing school resource efficiency and equity (Caillods, 1983; Varghese, 1997).

GIS school mapping as a term has much been used in educational planning in recent years. Conceptually it covers wider scope of educational planning and management and relates to allocation of resources, efficiency delivery of school system and improving efficiency of learning. Mapping is tool commonly used to reveal the apparent relationships between the distribution of school and the distribution of school age population to be served by them in a given area.

The use of GIS Maps could greatly help improve the frequency with which better decisions are made. It can minimize the irrational and unjustified demand regarding establishment of new school and providing financial support to non-deserving institutions. It makes

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geographical perspectives to education more readily available. Educational planning and scenarios are made simple through the map itself, assuming that an ocular visit to the area could not be made; information about the features are clearly marked with symbols or signs. Present and future requirements can be determined as one goes through the map including the appropriate and comprehensive characterization of the area and its relationship to the other features of the map. GIS database provides comprehensive framework and organization of spatial as well as non-spatial data and has become a focused tool to help planning and decision making. Mapping of an educational institution along with the information of administrative boundary and the biophysical layers such as, major road network, rivers, and major settlements provides the ground reality in terms of geographic coverage and social reality. Reuse of the data for different purpose is another possibility provided by GIS database.

LITERATURE REVIEW

Development and Implementation of School Mapping

School mapping as technical exercise has become a relatively normalized and institutionalized practice in education micro-planning. Its function in offering technical input into any educational micro planning effort is virtually self-evident. It should be noted that SM (a process) is not the same as aschool map (one typical product of the school mapping process; see Figure 1 below). More than simply being a tabular, graphical or cartographical representation of a particular space or place, mapping of schools involves the consideration and inclusion of various forms of technical data that impact and "populate" the physical and social context of analysis. As a process that produces specific functional products, school mapping is fundamentally an educational micro-planning effort focused on increasing school resource efficiency and equity (Caillods, 1983; Varghese, 1997). While the practical and conceptual road in school mapping is well travelled, a very brief review of the origin, typical functions, and standard procedures in school mapping will be presented.

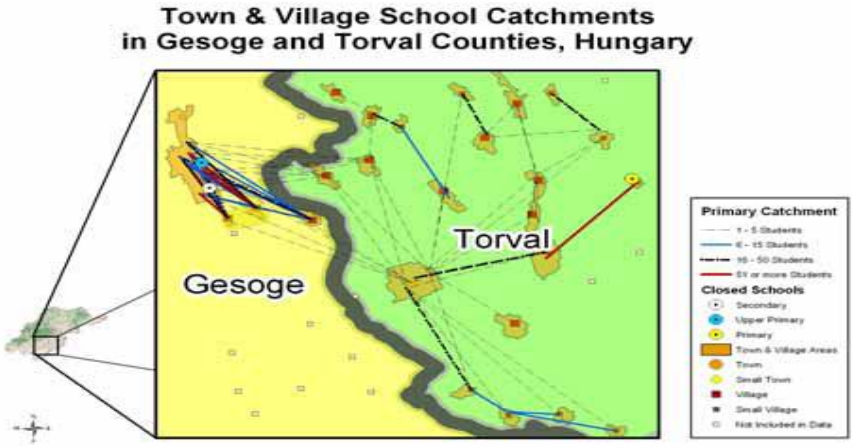

Fig 1: School map of Gesoge and Torval Counties, Hungary (S. J. Hite, 2006)

GIS in Micro-planning

When considering GIS in micro-planning, an obvious question is whether GIS is simply a better, more precise and flexible spatial analysis tool for representing schools and their physical, social and geopolitical contexts or whether GIS provides a different way to understand and plan those contexts geo-spatially. Another relevant consideration is whether GIS, which is clearly a financially and technically costly approach, might in fact create a larger and more challenging set of problems in the tensions between decentralised and centralised participants than has been experienced in school mapping. Before further

exploring whether GIS is simply a tool or is a potentially different approach to micro planning, a brief history of GIS will be valuable preparation.

Brief History of GIS

The mapping of physical and social space to consider and represent complex human-environmental systems perhaps finds its first recorded modern manifestation in Dr. John Snow's 1855 map of the Soho, London cholera outbreak, E. W. Gilbert's Version, 1958 (see Figure 2). Most contemporary efforts at mapping social and physical space, including GIS applications, acknowledge Snow's work as seminal, W. Gilbert's (1958)

Fig 2: E. W. Gilbert's Version (1958) of John Snow's 1855 Soho Cholera Map

While the actual origins of GIS are somewhat in dispute, most experts assert the Canadian Geographic Information System (CGIS) of circa 1965 as the first to develop GIS applications. Most early efforts at GIS were seen as costeffective technical solutions to relatively mundane administrative problems (i.e. planning urban transportation routes). In the 1970's, the real potential of digital computers to facilitate the analysis of geographic information emerged (Goodchild, 2006). The technology "revolution" of the mid- 1970's facilitated the explosive emergence of truly sophisticated GIS solutions by virtue of the rapid development of relational database management systems (RDMS) and the precipitous fall in the cost of computing power with the introduction of mini- and micro-computers by companies like IBM and DEC (Forseman, 1998; Maguire, Goodchild, & Rhind, 1991). Early implementations of GIS were clearly oriented at "GIS as a tool" mechanical operations – specifically, faster and more complex administrative computations. Since national, military and intelligence community applications of GIS bloomed quickly in the 1980's, asocio-political critique of GIS emerged by the late 1980's that generated notions of GIS well beyond mechanical and computational performance. This critique and its repercussions created a wave of analysis, some positive and some negative, around the potential of GIS as much more than a tool (Pickles, 1995).

Finally, compared to disciplines such as quantitative geography and business marketing, education policy and planning has been somewhat of a "reluctant latecomer" to the use of GIS. A number of important works in this area have been produced by the IIEP/UNESCO (Attfield, Tamiru, Parolin and DeGrauwe, 2002; Mendelsohn, 1996). As of yet, however, a consistent consideration and normative inclusion of GIS has not emerged as a consistent strand in education policy and micro-planning. That emergence is not likely to occur unless GIS can be shown to either be an extremely cost-effective and useful tool, or if new ways of GIS-facilitated thinking in education micro-planning emerge as clearly superior to current alternatives.

GIS and School Mapping as Educational Decision Support System (EDSS)

GIS is typically used in most application fields as an advanced and technologically-elegant tool. Even if GIS is considered as simply a better tool, the progress in presentation, preparation and flexibility appear to justify consideration of the benefits that GIS provides to micro-planning as potentially highly significance (Hite 2006).

The contribution of the rapid advancement and innovations in the applications of geographic information system and geo-imaging technology contributes an essential role in planning and decision making process. It acts as the infrastructural base for building on top other information from various perspectives. It is in fact, the current trend in modern organization towards flatter structures and the involvement of many stakeholder groups in solving decision problems based on what can be called spatial decision support system (Jankowaski et. al 1997, quoted in Al-Hanbeli 2005) In developing countries, the need for GIS technology is even more exacerbated as there are more resource management problem as well as urban and rural planning problems and in many situations there is no planning strategies. In this milieu, we need more information to help break down the complication of the problem for decision making.

The trend toward using GIS and school mapping to support decision making in the work is becoming very important for planning purpose (Al-Hanbeli 2005) In order to have proper planning, the educational sector should not start any project unless a comprehensive database of schools, pupils, teachers and resources. Building that part of GIS layers showing school locations and other significant geographic features such as road networks, administrative boundaries, distribution of settlement and public utilities, river system and other geographic features would provide an excellent tool for concerned planners

METHODOLOGY

Data Acquisition

Shomolu Local Govermnent office provided Ward information of our study area and also a complete gazette containing approved public and private primary and secondary schools. Field data acquisition where coordinates of all the schools located in the study area was obtained and this was done using a mobile mapper 12 channel GPS. Digital camera was also used to obtain the pictures of various schools for better visualization and analysis.

Data Manipulation

The aspect of data manipulation is one that requires a great level of precision in terms of data quality and integrity. It involved Data vectorisation

Database development & Management

A database is a collection of data that can be shared by different users. It is a group of records and files that are organized so that there is little or no redundancy. This is possible because in a database, there would be only one file so that an inquirer could ask, for example, either for the name of the owner of a particular property or for details of the property that a particular person owns. The file of names would contain pointers to the address file, and vice versa (Dale and McLaughlin, 1988).

The database was developed using ArcGIS 9.2 by using the already created “shapefiles”., an extension of the ArcGIS software, called ArcCatalogue, was used to create the shape files. These shapefiles represented the different spatial features that were going to be analyzed. These shapefiles were then projected to the same coordinate system as the Satellite imagery and topographic map to ensure conformity and accuracy of results obtained. The next stage of the database development stage was the creation of fields and tables for each of the

Shapefiles. These fields and tables are created so that the attribute or descriptive data for each of features (represented by shapefiles) can be put into them. These tables and fields represent the database via which results can be obtained when queries are performed by the ArcGIS Software. Microsoft Excel was used to create a tabular database for additional attribute data that was needed. The points obtained from the field using the GPS were the different primary and secondary (Public & Private) in the study area. These points were put into the Excel tables. These Excel files were then saved in a .DBF format, so that it could be recognized by the ArcGIS software and subsequently exported into the ArcGIS environment.

FINDINGS AND DISCUSSIONS

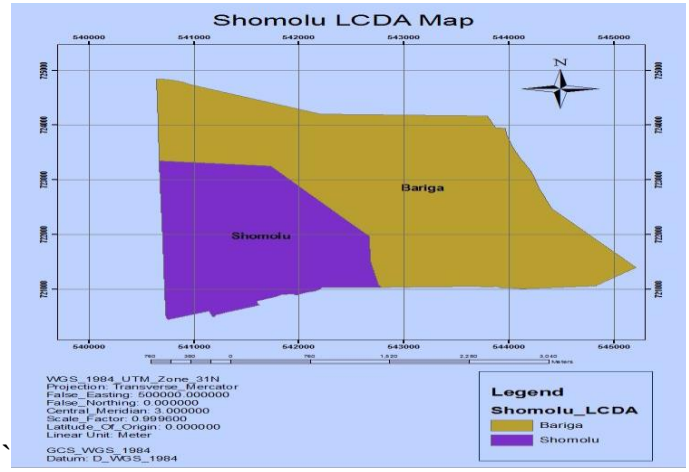

Fig 4.1: Map of Shomolu L.G.A showing the Local Council Development Areas

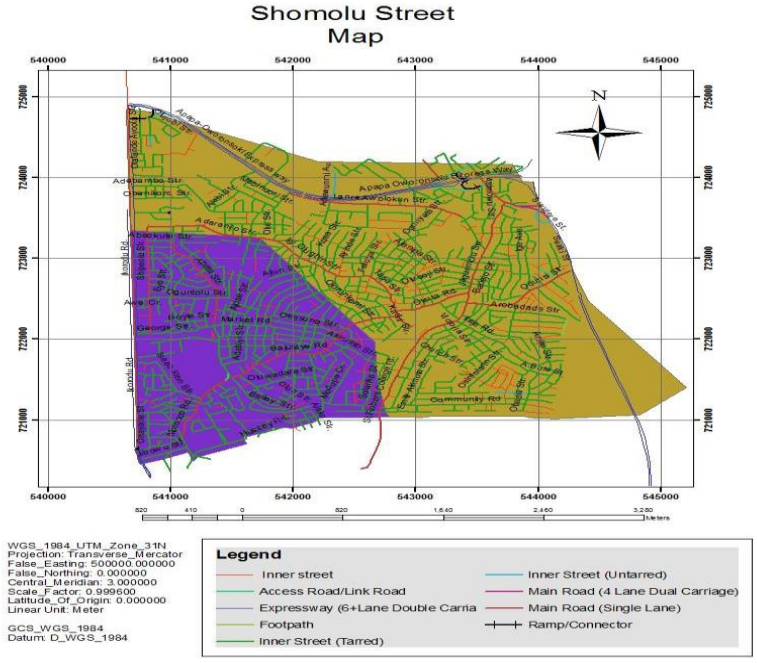

Fig 4.2: Street map of Shomolu LGA showing the different classes of roads

The street map of Shomolu LGA is shown above. Different classes of roads are contained within the Local Government as depicted in the legend above

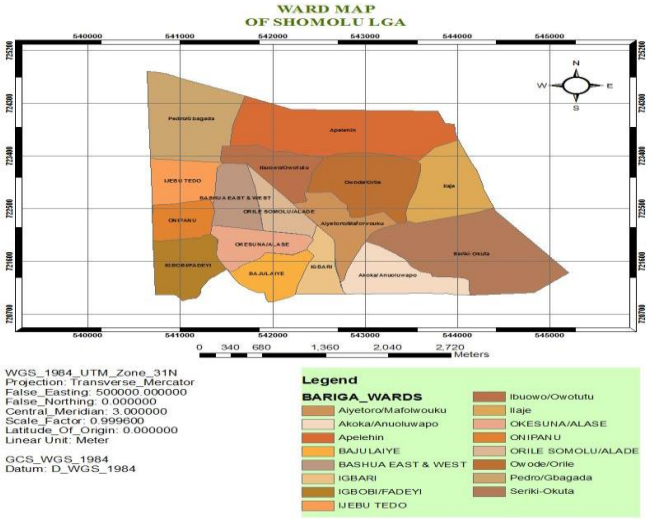

Fig 4.3: Map showing Wards in Shomolu LGA

Figure 4.3 above shows Shomolu LGA divided into wards. The wards are spread across the two LCDA's which are; Shomolu and Bariga.

The wards include: Seriki-Okuta, Ibuowo/Owotutu, Aiyetoro/Mafolwouku, Owode/Orile, Akoka/Anuoluwapo, Pedro/Gbagada, Apelehin, Ilaje, Onipanu, Ijebu-tedo, Orile-Somolu/Alade, Igbari, Igbobi/Fadeyi, Bajulaiye, Bashua East & West and Okesuna/Alase.

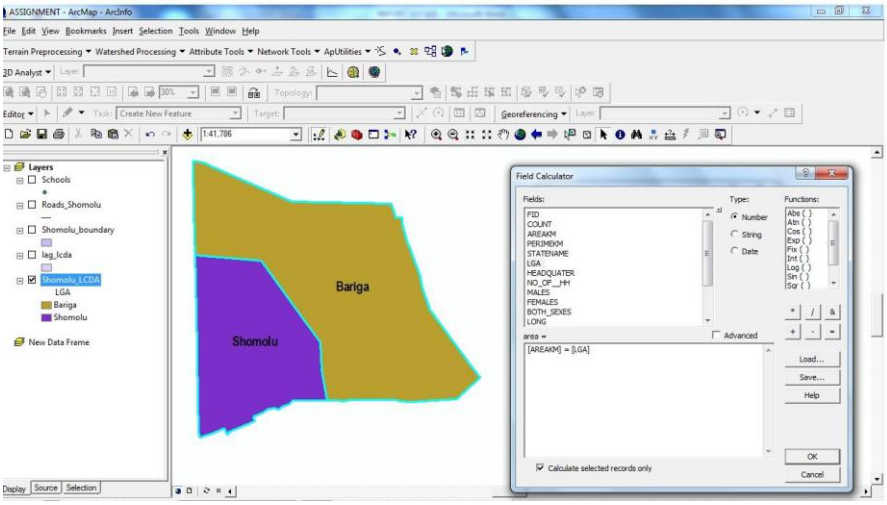

Fig 4.4: Advanced Field calculation

Figure 4.4 above shows a field calculation query. An area calculation was performed on the two LCDA's that make up Shomolu LGA

Table 4.1: Area extent of Shomolu LCDA

LCDA	Area (Square Km)	Percentage
Shomolu	4.35	30.27
Bariga	8.57	69.73
TOTAL	12.92	100

Table 4.1 above shows area extent for the two LCDA in Shomolu LGA. Shomolu LCDA covers an area of about 4.35 Square Km which is 30.27% of the total spatial extent of Shomolu LGA and Bariga LCDA covers an area of about 8.57 Square Km which is approximately 69.73% of the total land extent of Shomolu LGA.

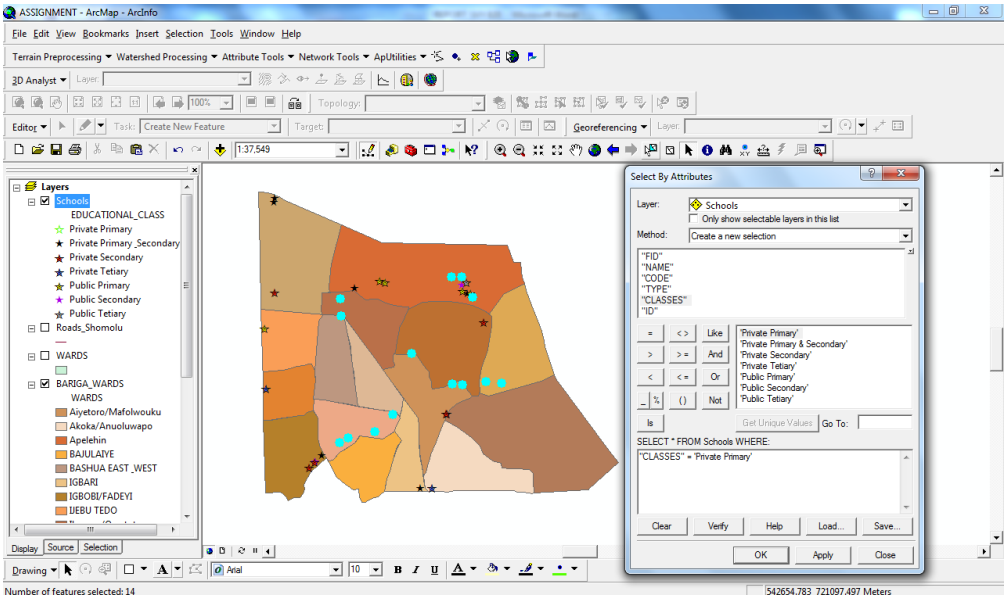

Fig 4.5: Query showing private primary school

Figure 4.5 above shows all the private primary school within Shomolu Local Government Area. The green dots in the figure above shows the private primary schools that are the result of the query performed

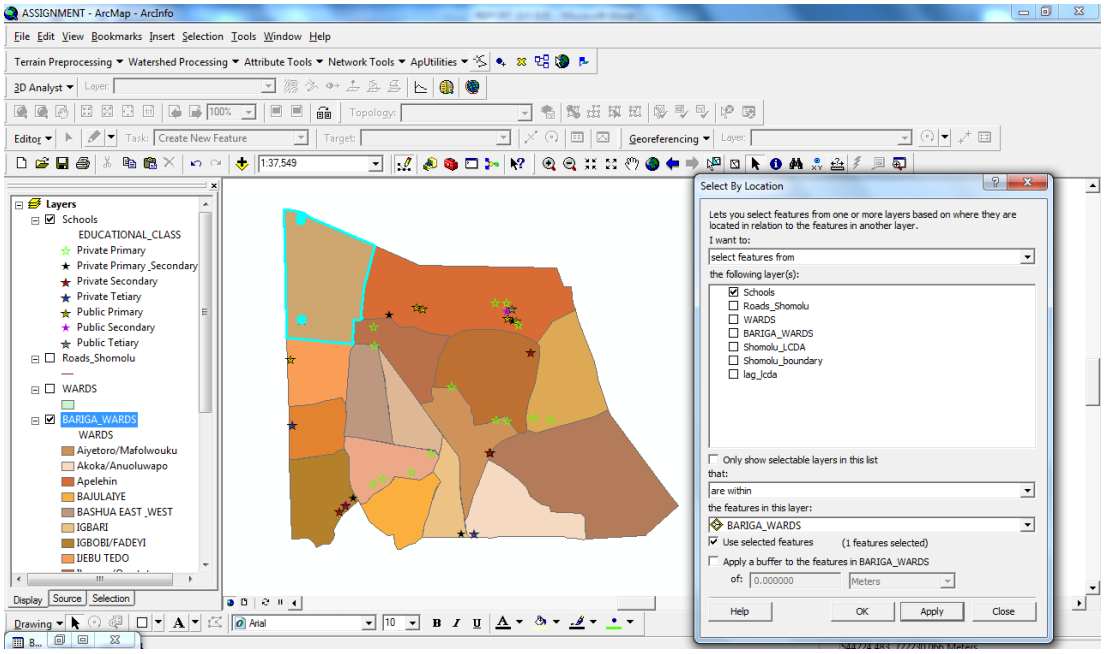

Fig 4.6: Query showing Educational Institutions in a ward

The query performed above shows all the educational institutions that are within Pedro-Gbagada ward in Shomolu LGA. The green dots and line depict the result of the query performed.

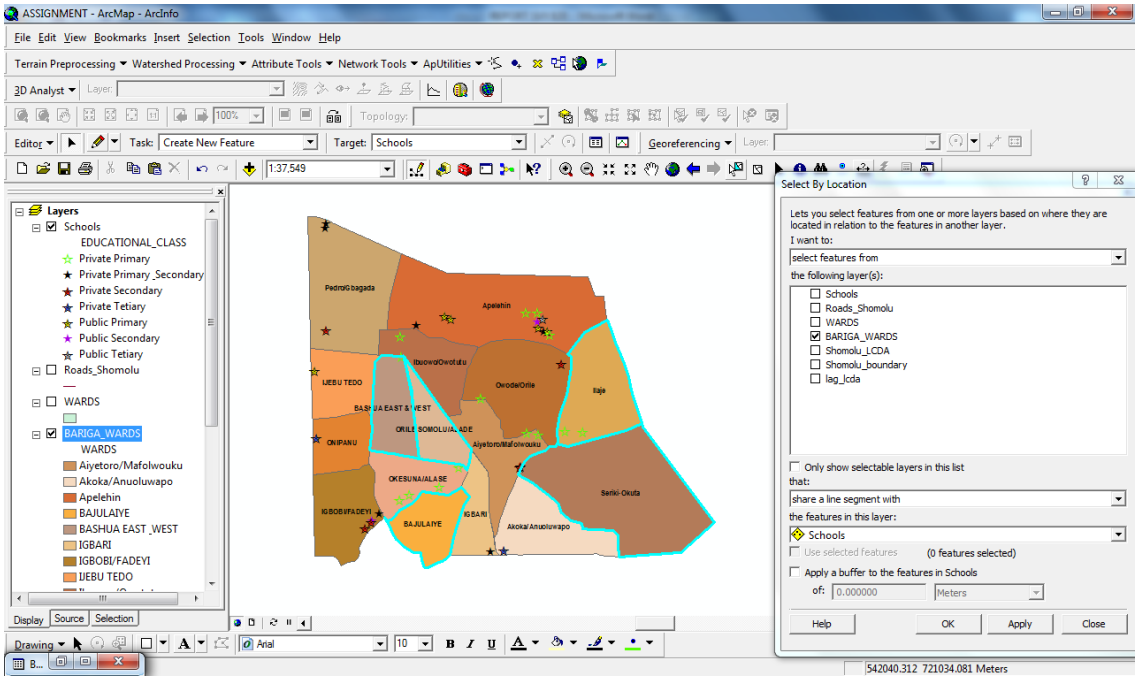

Fig 4.7: Query showing Wards without any educational institutions

The spatial query above shows the wards within Shomolu LGA that do not have any educational institutions within them

Attributes of private_primary

FID	Shape *	NAME	CODE	TYPE	CLASSES	ID
0	Point	Bright Star Nur/Pry Sch.	6	School	Private Primary	6
1	Point	Okemeta Memorial Pry. Sch.	6	School	Private Primary	6
2	Point	Crown Gate Nur/Pry Sch.	6	School	Private Primary	6
3	Point	Prime Rose Nur/Pry Sch.	6	School	Private Primary	6
4	Point	Lantana Private Nur/Pry Sch.	6	School	Private Primary	6
5	Point	Little Rock Nur/Pry Sch.	6	School	Private Primary	6
6	Point	C.M.S Primary Sch.	6	School	Private Primary	6
7	Point	Bishop Howell Memorial Pry. Sch.	6	School	Private Primary	6
8	Point	Adeife Sonpo Akindeko Memo. Pry Sch.	6	School	Private Primary	6
9	Point	Kids 'R' Tops Children School	6	School	Private Primary	6
10	Point	New Hosanna School Nur/Pry	6	School	Private Primary	6
11	Point	Pedro Primary School	6	School	Private Primary	6
12	Point	Adaranijo & Igbehin Adun Pry Sch.	6	School	Private Primary	6
13	Point	Ladi Lak Pry Sch.	6	School	Private Primary	6

Fig 4.8: Database showing private primary schools within the L.G.A

The figure above shows a GIS database containing the complete listing of private primary schools that are within Shomolu L.G.A. some of the schools include Pedro Primary school and New Hosanna nursery and primary school.

Attributes of Private_Secondary

FID	Shape *	NAME	CODE	TYPE	CLASSES	ID
0	Point	Igbobi High Sch.	6	School	Private Secondary	6
1	Point	Igbobi College	6	School	Private Secondary	6
2	Point	Baptist Academy Secondary Sch.	6	School	Private Secondary	6
3	Point	Eva. Adelaja Girls Secondary Sch.	6	School	Private Secondary	6
4	Point	CMS Grammar Sch.	6	School	Private Secondary	6
5	Point	Howell Mem. Grammar Sch.	6	School	Private Secondary	6

Fig 4.9: showing database of private secondary schools within Shomolu LGA

Figure 4.9 above shows a GIS database which contains the list of private secondary schools that are within Shomolu LGA. Some of these institutions include; CMS Grammar school and Howell Memorial Grammar school

CONCLUSION

Social geographers claim that nearly 80% of our thinking and public discourse involves some form of geo-spatial thinking. However, this geo-spatial way of thinking about our world seldom exerts a significant impact on education policy and planning for a number of reasons. Among those reasons is the lack of formal representation, or even a jointly acknowledged way of talking about and presenting the geo-spatial characteristics of our physical and social world – even though so much of our awareness references and indexes space and place.

In future trends in School Mapping and GIS it is important to contemplate that interactive user controlled visual displays of reality, such as those facilitated by Google Earth 2 on the internet, are becoming ubiquitous in most parts of the world. These visual representations are creating an increasing expectation that should indicate a move in educational micro-planning efforts toward more visually-conceptualised and oriented planning at all levels of decentralisation. In this regard, it is reasonable to expect that GIS and other user-controlled visualisation techniques and solutions should become more prominent in education micro-planning efforts in the near future.

These efforts, however, must represent more than simply high-tech versions of static cartographical representations and visualization of complex physical, social and geo-political contexts. New ways of thinking about those contexts will certainly emerge – a more recursive geo- and politico-spatially aware way of thinking in multiple physical and social "layers." Movements toward global awareness, as well as more physical- and cyber-space-mobile populations and contexts, will inevitably lead to different ways of viewing, thinking and interfacing in micro-planning approaches. These approaches will help facilitate more relevant and effective educational micro-planning in a fast-changing "flattening" world (Friedman, 2007).

School Mapping and GIS certainly can, and perhaps should, have a significant role in the education micro planning future. In this visually-oriented and geo-spatially aware future, "a well designed and implemented GIS can draw upon the technical expertise of centralized staff, while preserving, using, and enhancing the context-rich knowledge and ability of locally situated administrators, teachers, and community members" (S. J. Hite & Hite, 2004, p. 61). Nonetheless, tension between the capacities and imperatives of centralized and decentralised participants and agencies will remain.

School Mapping using, GIS can, and most likely will, increasingly support the careful conceptualization and implementation of educational micro-planning required to leverage the emerging global expectation of interactive user-controlled visualization.

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Effective Training for Construction Craftsmen and Optimisation of Productivity in the Nigerian Construction Industry

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ABSTRACT

This research work aims at investigating the most effective training type that can optimize the productivity of the Nigerian construction craftsmen. In achieving this the following objectives were set-up: identification and determination of training types, most severe factors militating against, most suitable and efficient type of training applicable to construction craftsmen in Nigeria. This research adopted literature review, oral interview and use of questionnaires in its methodology. Only construction professionals were used for the ranking of severe hindrances and efficient type of training to be adopted for construction craftsmen. Analysis of findings involved the use of statistical methods (ranking). Hindrances to training were identified as poverty, lack of effective regulatory body, government negligence and lack of support from the construction industry. Lack of effective regulatory body was ranked as most severe with a combined rank agreement of 67.69% while "poverty" was least with 0.00%. Similarly, 22 types of trainings that can be applicable were established. The most efficient type "Vestibule Schools" ranked 83.24% and the least was "Sink – or – Swim" type with 0.03%. This study recommends increase in support both from Government and the construction industry in financing technical and vocational institutions. They should also be instrumental in promoting stringent measures on craftsmen's registration. Regulatory body should also be put in place to monitor the activities of these construction craftsmen.

Keywords: Apprentice certificate, Construction process, Nigerian construction craftsmen, Reservoir of trained replacements, Vocational training

INTRODUCTION

The building industry plays a key role not only in terms of the national economy of any country but stands as a central function in providing the urban fabric necessary for man's progress towards greater civilization. The saying that the level of building achievement and activity in any country is a measure of the country's success correctly reflects the two relevant factors: a high level of building activity indicates a healthy vigorous national economy; and highly developed building forms indicate a high level of construction industry development in a country. (Obiegbu, 2003; Usman, Inuwa, & Dantong, 2012). For the construction industry in Nigeria be able to service the economy, it has to parade competent hands in its operations; this includes credible consultants and contractors with qualified and competent operatives inclusive of craftsmen. The need for maintaining standards in construction operations is overwhelming; it requires investment in research, human and technical capital developments. Critical to this strategy is the empowering of craftsmen, there is a need for continuing upgrading of skills so as to meet the ever-increasing demands in today's constantly changing world. Hence, the need to train its operatives has become imperative so as to meet its responsibility in the economy.

According to Lawal, (2012) training is impacting skills into a person or persons in order to bring him or her to a desired standard of behaviour, efficiency or physical condition. He further defined training as: "submitting a person to discipline and instruction, to educate, to bring up, rear in habits of good behaviour and conduct". This is precisely what must be done in the Nigerian construction industry where, as a result of death of skills it has become

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necessary to educate, instruct and above all, discipline and bring up habits of "good behaviour". Failure to do so will result ultimately in poor on the job performance and eventual unsatisfactory output, resulting in huge correction expenditure. However, training types/methods are numerous, and to achieve the desirable objective of having skilled workforce, it is necessary to adopt the most suitable training types and methods that are affordable and relevant to the needs of Nigeria's construction industry.

Training of Construction Craftsmen in Nigeria

The developmental process of any nation is largely a function of the emphasis placed on human resources development and utilization To achieve this, opines that, first the overall and projected manpower requirements should be identified at all cadres (lower level, middle level and higher level), this will help in knowing whether the expansion of existing educational and training facilities will suffice or the establishment of new ones would be preferable in achieving the national manpower requirements. (Kolawole & Frank, 1999; Olayeni, 2011).

The construction industry according to (Pam, 2002; as cited in Iro, Inuwa & Dantong, 2013) has three broad cadres of manpower needs, which are closely inter-related, one cannot do without the other; these are: the lower technical cadre, the middle - level technical cadre and the professional cadre. The lower level technical cadre, he reported are: labourers and tradesmen; whose qualifications range from apprentice certificate (formally trained) to other formal trade certificate, which fall below the National Diploma. This cadre is one much directly involved in practical construction, with a few of them rising to headmen capacities which includes nominal supervision of specific trades in the construction process. The position of the lower level technical cadres, which includes craftsmen is very sensitive and important to the survival and growth of the industry, because they are the ones directly involved in the practical aspects of construction and a bridge between management and the operative when serving as frontline managers (headsmen of various trades). For a company and for a nation to survive productivity improvement is imperative.

Training of Nigerian Construction Craftsmen has seriously declined as Bamisile (2004 as cited in Lawal, 2012) reported that:-In the time past, many of the tradesmen (craftsmen) were generally trained through trade cadres, vocational training institutes and technical colleges. Some even took examinations at the end of the apprenticeship period such as the examinations of the City and Guild Institute of Great Britain, trade test certificate of the ministry of labour and productivity, etc. it is regrettable to note that, there are no more serious formal vocational training centres for training craftsmen. The average age in trained craftsmen and artisans in Nigeria for instance is between 45 - 50 years. If care is not taken, in another ten years craftsmen and artisans that are really worth their salt would have gone into extinction. Reasons for this situation is not far fetch; Government neglect to funding, let alone enforcement of the training and corruption where craftsmen who care to get these certificates barely pay for them without any requisite training or examination as it used to be. Bamisili concluded that; there is an urgent need to embark on serious, well-funded and coordinated formal training and retraining programs for artisans and craftsmen. This has become necessary in order to address the issues of labour cost and workmanship. According to Abiola, (2004) for enterprises productivity is essential if they are to remain competitive and viable. Enterprises with high productivity are better able to create and sustain quality jobs and are in a better position to pay good wages of their employees. Training of construction craftsmen is imperative to the construction industry, since it is confirmed that training improves productivity and productivity improvement if achieved will ensure survival and growth of an enterprise; of which construction is one.

Statement of the Problem

The construction industry is routinely accused of being wasteful, inefficient, and falling short of quality and working to costs and time schedules. (Osei, 2000 as cited in Iro et al., 2013) . This accusation might be partially due to poor workmanship of the workforce, which can also be traced to the negligence of the employers. Morale in the industry, according to Osei is at its lowest ebb. He stressed that; *companies are concentrating on financial gains and forgetting the people that make the job and money. This perhaps contributes to the poor performance of the industry.* But the fact is that this is more a problem of externality where no contractor is willing to train workers as there is no guarantee that the worker will stay with the company, hence training of all sorts are often undertaking by the industry and government. (Bamisile, 2004; as cited in Dantong, 2006) reported that the industry has a poor performance rating, it is too fragmented, individualistic and out-dated in its operation and thinking.

The impact of the craftsmen in the industry is very conspicuous in its end products, especially where competent craftsmen are involved. However, where an end product of the industry wears a look characterized by poor work, poor quality, low productivity, late completion, cost overruns, increased accident rate, poor work practices and conflicts will also clearly be in evidence. This problem is mostly attributed to poor level of workmanship. (Abiola, 2004) Looking at the craftsmen in the construction industry, they play a crucial role in the practical realization of any construction project, they are mostly engaged in the technical aspect of construction and at the management level serve as frontline manager (supervisor); giving the role of interpreting the company policies into practical realization of the organizational goal of employer. Olayeni, (2011), enumerated qualitative and quantitative deficiencies in workmanship, is one of the factors militating against the attainment of success in the construction industry.

Need for the Study

The nature of the human resource problem and its pervasive effects in the Nigerian construction industry indicate the need for extraordinary action to upgrade managerial and technical skills, broaden their range of skills and enhance their professionalism. Education and training are, consequently, needed at all levels and across a wide spectrum of technical disciplines, indeed, what is required more than ever before is a highly trained cadre of people who are alive to the needs and realities of their own societies, sensitive to cultural values of intrinsic worth, conscious of the social nature of design and imbued with philosophy, which leads to the efficient use of indigenous materials and techniques. (Usman et al., 2012)

Housing, education, religion, entertainment, sport, government, industry, transport, commerce, and all the amenities of civilization all present claims on the resources of the construction industry, and so the activities of the industry never cease. Unless an adequate supply of appropriately trained workers can be ensured, the industry will consistently fail to satisfy the demands of the market for an adaptive, innovative and capable service. The industry has a responsibility to its customers to be an enlightened, progressive employer: the needs of the workforce are inextricably linked with the requirements of its consumers and need must be paid to each. History has shown that the effort of an ill-prepared and disenchanted workforce has failed to produce good service, and as a result, the industry is burdened with a poor image.

Aim and Objectives

The aim of the research is to investigate on the best training type that will optimize the productivity of construction craftsmen in the Nigerian construction Industry. To achieve this aim, the following objectives were set up:

i. To identify factors militating against training of the construction craftsmen in Nigeria.

ii. To determine the most severe factor militating against the training of the construction craftsmen in Nigeria.

iii. To identify the various types of training that can be applicable to the Nigerian Construction Craftsmen.

iv. To determine the most efficient type of training applicable to construction craftsmen that will enhance their productivity in the Nigerian Construction Industry.

Research Hypothesis

H0 - There is a significant relationship between training of construction craftsmen and productivity improvement

H1 - There is no significant relationship between training of construction craftsmen and productivity improvement.

RESEARCH METHODOLOGY

According to Usman et al., (2012) the guiding principle for developing a research strategy is that it must address the research questions. This research is intended to follow this guiding principle to achieve the desired objectives.

This Research collected and adopted both qualitative and quantitative data which is a *triangulation* that offer more clarity and explanation of the research question, leading to possible solutions. Quantitative data refers to data extracted out of existing literature on the subject and used in designing a well-structured questionnaire which was used in collecting the qualitative data through questionnaire survey.

Scopes and Delimitation

The research is concerned with the investigation into the factors hindering training and the different types of training that can be applicable to construction craftsmen in the construction industry with a view to finding the best method of training adopted to improve productivity of the craftsmen. The research confined itself to the following craftsmen: Bricklayers (Mason), Reinforcement Benders/Welders, Carpenters and Electricians. The research work covers the activities of craftsmen in five selected states of Northern Nigeria; Nasarawa, Kaduna, Niger, Plateau and the Federal Capital Territory (FCT). The selection of these cities is for no bias reason but for the fact that they are the major towns in north-central Nigeria where major construction work takes place and due to advantage of proximity.

CONSTRUCTION CRAFTSMEN TRAINING

Types of Training

Apprentices or other workers can have benefit of either day release, which means attendance one day a week at a local technical college or commercial institute, or block release, which means attendance over several weeks at a time. In both cases there is a marriage between "know - how" picked up on the job and the theory/practice learnt elsewhere. Types of training are: Trade group training programmes, Craft apprenticeship courses, on - the - job training, Sink - or - swim method, Sponsor system, Time release training and Self - teaching approaches. (ITF, 2000 as cited in Dantong, 2006). Training types can be further classified as follows:

Evaluation of Training

Training and development programmes should always be evaluated. Typical evaluation approaches include measuring one or more relevant criterion (such as attitudes or performance) before and after the training and determining whether the critical changed.

Evaluation measures collected at the end of training are easy to get, but actual performance measures collected when the trainee is on the job are more important. Trainees may say that they enjoyed the training and learned a lot, but the true test is whether their job performance improved after their training. Usman et al. (2012). According to Iro et al., (2013), Training is said to have "worked" if it accomplishes its objective. Since the training objectives are (or should be derived from the strategic objectives. However, training is only one of dozens of factors that determine if an organization accomplishes its strategic objectives, and one that is often far removed in time from the final result. To harness training effectiveness we need measures of success is required and the need to measure near the time the training has been completed.

Except in academic settings (Pyzdek, 1991; Lawal, 2011) further stressed that imparting knowledge or wisdom is seldom the ultimate goal of training. Instead, he added, it is assumed that the knowledge or wisdom will result in improved judgements, lower costs, better quality, and higher levels of customer satisfaction In other words, the training will produce "observable" results. The results should be the focus of the training plan development and training needs analysis. Training evaluation requires that they be converted to training measurable or objectives. Irrespective of the format of the presentation, the basic unit of training is the lesson. A lesson is a discrete "chunk" of information to be conveyed to learners. The training objectives should form the basis of each lesson, and the lessons must provide guidance for the development of measurements of success. At the lowest level, lesson plans provide the basis of measurement. The objectives in the lesson plan must be specific and designed to attain these specific objectives. The assumption is that by meeting the objectives of all of the training activities, the objectives of the training plan will be met. Finally, it is assumed that by meeting the objectives of the training plan, the objectives of the strategic plan will be met, or at least will not be compromised due to training inadequacies. For evaluation to be complete as a process, these assumptions must be subjected to evaluation. For training to be effective and efficient and subsequently improve productivity of the construction workforce or any business organization, post training evaluation is necessary.

Post Training Evaluation

According to Nmadu, (1998 as cited in Usman et al., 2012) training observations involve a four step process called job instruction training, and it requires that trainees during training be: told how to do it, shown how to do it, asked to perform the behaviour and; given a review of their performance until correct behaviour is learned. For training to be effective and efficient evaluation of the whole process is inevitable. According to Philips, (1996 as cited in Iro et al., 2013) the evaluation process in training involves four elements:

i. **Reaction** - How well did the conferees like the program? This is essentially customer satisfaction measurement. Reaction is usually measured using comment sheets, surveys, focus groups and other customer communication techniques
ii. **Learning** - What principles, facts, and techniques were learned? What attitudes were changed? It is entirely possible that conferees react favourably to training, even if learning does not occur. The learning of each conferee should be quantified using pre - and post - test to identify learning imparted by the training. Results should be analysed using proper statistical methods. In 9 exceptional cases, for example, evaluating a consulting company for a large training contract; a formal designed experiment may be justified.
iii. **Behaviour** - What changes on-the-job behaviour occurred? If a candidate leaves the seminar and immediately begins to effectively apply control charts where none were used before, then the training had the desired effect on behaviour. However, if the

conferee's tests indicate that there is gained competence in the subject matter from the training, but no change in the behaviour took place, the training investment was wasted. Note that behaviour change is dependent on a greater number of factors besides the training, example; management must create systems where the newly learned behaviours are encouraged.

iv. **Results** - What were the tangible results of the program in terms of reduced cost, improved quality and improved quantity. This is the real payback on the training investment. The metrics used for measuring results are typically built into the action plan, project plan and budgets etc. Again, as with behaviour change, there are many factors other than training that produce the desired results.

The Importance of Training

According to Nmadu, (1998; Lawal, 2011) training aims at changing the behaviour at the work place into efficiency and higher performance standards. They pointed out the major values of training are: Increased Productivity- Increase in skill usually result in an increment in both quantity and quality.

Heightened Morale - Possession of needed skills helps to meet such basic human needs as security and ego satisfaction.

Reduced Supervision - Trained employees can perform with limited supervision. Reduced **Accidents** – More accidents are caused by deficiencies in people than by deficiencies in equipment and working conditions, proper training reduces the accident rate.

Increased Organization Stability and Flexibility - The ability of an organization to sustain its effectiveness despite the loss of key personnel can be developed only through creation of a reservoir of trained replacements. Flexibility - the ability to adjust multiple skills to permit their transfer to jobs where demand is greatest. The biggest organizational asset is trained and motivated personnel.

The Effect of Training on Productivity

Like most developing economies, Nigeria has been identified as a region with construction-productivity problems (Izam and Adeagbo, 1999). In an attempt to proffer solution to the problems, much has been done on issues or factors affecting productivity with little or no success. According to (Lim & Alum, 1995; Winch & Carr, 2001) productivity aspect of the Nigerian construction industry is characterised by low productivity as noted by various researchers. The productivity problems cut across both the public and the private sectors (FOS, 1997) noted that capacity utilization of the manufacturing industry in Nigeria was said to be 30% on the average from the time of Structural Adjustment Programme (SAP) in Nigeria in 1986.

Training an aspect of human resources in improving productivity according to Iro et al., (2013) focuses more on doing, "it is job - focused". The emphasis is on maintaining or improving skills needed to perform the current job, or on acquiring new job skills. Often, training is employer - specific and the skill acquired may not always transfer readily to another employer. Bamisile, (2004), observed that in spite of advancement in technology, plant and equipment and in particular robotics, the construction industry is one of the few that still relies on individual skill of a tradesman. Abiola, (2004) reported that managers are being asked to get more mileage out of all their resources: human, financial, informational and materials. To achieve this, training is proffered as one of the "cannon" that can improve productivity. In support of this Dantong, (2006) agreed that staff training enhances and facilitates productivity improvement in any business undertaking. Through improvement and self-development of staff to meet the ever-changing challenge and requirements of new

equipment of new techniques of production and management is a continuous process. When observing the definition of training, which is understood as the process of acquiring knowledge, skills and attitudes for the sole purpose of executing a specific or present job more effectively and efficiently, it can be deduced that training has a positive effect on productivity, hence, a tool for improving productivity.

Factors Militating Against Training of the Nigerian Construction Craftsmen

Osei (2000), stated hindrances militating against training that affects all departments (Junior Technical Workers from maintenance department who are craftsmen, are inclusive) as follows:

Lack of Departmental Approval

Osei, (2000) revealed that most departments in the construction industry view training as a capital intensive venture that increase overheads to their company, as such put them at a disadvantage when tendering for a job, due to high cost reflected in their tender. However, few companies who really acknowledged the importance to training view it as an incentive towards achieving customer satisfaction consequently serve as a marketing mechanism that can improve the company's income in the long run. Training no doubt has been proven by many as a means of increasing productivity; in view of this it is necessary to support the training of construction craftsmen in the industry. Lack of departmental approval can however be viewed as lack of support and encouragement from the company on training.

Lack of Implementation of Training Policies by Organizations

Most companies prefer to recruit operatives they think will no longer require training, this is a measure been adopted by some managers to cut down Cost (ITF, 2002). However, the world is always changing with customer taste changing every day and also innovations coming up every day, to meet the rising demands of people, therefore it is imperative for managers to embark upon training and retraining of their operatives. Most construction companies don't have a training programme, and those that have, hardly implement these policies and programmes in training (Osei 2000).

The Problem of Craftsmen applying for irrelevant Fields of Study

Osei, (2000) revealed that application for irrelevant training programmes is common to the junior staff of the National Institute Kuru, of which the junior technical workers (Craftsmen) are majority. According to ITF, (2002). One main reason why training is believe to be a wasted venture by managers in the industry, emirate from the operatives inability to go for suitable training type/method relevant to their trades.

Lack of Funds

According to Osei, (2000) poverty or lack of funds could hinder someone from undergoing training especially where it involves payments of fees and so on. But the most important thing is the willingness and interest to undergo training is most paramount. He also revealed that training can be capital intensive and because of the "stop go" attitude of the construction industry most operatives hardly sponsor themselves for a training course. In view of the above, hindrances to training of the Nigerian Construction Craftsmen can be summarized as:

i. Lack of support and encouragement from the construction industry.
ii. Lack of effective regulatory body
iii. Poverty/Lack of funds.
iv. Lack of adequate encouragement and support from government for the training of construction craftsmen.

DATA PRESENTATION AND ANALYSIS

The obtained data are presented and analysed using the standard statistical methods explained in 5.1 below. Also simple bar and pie charts are also used for easy understanding of the presentation and analysis of the data at a glance.

Construction professionals with respondents from fifty six (56) Architects, thirty four (34) Quantity surveyors, twenty Six (26) engineers and thirty eighty (38) Builders. All questionnaires were distributed within five (5) states of central Nigeria including the Federal Capital Territory (FCT), Kaduna, Niger, Nassarawa, and Plateau States.

Presentation and Analyses of Construction Professionals' Responses to Questionnaire

Table 1 below shows the random distribution and responses of construction professional to questionnaires in five selected state of Nigeria 80 questionnaires were distributed within the Federal Capital Territory (F.T.C) where 58 of the construction professionals responded, that means 72,5% responded. In Kaduna state, only 6 construction professionals responded out of the 40 questionnaires distributed, that means only 15% responded. In Niger State 38 responded out of 60 questionnaires distributed that means 63.3% responded. Also in Nassarwa State 16 responded from the 40 questionnaires distributed that responded from the 60 questionnaires distributed, that means 60% response was received from Plateau State. A total of 280 questionnaires were distributed, from which 154 responded. Therefore, percentage responses were 51.4. The high response from Abuja, Niger and Plateau states cannot be unconnected to the familiarity of the researcher to the states. (see Figure 1)

Table 1: Distribution and responses of construction professionals to questionnaire

S/No	Location states	No. Distributed	No. responded	% responded
1.	FCT	80	58	72.5
2.	Kaduna	40	6	15
3.	Niger	60	38	63.3
4.	Nassarawa	40	16	40
5.	Plateau	60	36	60
Total	5 states	280	154	51.4

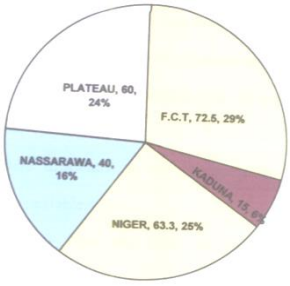

Figure 1: Percentage of Construction professionals to questionnaires in 5 states

Construction professional's responses to questionnaire

Table 2 shows construction professionals' percentage response to questionnaire in five states, which was randomly distributed. In the FCT 19 Architects responded from 25 questionnaires distributed to them with 79% response. Also 11 Quantity Surveyors responded from the 20 questionnaires distributed to them, that is 55% response. And 10 Engineers responded out of 15 questionnaires distributed with 66.67% response. In Kaduna, Niger, Nassarawa and Plateau States, different numbers of questionnaires were distributed to the professionals and different numbers responded as shown on table 2. In the summary from the table 56 Architect responded from 73 questionnaires distributed. That is 76.71% of Architects responded. Similarly 34, 26 and 38 Responses came from Quantity Surveyors, Engineers and Builders respectively from 67, 53 and 67 questionnaires respectively distributed. The resultant percentage responses were 50.74, 49.05 and 56.72 respectively.

Table 2: Construction professionals' response to Questionnaires

Professional		Architects			Quantity surveyors			Engineers			Builders		
S/N	Date	Number distributed	Number of	Percentage response	Number Distributed	Number responses	Percentage response	Number distributed	Number of responses	Percentage response	Number distributed	Number responses	Percentage response
1	FCT	25	19	79	20	11	55	15	10	66.67	20	18	90
2	Kaduna	10	2	20	10	2	20	10	-	0	10	2	20
3	Niger	20	15	75	15	8	53.33	10	8	80	15	7	46.67
4	Nasarawa	10	6	60	10	4	40	10	2	20	10	4	40
5	Plateau	28	14	50	12	9	75	8	6	75	12	7	58.33
	Total	73	56	76.71	67	34	50.74	53	26	49.06	67	38	56.71

Combined Rank Agreement Factor (R.A.F) of Construction professionals on most severe factor militating Against Construction Craftsmen

The combined Rank Agreement factor (R.A.F) on table 4.15 si >ws the most severe factor to be: "lack of effective regulatory body for the Nigerian construction craftsmen" that came 1st with Rank order sum (R. O. S) o 6, Rank Agreement factor (R.A.F) of 1.5 and percentage Rank Agreement factor (PRAF) 53.85 (see table 3).

The least severe factor is poverty/lack of funds that came 4th with Rank order sum (R.O.S) of 13, Rank Agreement factor (R.A.F.) 3.25 and percentage Rank Agreement factor (PRAF) 0.00.

Table 3: Combined Rank Agreement Factor (R.A.F.) of Construction Professionals on most severe factor militating against Training of Construction Craftsmen.

S/N	Types/ Methods of training								
	Factors	Architects	Quantity Surveyors	Engineers	Builders	Rank order sum	Rank Agreement Factor (R.A.F.)	Percentage Rank Agreement Factor (PRAF)	Rank Order
I.	Lack of effective regulatory body for the Nigerian construction craftsmen	1	1	3	1	16	1.50	53.85	1
2.	Poverty / lack of fund	4	2	3	4	13	3.25	0.00	4
3.	Government negligence of training construction craftsmen	3	4	1	3	11	2.75	15.38	3
4.	Lack of encouragement & support for training of construction craftsmen by the construction industry	2	3	3	2	10	2.50	28.07	2

Combine Ranking Agreement of Construction Professionals on Most Efficient Type of Training that can improve productivity

Table 4 below shows the combine ranking agreement of construction professionals on most efficient training type. Vestibule Schools came first with rank order of 1st, 1st, 10l" and 1st from Architects, Quantity Surveyors, engineers and Builders respectively. Vestibule Schools emerge first with a Rank Sum (RS) of 13, Rank Agreement Factor (RAF) of 0.59 and Percentage Rank Agreement Factor (PRAF) 83.25. Trade group training came second with Rank Sum (RS) 15, Rank Agreement Factor (RAF) 0.68 and Percentage Rank Agreement Factor (PRAF) 80.68. Time-release training came third with 20.5, 0.93 and 73.58% as RS, RAF and PRAF respectively. The 20th position was "Action Research" with results 70, 3.18, 9.66 as RS, RAF and PRAF respectively. The last but not the least was Transactional Analysis, which came 21s1 position with RS - 73, RAF - 3.32 and PRAF - 5.68%. The least efficient type/method of training was sink - or - swim training with rank orders 19.5th, 17th, 21st, 20th from Architects, Quantity Surveyors, Engineers respective!) Sink - or - swim

method had Rank Sum (RS) of 77.5, Rank Agreement Factor (RAF) 3.52 and Percentage Rank Agreement Factor (PRAF) 0.00 (see Figure 2). From the analysis of results above vestibule school is the most efficient training type to be adopted for the Nigerian Construction Craftsmen.

Table 4: Combined Ranking Agreement of Construction Professionals of Most Efficient Type of Training for Construction Craftsmen that can Improve Productivity

S/N	Types/ Methods of training	Architects' Rank order	Quantity Surveyors' Rank order	Civil Engineers Rank order	Builders' Rank order	Sum of Rank orders	RAF= $\frac{\text{Sum of Rank orders}}{\text{Number of factors}}$	PRAF = $\frac{RAF_{max} - RAF_{considered}}{RAF_{max}} \times 100$	Rank order (R O)	Rank order (R O)
1.	Trade group training	3	6	3	3	15	0 68	80.68	2	2
2	Craft Apprenticeship programme	7.5	3.5	2	9	22	1.00	71.59	4	4
3.	On-the-job training	6	3.5	9	5.5	24	1.09	69 03	6	6
4.	Sell keeping approaches	22	22	1	22'	67	3.05	13.03	18	18
5.	Sponsor system	10.5	11	4	5,5	31	1.4	59.54	8	8
6.	Time Release training	4	7	5.5	4	20.5	0.93	73.58	3	3
7.	Action research	21	21	7	21	70	3.18	9.66	20	20
8.	in-house training	9	8	8	7.5	32.5	1.48	15.91	16	16
9	Visible schools	1	1	10	1	13	0.59	83.24	1	1
10	Special courses	5	5	5.5	10	25 5	1 16	67 05	7	7
II.	Written materials	14	12.5	1 1	14	51.5	2.34	33.52	1 1	1 1
12.	Lecture method	7.5	12.5	14	15.5	49.5	2.25	36.08	10	10
13.	Conference method	13	14	12.5	15.5	55	2.50	28.98	13	13
14.	Business games	18	19	12.5	17	66 5	3.02	14.21	17	17
15.	Role playing	12	20	15	13	60	2.73	2 44	14	14
16,	Job rotation	10.5	9	18	11	48 5	2.20	37 50	9	9
17.	Apprenticeship and coaching	2	2	17	2	23	1.05	70.17	5	5
18.	Sensitivity training	15	15	16	18	64	2 90	17.61	15	15
19.	Transactional analysis	16	16	22	19	73	3.32	5 68	21	21
20.	Sink or swim training	19 5	17	21	20	77.5	3.52	0 00	22	22
21.	Remedial training	19.5	18	19.5	12	69	3.14	10.80	19	19
22.	Development training	17	10	19 5	7 5	54	2 4 5	30 40	12	12

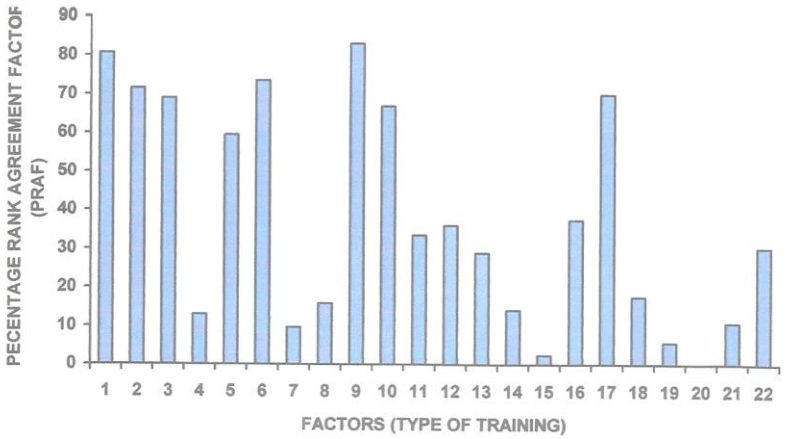

Fig. 2: Combined Ranking Agreement of Construction Professionals of most Efficient Type of Training for Construction Craftsmen that can Improve Productivity

SUMMARY AND CONCLUSION

From the investigations carried out in the form of literature search, twenty- two (22) different types of training were identified. From the analysis also, four factors militating against training of construction craftsmen were also identified. Lack of effective regulatory body was found to be most severe. The types of training were presented in a questionnaire and ranked by professionals in the four sampled groups. Based on the rankings, it was discover that, vestibule school was the most efficient method of training with a combine rank of 83.24%. Sink - o r - swim method was the least efficient type of training with combine rank of 0.00%. The hypothesis test arrived at a Kendall's coefficient of concordance of 0.0469, from which a calculated. X^2 value of 3.9396 was obtained. The critical X value at 5% level of significance and 95% degree of freedom is 32.671, which higher than the calculated X value. This means the null is accepted. From analysis of the responses by construction craftsmen, it was found that the older age-group underwent training more than the younger age-groups. From the summary of the findings above, it can be concluded that;

The Training of Construction Craftsmen is diminishing with time and may die out completely if nothing is done to revive it.

The most severe hindrance to training of the Construction Craftsmen was found to be lack of standard type of training adopted for the Construction Craftsmen in Nigeria. The least severe was found to be lack of funds/poverty.

It was also discovered that the most efficient and effective type/method of training to improve productivity is vestibule school.

RECOMMENDATIONS

In view of the analysis, findings and scope of this study, the following recommendations are made in order to increase the efficiency of training, of the Nigerian construction craftsmen for increase in productivity: -

Government should increase support to technical and vocational institutions to increase standards and to make these institutions attractive for Nigerian construction craftsmen.

The relevant trade bodies in collaboration with Government should ensure high standards by re-designing an appropriate standard curriculum and programmes and adopt standard equipped vestibule schools

Stringent measures be exerted on craftsmen's trade registration. This registration is a situation where a craftsman must have duly passed through a vestibule trade school and duly confirmed qualified to practice and can perform in the trade.

Training and re-training of construction craftsmen in companies should be made compulsory and enforced by government.

Nigerian construction companies should be made to ensure not only the existence of a training policy but its full implementation.

Government should encourage private entrepreneurs who wish to set-up similar training institutions, but insist its conditions.

Recommendations for Further Studies

i. This research work was carried out to improve productivity of the Nigerian construction craftsmen through training based on situations in the Nigerian construction industry. Comparative studies should be carried out in other parts of the world to ascertain productivity of the construction craftsmen through effective training.

ii. The four major hindrances identified as factors militating against the training of Nigerian construction craftsmen, could be studied and analysed further, in order to proffer solutions to the problems of diminishing training amongst construction craftsmen.
iii. Further studies should be carried out on Design of effective curriculum and Establishment of standard programmes for the Nigerian construction craftsmen.

Contribution to Knowledge

Adopting an effective and efficient training type/method can increase productivity. It was discovered with dismay that training of the Nigerian Construction craftsmen is dying out as a result of falling standards of training type. It was also observed that training of craftsmen is fast diminishing with age. Therefore, if the situation is left unchecked; training of the Nigerian construction craftsmen will die out completely in the near future.

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Architectural Transformations in an Educational Facility and its Impact on Teaching and Learning: a Study of the Department of Architecture Ahmadu Bello University Zaria

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ABSTRACT

Transformations are common and generally perceived to bring improvements to the built environment (Sani-Katsina, 2013; 2015) However there are underlying issues with transformations. This study is concerned with looking beyond the physical quality of the educational facility upgrade in the Department of Architecture Ahmadu Bello University Zaria. The aim is to assess the impact of the transformation on teaching and learning. The study is particularly interested in the effect of the transformations on the quality of life of the students in the department of Architecture Ahmadu Bello University Zaria between 2010 and 2015. The study adopts a mixed method strategy and draws on data collected in 2015. The findings show that during the prolonged transitional period the facility users experienced difficulty mostly resulting from lack of instruction and demonstration spaces which impacted negatively on the teaching and learning. This study recommends that architectural transformations in educational facility should be executed when school is not in session. The conclusion drawn gives direction for future policy and research on the general standards and requirements of university regulatory bodies.

Keywords: Architectural transformations, educational facility, quality of life, renovation, upgrade

INTRODUCTION

The Department of Architecture Ahmadu Bello university Zaria has undergone major renovation works which have transformed and upgraded the educational facility in the department. This upgrade was carried out when the school was in session. therefore, the purpose of this research is to study the impact of the Architectural Transformations on Teaching and Learning.

This paper is in two parts; the first part presents the present day physical condition of the department of Architecture. The second part presents the impact of the ongoing transformation on teaching and learning and seeks to contribute to the understanding of the impact on the quality of life of students.

THE DATA COLLECTION TECHNIQUES EMPLOYED

The study has used mixed methods as indicated in Table 1 below.

Table 4: shows the data collection tools and techniques

	Data collection tools and techniques
1	10 number face to face in depth interviews conducted with the academic staff
2	15 number face to face in depth interviews conducted with the students
3	Observation of the physical structure
4	Archives and library for existing records and documents
5	Image recording equipment to capture actions and events through photographs
6	Measuring tapes to determine measurements to produce architectural plans

Present Day Physical Condition of the Department of Architecture

Upgrade is generally considered by researchers to mean architectural transformation (see, Peng, 2012; Sani-Katsina, 2013, 2015; Tipple, 2000). Similarly according to Popoola (1996) upgrade in educational facilities can mean replacement, repair, conversion, improvement enhancement and modernization. This study therefore considers upgrade and renovation to mean architectural transformation.

Sani-Katsina,H. & Shuaib, A. U. (2016). Architectural Transformations in an Educational Facility and its Impact on Teaching and Learning: a Study of the Department of Architecture Ahmadu Bello University Zaria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1259-1263

The reasons for the transformation of the educational facility of the department of Architecture arose from the need to cope with demand in the increase in annual intake of students (NIA/ARCON, 2014), to impart quality education, train and develop creative professionals, produce top grade manpower that measure up to global standard and to maintain the departments position in the development of architectural education in Nigeria and beyond (Department of Architecture, 2014). It is important to note the many changes resulting from the upgrade include a change in the curriculum and this change in the curricular activity was to support the transition of the upgrade from a department to a faculty in order to support academic and teaching staff in their move to a new learning and teaching landscape (Department of Architecture, 2012). However this study focuses mainly on the architectural transformations and its impact on teaching and learning.

Figure 1 and Table 2 below show the present day facilities in the department

Figure 1 shows the workspaces in the transformed studio

Source: Umar 2015

However the implementation and transition phase in educational facility upgrade presents a range of critical issues to consider which Blackmore et al.(2011) discuss, including: security and access, changing perceptions, adaptation, managing transition, school and class size, formation of learning communities, curriculum, school social and academic culture, scheduling and facilitation of group work. According to Darling and Hammond (2002) facilities and spaces may have an impact on teacher and student perceptions. While Bullock (2007) suggests that there is a correlation between renovated educational facility and student learning. In line with this there is the need to assess the impact of the transformation on teaching and learning in the Department of Architecture, Ahmadu Bello University Zaria during the prolonged period of the exercise.

Impact of the Transformation on Teaching and Learning during the Upgrade Exercise

The impact of the transformation on teaching and learning during the upgrade exercise was accessed based on effect on students' performance, lecture delivery mode and students understanding, major inconveniences experienced by teachers and students and finally how the students coped with the situation during the upgrade exercise between 2010-2015.

Through this time staff and students experienced some difficulty in finding venues to conduct lectures and studio sessions as the classrooms and studios were being upgraded. Figure 3 below shows a summary of the students' perception of how the upgrade period impacted on their quality of life

Table 2: Facilities in the department of Architecture based on the NIA/ARCON /NUC Requirements

Spaces/Floor finish/wall finish	NUC/NIA/ARCON Requirements	No. Available	Average Carrying Capacity	Advantages
Lecture room/ Vitrified tiled floor(grey)/ Grey paint	i. Adequate and well equipped classes ii. space allocation and accessories iii. ICT iv. IEQ tools [natural/artificial [supplements]	5	50	i. Advanced technology ii. Adequate space for fast teaching and fast learning iii. Spaces appear wider , more calm and flexible
Offices/ Vitrified tiled floor(grey)/ Grey paint	i. Adequate and well equipped offices for academic and non-academic staff ii. Pc's and accessories iii. IEQ tools	5-small 30-large	1 2	i. To aid teaching and learning ii. Advanced technology iii. Facilitate research works iv. Avenue for brain capacity building v. Spaces appear wider , more calm and flexible
Cafeteria	Provision for eatery/cafeteria	nil	Nil	-
Studio	i. Adequate and well equipped studio ii. Emphasis on studio facilities iii. Manual Drawing tables and stools iv. Digital studio v. ICT connectivity vi. Sockets ports vii. Display areas viii. Smart/white boards ix. Loud Speakers	1-small 2- twin 2- large 1 - medium.	30 200 250 80	i. Maintain studio culture ii. Sharing of new ideas iii. studio design classes iv. Critique sessions
Research laboratory	i. Adequate and well equipped research facilities for staff and students ii. Acoustical tools, survey tools, model tools, testing, iii. Pc's and accessories iv. IEQ tools	2	40	i. Facilitates teaching/learning ii. Technology modernization iii. Facilitate research works iv. Specialization v. Avenue for brain capacity building
Computer laboratory	i. Adequate and well equipped computer laboratory ii. computers & accessories, iii. personal work stations, iv. ICT connections	1	40	i. Aids software skills ii. Facilitate teaching and learning
Data room	i. Adequate and well equipped library for staff and students ii. IEQ iii. Thesis collection iv. Books, journals, articles	1	80	i. Fast learning ii. Facilitate research iii. Avenue for brain capacity building iv. library
Lounge	Provision for staff and students lounge .minimum of one (1) each	1	20-30	i. Relaxation ii. Common room iii. Visitors waiting

Source: Adapted from Umar 2015

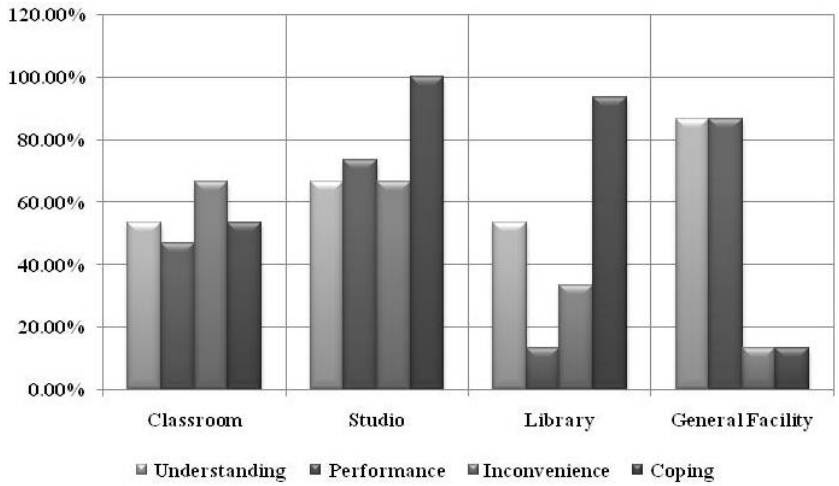

Figure 2: shows students perception on the impact of transformation on teaching and learning in Department of Architecture, Ahmadu Bello University Zaria

Student Performance

Darling and Hammond (2002) and Bullock (2007) agree that there is a relationship between educational facility renovation and student learning. In Figure 2, this relationship is observed when in an interview conducted with 15 students of the department of Architecture, 46.66% and 73.33% of the respondents agreed that lack of classrooms and studios consecutively affected their performance with 66.66% of the respondents adding that lack of classrooms and studios caused much inconvenience and 100.00% of the respondents couldn't cope with lack of studios. In the interview one of the students added that because of the competition for studio spaces the duration for consultation was reduced which lead to the students poor final presentation. However another student (Source, R3S)said it was also difficult for the lecturers to conduct studio sessions as the spaces were over crowded. while another student believes that the insufficient tables, choked circulation spaces " didn't really affect my performance the drop in performance was due to personal issues" (Source, R4S).

This argument is supported by a member of staff who said that;

I don't have all the answers but am doing my best. My worry is how do you give the students back what they have lost?"(Source, L8R1). Other members of staff acknowledge the difficulties associated with teaching and learning design especially within the upgrade period but add; "That the department is in transitional upgrade for positive change. changing from manual/traditional methods to new e-teaching/learning for fast and effective learning and the upgrade changes in the department is in harmony to their history, goals, aim, and objectives"(Source, L5R2).

Another staff said that; "The result is obvious! As a result of the upgrade changes, adequate but technologically sound educational facilities are being provided"(Source, L5R2).

According to the current Head of Department; I am optimistic that we will overcome our difficulties and emerged triumphant"(Department of Architecture, Student's Prospectus, 2012, p. 3)

This is already obvious in the completed general facility which include smart boards, library and computing facility as 86.66% of respondents as indicated in figure 2 believe that this transformation has increased their performance and their understanding as summarised by a student that, " lectures are now very interesting"(Source, R1S)

CONCLUSION

The study has looked at the impact of the architectural transformation on teaching and learning during the upgrade period and found that the many difficulties experienced by staff and students of the Department of Architecture Ahmadu Bello University Zaria resulted mainly from lack of spaces for teaching and learning especially design and studio work. Students believe that during this period the lack of studio culture during the upgrade activity lead to low performance in design. This study did not verify this fact by looking at final grades for the design courses during this period. This is however recommended for further study. Furthermore Staff and students believe that the facility provided at the end of the exercise will move teaching and learning of Architecture in the Ahmadu Bello University to a higher level in terms of technological advancement. This study finally concludes that all transformation works in terms of educational facility upgrade should be carried out when the university is not in session to avoid any inconvenience which will ultimately affect the teaching and learning process.

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Community Participation in Education: The Role of Parent Organizations (POS) in Decision Making Process

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ABSTRACT

Parent Organizations play a vital role in the decision making process in schools. This study was descriptive survey in design. It was aimed at determining the role of Parent Organizations in decision making process in schools. The researcher used teachers and parents as sample for the study. The simple random sampling technique was used. In addition, structured questionnaire was used as an instrument for data gathering. The instrument was adapted and modified from the work of Hammayero (2015). Mean, standard deviation and independent sample t-test were used as data analysis instruments. The study revealed no significant difference between the opinions of teacher and parents on the contributions of parent organizations in school decision making process. The work further revealed the consensus opinions of teachers and parents on the role played by Parent Organizations (POs) in decision making process in schools. In the light of the above findings the researcher recommends the revitalization of Parent Organizations in initial education (Primary and Secondary schools). This will assist in promoting and enhancing community participation in education for better service delivery in Nigerian education sector.

Keywords: Community, Decision-Making, Organizations, Parent, Participation

INTRODUCTION

Parents Organizations (POs) is a formal organization that consists of parents, teachers and non-teaching staff in the school. It is a voluntary association of parents and teachers in a particular school established for its development Hammayero (2015). The main objective of the Parent Organisation (PO) is to help enrich the educational environment and learning experience of all students. The organization is not only concerned with fund raising, but is also involved in the Open Day, Special events, and as a board for development. The main aim of Parent Teacher Association is to provide the school with those items not normally provided by the government and foster more extended relationship between home and school.

The objectives of the organisation assert Murtaza and Khan (2011) are: to work for the well being of every student of the institution in the home, the institution and society, to enhance awareness and understanding of parents that they have a vital role to play in the provision of quality education, to encourage active involvement of parents in improving the standard of the institution, to create awareness among the people involved that optimum use should be made of the educational facilities being offered by the government, and avail expertise of the communities members, to motivate the parents especially in the rural areas to send their children to school, to consider ways and means to decrease dropout ratio and teacher absenteeism in the institutions, to develop a congenial and harmonious relationship between parents and teachers avoiding bureaucratic rigidity on the both sides, to mobilize community resources for improvement of the institution and benefit of the students.

The Federal Ministry of Education in Nigeria insists as a matter of policy, that every approved school (primary or secondary) in the Country must have a functional Parent Organisation (PO) (Abdullahi, 2006). The Federal Republic of Nigeria in its National Policy on Education (FRN, 2013) recognised the importance of parents in the school management when it stated that "the local people particularly parents will be encouraged to participate in

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school management". In compliance to this, there is a PO established in every secondary school in Nigeria. The association is usually headed by a Chairman/Chairperson. According to Onderi and Makori (2013), POs provide a link through which parents and the rest of community assumes a partnership responsibility and in that way participate in the education of their children. In this circumstance, Igwe (1999) highlighted some functions of POs as applicable to public schools (a) promoting better acquaintances and healthy working relations between teachers and parents (b) serves as effective channel of communication between the school a community (c) advise the school staff, the board of governs or the school committee on pressing education needs of the community as perceived by parents amongst others.

Many communities in Nigeria have been playing very useful roles in their local schools. The involvement of parents in school matters in most of the communities is usually through the Parent Teacher Association or Parent Organisations (Ejieh 2005). Some schools asserts Ejieh (2005) still depend on the parents for money with which to purchase examination materials each term. The involvement of the community in the life of their schools has recently gone beyond mere financial contributions. In her study Hammayero (2015) discovered that the Parent Organizations (POs) contribute in the management of secondary schools in the following area: provision of infrastructure, instructional facilities, promotes school-community relationship, maintenance of discipline, decision-making process and extra-curricular activities.

Traditionally, schools have isolated themselves from the communities which they served and teachers would prefer to do their work quietly in their schools with minimum interference from parents and other community members. Parents and other members of the community appear to be no longer satisfied with this state of affairs. Increased parental and community involvement in school affairs is desirable in our quest for the qualitative development of our school system especially in these days of continued cutbacks in the votes for education. Equally desirable in this respect is increased interaction between teachers and parents and other members of their pupils' community (Ejieh 2005).

Schools are located in communities, but are often "islands" with no bridges to the "mainland." Families live in neighborhoods, often with little connection to each other or to the schools their children attend. Nevertheless, all these entities affect each other, for good or ill. Because of this and because they share goals related to education and socialization of the young, schools, homes, and communities must collaborate with each other if they are to minimize problems and maximize results(Adelman & Taylor 2007).

Despite the crucial role played by Parent Organisations (POs) in decision-making process of schools, personal experience and observations revealed that few schools in the study area did have vibrant and functional POs. The problem of this study hinges on a determination of the role of Parent Organisations in decision-making process in schools.

Purpose of the Study

This study is aimed at determining the contributions of parent organizations (POs) in schools decision making process. Specifically, the study examines the views of teachers and parents on the contributions of parent organization in decision making process in schools.

Research Question

i. To what extent do Parent Organizations contribute to decision making process in schools?

Null hypothesis

H_{01}: There is no significant difference between the opinions of teacher and parents on the contributions of Parent Organizations in decision-making process in schools

METHODOLOGY

Design

The design used in this study is descriptive survey design. The study utilized simple random sampling technique to select teachers of primary schools from Zaria Education zone, Kaduna state-Nigeria. The study used structured questionnaire titled "Contributions of Parent Organizations Decision Making Process in Schools (COPODMPS) as an instrument for data gathering. The instrument was adopted and modified from the work of Hammayero (2015). The respondents reacted to each item on a four point scale ranging from strongly agreed (S.A) 4, Agreed (A) 3, Disagreed (D) 2, and Strongly Disagreed (S.D) 1. The instrument was duly validated. The study's research question was answered using mean and standard deviation. In addition, the t-test independent sample was used in testing the research hypothesis at 0.05 level of significance.

RESULTS AND DISCUSSIONS

Research Question: To what extent do Parent Organizations contribute to decision making process in schools?

Table 1.1 Opinions of parent and Teachers on the Contributions of parent organizations in decision making process in schools

S/N	ITEMS	Respondents	Response Categories				Mean	STD
			SA	A	D	SD		
1	POs participates on students disciplinary decisions in the school	Teachers	130	12	62	13	3.1935	1.0449
		Parents	71	14	59	9	2.9605	1.0443
2	POs participates in decision making process that involves staff discipline	Teachers	113	57	18	29	3.1705	1.0556
		Parents	74	51	19	9	3.2415	.8887
3	POs participates in decision making process that involves procurement in the school	Teachers	149	25	6	37	3.3180	1.1407
		Parents	126	13	2	12	3.6536	.8531
4	POs participates in decision making process that relates to recruitment of teachers	Teachers	114	55	36	12	3.2488	.9243
		Parents	87	30	27	9	3.2745	.9544
5	POs participates in decision making process that relates to school time tabling	Teachers	43	129	31	14	2.9263	.7722
		Parents	42	93	11	7	3.1111	.7214
6	POs performs an advisory role on school expenditure	Teachers	95	66	40	16	3.1060	.9539
		Parents	62	53	26	12	3.0784	.9426
7	POs liaises with the school heads to advice the government on appropriate projects needed in the school	Teachers	99	57	42	19	3.0876	.9984
		Parents	70	39	21	23	3.0196	1.0970
8	POs ensures that projects and contracts awarded by the government are executed	Teachers	83	75	28	31	2.9677	1.0425
		Parents	43	50	28	32	2.6797	1.0951
9	POs advices on review of school fees	Teachers	86	85	17	29	3.0507	1.0056
		Parents	82	53	5	13	3.3333	.8959
10	POs assists in organizing extra lessons for students	Teachers	89	36	68	24	2.8756	1.0750
		Parents	45	18	63	27	2.5294	1.0946

Decision Mean= 2.50

The Outcome of the statistics in table 1.1 revealed the opinions of teachers and parents on the contributions of Parent Organizations (POs) to decision making process in schools. Therefore, taking into account the decision mean of 2.50 against the individual mean of the items in the table1.1 above, it can be concluded that the responses were positive as all the individual mean of the items as seen in the table were higher than 2.50 decision mean. In another development, their cumulative mean responses were 76.7097 and 76.4967 for teachers and parents respectively. It can therefore be deduced that Parent Organizations (POs) contribute to schools decision making process.

Hypothesis Testing

H_{01}: There is no significant difference between the opinions of teacher and parents on the contributions of Parent Organizations in decision-making process in schools.

Table 1.2: Independent t-test sample statistics on the mean opinions of teachers and parents on the contributions of parent organizations to decision making process in schools

Gender	N	Mean	std.dev	Df	t-Cal	t-Crit	Sig (p)
Teachers	**217**	**76.7097**	**6.59360**				
Parents	**153**	**76.4967**	**6.43093**	368	0.309	1.96	0.757

Calculated p > 0.05, calculated t < 1.96 at DF 368

The result emanating from the above Independent sample t-test statistics showed that there was no significant difference between the views of teachers and parents on the contributions of Parent Organizations (POs) to school decision making process. This was due to the fact that the calculated significance (P) value of 0.757 is higher than the 0.05 alpha level of significance while the calculated t value of 0.309 is lower than the 1.96 critical t value at Df 368. Similarly, their calculated mean responses were 76.7097 and 76.4967 for teachers and parents respectively. Therefore, the null hypothesis which states that there was no significant difference between the views of teachers and parents on the contributions of Parent Organizations (POs) to decision making process in schools is hereby retained.

Major Findings

The study revealed no significant difference between the opinions of teacher and parents on the contributions of Parent Organizations in school decision making process in the areas of disciplinary matters affecting staff and pupils', decision on procurements, decisions on recruitment and school time tabling, advisory role, oversight roles and financial assistance in organising extra-lessons among others. The study further revealed the consensus opinions of teachers and parents on the role played by Parent Organizations (POs) in decision making process in schools.

Discussion on Findings

The study revealed that Parent Organizations (POs) play an important role in school decision making process. The finding of this study corresponded with that of Hammayero (2015). In her study Hammayero (2015) discovered that the Parent Organizations (POs) contribute in the management of secondary schools in the following area: provision of infrastructure, instructional facilities, promotes school-community relationship, maintenance of discipline, decision-making process and extra-curricular activities. This study centred on the role of parent organisations in decision making process in primary schools while that of Hammayero looked into the organisation's role in management of secondary schools. Although this study centred on only one aspect of management (decision-making process) it further validates Hammayero's findings on the crucial role played by POs in decision-making process and by extension the management of secondary schools. This study filled the gap left by Hammayero as her worked covered only primary schools. This study in an attempt to bridge the gap used primary schools as case study.

CONCLUSION

Based on the findings of this study, it is concluded that Parent Organisations' (POs) participation in schools is an important way a community can participate on matters effecting education of their children in Nigeria especially in primary schools that concerns this study. The benefits of POs in decision-making process as identified by this work include: disciplinary matters affecting staff and pupils', decision on procurements, decisions on

recruitment and school time tabling, advisory role, oversight roles and financial assistance in organising extra-lessons among others.

RECOMMENDATIONS

Based on the above findings this study recommends the revitalization of Parent Organizations in primary schools in the study area. This will assist in promoting and enhancing amicable and just resolutions on disciplinary matters affecting staff and pupils', effective and all-inclusive decisions on procurements, recruitment and school time tabling, advisory role, oversight roles and financial assistance in organising extra-lessons in order to minimize problems and maximize results.

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Promoting Environmental Sustainability for the Attainment of Agenda 2063 in Nigeria: The Role of Social Studies Education

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ABSTRACT

The symbiotic relationship between man and his physical environment is an important area of interest to social studies education. This study assesses the opinion of students on the role of Social Studies Education in promoting environmental sustainability for the attainment of Agenda 2063 in Nigeria. The study was descriptive survey in its design. One question was answered using Frequency counts, Mean and Standard Deviation and a null hypothesis was tested using independent sample t-test at 0.05 level of significance. The respondents were NCEII & NCEIII Social Studies students of the two Colleges of Education in Niger state-Nigeria. The instrument for data collection was Social Studies Environmental Sustainability Questionnaire (SSESQ). The study discovered that the students regardless of their study level have positive opinion on the potency of social studies education to promote the development of sustainable environment. In the light of the findings made, the study recommends the teaching of social studies at all levels of education in Nigeria and a need for the government to use social studies as a means to create awareness and enlightenment campaigns on the need to promote environmental sustainability among its citizenry.

Keywords: Agenda 2063, Environment, Nigeria, Social Studies, Sustainability

INTRODUCTION

Background Statement

Social studies has been defined as the study of man and his physical and social environment. According to Dubey and Barth (1980) in Muhammed (2014) among the focus of social studies education is the creation of an "awareness and understanding of the evolving social and physical environment, its natural, man-made, cultural and spiritual resources, together with the rational use and conservation of these resources for development". In a related development, Dubey and Barth (1980) cited in Salihu (2015) state that one of the objectives of social studies is to develop in the students an appreciation of his cultural heritage and a desire to preserve it". Thus, social studies education strives towards sustaining and preserving the physical environment through its teachings and advocacies at all levels of education where it is offered. Students of social studies often embark on excursions under the guidance of the school at regular intervals to acquire first-hand information on the nature, typology and geographical distribution of environmental challenges with a view to determine their causes, effects and the way forward. This is because social studies education asserts Ololobou (2010) is a problem-oriented area of study and a response to the problems of society with a view to seeking rational solutions to the identified problems.

The symbiotic relationship between man and his physical environment is an important area of interest to social studies education. This is because man and the environment are inseparable twins. They co-exist side by side. Man influences his physical environment and he is in turn influenced by the environment. The relationship between man and the environment has been mutual from time immemorial. The advancement in the area of science and technology in recent times have made this mutual man-environment relationship to be less mutual and more of parasitism in favour of man and at the detriment of the physical environment. Human beings in an attempt to make ends meet depletes and injures the environment. In the light of the above Jimoh (2000) in Ibimilua & Ibimilua (2014) observes that man-environment

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interaction emanates from the effort by man to meet his needs, and that allowances have never been made to accommodate possible environmental stress. According to Ibimilua & Ibimilua (2014:248):

> *"Human activities in Nigeria have also resulted into environmental challenges like biodiversity loss, oil spillage, bush burning, urban housing problem, water scarcity, as well as pollution (water, soil, air, marine, noise, thermal, radioactive and vehicular). Broader worries have also arisen about the environmental challenges of deforestation, urban flooding, destruction of aquatic habitats, over-exploitation of forest resources, illegal mining activities and dereliction, road transportation mishaps as well as solid waste problems (municipal, agricultural, industrial, hazardous radioactive and biomedical). Other forms of environmental degradation are desert encroachment, ozone layer depletion, global warming, poor environmental sanitation, unlawful exploitation of fossil fuel resources, oil spillage, gas flaring and many other challenges relating to oil exploration and production. The environmental challenges are aggravated by poverty and rapid increase in human population."*

This brings about the issue of sustaining the environment for healthy living by the present occupants (living things) and for the future generation.

Environmental sustainability is aimed at utilizing the environment without depleting it or causing serious injuries to it. Environmental sustainability is defined as responsible interaction with the environment to avoid depletion or degradation of natural resources and allow for long-term environmental quality (study.com). The practice of environmental sustainability helps to ensure that the needs of today's population are met without jeopardizing the ability of future generations to meet their needs.

One of the critical issues of concern to most national governments world over is the need to stem the rate of environmental challenges caused by various human and industrial activities. However, recognizing the importance of a sustainable environment to overall national and continental development, the African Union (AU) in 2013 incorporated environmental sustainability in its vision for the future tagged Agenda 2063. Agenda 2063 according to African Union Commission (2014) is "a shared strategic framework for inclusive growth and sustainable development and a global strategy to optimize the use of Africa's resources for the benefit of all Africans. Among the ambitious aspirations of the African Union in the agenda 2063 is the promotion of "Environmentally Sustainable and Climate Resilient Economies and Communities". The above implied that by 2063 Africa will be recognized globally as a continent respectful of its environment, ecologically conscious with well-established green economy and green energy. The aspired prosperity of Africa will be based on inclusive growth and sustainable development (AU Commission 2014).

The Nigerian environment not only plays a vital role in life support system, it particularly provides the basic resources for virtually all socio-economic activities in the country (Nwachukwu, 2002:1) in Ibimilua & Ibimilua (2014). Human actions can deplete natural environment, and without awareness of environmental sustainability methods through education and enlightenment as did social studies education, the long-term viability can be compromised.

Nigeria is a bonafide member of the African Union and an active partner in the formulation of Agenda 2063. Apart from being a signatory to the Agenda 2063, Nigeria has a long history of environmental issues and challenges of various nature, typology and magnitude that need

to be checked. There is a unanimous decision by all stakeholders throughout the world that environmental degradation should be effectively and completely checked using any means possible. Education is an all-time tool for creating awareness and understanding of the various challenges facing human habitat with a view to finding out lasting solution to these problems. Social studies education is an aspect of education that is aimed at instilling the right types of attitudes, values, skills and competencies to enable man solve his socio-economic, political and environmental challenges. Studies have shown that social studies education is a viable tool for attitudinal change and adjustment among its adherents. The problem of this study hinges on a determination of the role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria.

Objective of the Study

The main objective of this study was to determine the Role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria. In the light of the above, the following specific objective was stated:

i. To determine the opinion of students on the Role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria relative to their study level.

Research Question

On the basis of the objectives identified above, the following question was raised:

i. To what extent does the opinion of students differ on the Role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria relative to their study level?

Research Hypothesis

In the light of the above, it is hypothesized thus:

H_{01}: There is no significant difference between the opinions of students on the Role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria relative to their study level.

Scope of the Study

The study is delimited to NCEII and NCEIII students of social studies in Federal College of Education, Kontagora and Niger state College of Education, Minna, Niger state, Nigeria.

RESEARCH METHODOLOGY

Design and Sampling Procedure

The design of the study was descriptive survey. The simple random sampling technique was used in selecting the required sample size. A total number of 280 student respondents from NCEII and NCEIII were sampled. The decision to use the sample size was based on the Krejcie and Morgan table (1970) and Research Advisors (2006).

Instrumentation

The study used structured questionnaire titled “Social Studies Environmental Sustainability Questionnaire (SSESQ). The instrument was validated by experts for content and construct validity. The Cronbach alpha formular for determining reliability co-efficient of instrument was used and has been found reliable for the main work.

Data Collection and Analysis

The distribution and retrieval of the questionnaires was done simultaneously. This is aimed at reducing unnecessary loss of the questionnaires.

The data analysis was done using mean and standard deviation in the case of answering the question raised by the study. The null hypothesis was tested at 0.05 level of significance using independent sample t-test. The choice of t-test was based on Ekeh (2003), who states that t-test should be used in comparing two mean. The hypothesis tested in this study has two mean.

Table1.1 Descriptive statistics on the mean opinion of NCEII & NCEIII students on the role of social studies education in promoting environmental sustainability

S/No	Items	Study Level	Response Patterns SA	A	D	SD	Mean	Stan Dev.	Remark
1	Social studies education develops knowledge of the interconnections and interdependency of ecological, social, and economic systems	NCEII	70	54	31	23	2.9607	1.0134	Agreed
		NCEIII	52	28	14	8	3.2157	.9608	Agreed
2	Students of social studies acquire and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote environmental sustainability	NCEII	66	55	32	25	2.9101	1.0538	Agreed
		NCEIII	41	39	14	8	3.1078	.9217	Agreed
3	Students of social studies engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments	NCEII	71	67	24	16	3.0843	.9440	Agreed
		NCEIII	40	30	19	13	2.9510	1.0471	Agreed
4	social studies education develops in the students critical appreciation of the concepts of sustainable development and conservation	NCEII	66	55	32	25	2.9101	1.0535	Agreed
		NCEIII	41	39	14	8	3.1078	.9217	Agreed
5	social studies education increases in the students' knowledge and awareness about the environment and associated challenges	NCEII	82	54	25	17	3.1212	.9855	Agreed
		NCEIII	40	30	19	13	2.9510	1.0471	Agreed
6	Social studies education develops in the students the necessary skills and expertise to address environmental challenges and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action	NCEII	52	51	45	30	2.9022	1.0662	Agreed
		NCEIII	41	39	14	8	3.1076	.9217	Agreed
7	Students of social studies learn skills, perspectives, and values that guide and motivate them to seek sustainable livelihoods	NCEII	82	54	25	17	3.1292	.9858	Agreed
		NCEIII	40	30	19	13	2.9510	1.0471	Agreed
8	Students of social studies demonstrate understanding of how the health of the ecological, social and economic systems determines the sustainability of natural and human communities at local, regional, national, and global levels.	NCEII	50	16	104	8	2.6067	.9462	Agreed
		NCEIII	25	10	62	5	2.5392	.9192	Agreed
9	Students of social studies investigate variety of ways in which different societies respond to and value the environment	NCEII	64	58	32	24	2.9101	1.0396	Agreed
		NCEIII	40	30	19	13	2.9510	1.0471	Agreed
10	Students of social studies use technology to collaborate, communicate, generate innovative ideas, investigate and solve environmental problems	NCEII	73	64	24	17	3.0843	.9619	Agreed
		NCEIII	41	39	14	8	3.1078	.9217	Agreed

Decision Mean 2.50

RESULTS AND DISCUSSIONS

Answering Research Question

Details from table 1.1 above reveal the mean opinions of NCEII and NCEIII students on the role of social studies education in promoting environmental sustainability for the attainment of Agenda 2063 in Nigeria. The frequency counts, mean and standard deviation were used to analyse and interpret the response pattern of the respondents in relation to their study level. The decision mean adopted for determining the response pattern of the respondents on all the questionnaire items was 2.50.

Looking at the individual mean responses of the entire questionnaire items in relation to the decision mean adopted for the study (2.50), it can be deduced that the response pattern of the respondents was positive. This is because of the fact that the individual mean response was equal to or greater than the decision mean (2.50). In the light of the above, it can be said that the respondents regardless of their study level, agreed with all the statements presented in the questionnaire. Based on this therefore, it can be said that both NCEII and NCEIII student respondents had high positive opinion on the ability of social studies education to promote environmental sustainability for the attainment of agenda 2063 in Nigeria.

Test of Hypothesis

H_{01}: There is no significant difference between the opinions of students on the Role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria relative to their study level;

Table 1.2: Independent t-test sample statistics on the mean opinion of respondents on the role of social studies education in promoting environmental sustainability relative to their study level

Variable	Study Level	N	Mean	STD	DF	t-cal	t–crit	Sig (p)
Opinions of NCEII & NCE III on the role of social studies education in promoting environmental sustainability	NCEII	178	83.20	8.25				
						0. 96	2.00	0.
	NCEIII	102	84.19	8.33	278			34

Calculated p > 0.05, calculated t< 2.00 at DF 278

Results of the above independent t-test statistics in table 1.2 above showed that there was no significant difference between the opinions of students on the Role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria relative to their study level. Reason being that the calculated significance (P) value of 0.34 is higher than the 0.05 level of significance while the calculated t value of 0.96 is lower than the 2.00 critical t value at DF 278. However, their calculated mean opinions were 83.20 and 84.19 for NCEII & NCEIII student respondents respectively. Therefore, the null hypothesis which states that there is no significant difference between the opinions of students on the Role of Social Studies Education in promoting Environmental Sustainability for the attainment of Agenda 2063 in Nigeria relative to their study level is hereby retained.

Summary of Findings

In the light of the above, the study discovered that there was no significant difference between the opinion of NCEII and NCEIII students on the role of social studies education in promoting environmental sustainability for the attainment of agenda 2063 in Nigeria. In addition, the students regardless of their study level have positive opinion on the ability of social studies education to promote the development of sustainable environment.

Discussion on Findings

The study discovered that social studies education is a viable tool for promoting environmental sustainability for the attainment of agenda 2063 in Nigeria. It has been mentioned earlier that social studies education centres on man and his environment. It

studies mutual relationship and parasitism between man and the environment. Social studies is a viable tool in creating awareness and understanding of issues of national and international importance. Several studies like that of Mohammed (2014); Idris (2015) and Abdullahi (2015) have identified the viability and potency of social studies education in promoting desirable attitudes, values, skills and competencies among its adherents. This was buttressed by in their different studies on the role of social studies in solving national problems and creating awareness on important issues. As an aspect of education, social studies education provide learners' with tools for problem-solving in the area of social, political, economic, environmental, technological, education among other aspects. Buttressing on the above, Ololobou (2010), asserts that social studies is "the integrated study of man as he battles for survival in the environment both physical and social. It promotes awareness, appreciation, and understanding of the reciprocal relationship between man and the environment. The essence of studying social studies is to make out of learners, persons who are responsive and responsible citizens". Therefore in the light of the above findings, it can be said that social studies education is a potent tool in promoting environmental sustainability for the attainment of agenda 2063 in Nigeria and beyond.

CONCLUSION

In the light of the above findings, this study concludes that social studies education in Nigeria is a viable instrument and a mega-force in promoting environmental sustainability through its well-articulated objectives, dynamic and time-tested curricular.

RECOMMENDATIONS

This study recommends the teaching of social studies at all levels of education in Nigeria. The government should use social studies as a means to create awareness and enlightenment campaigns on the need to promote environmental sustainability among its citizenry.

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Impact of Field Trip Technique on Students' Cognition Level of Environmental Health Hazards in Junior Secondary Schools, Kaduna State-Nigeria

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ABSTRACT

Man and his immediate environment lies at the heart of social studies. Human beings in an attempt to make ends meet create serious environmental health hazards that have negative consequences to their survival and well-being. This study is aimed at determining the cognition level of students taught environmental health hazards by way of field trips and those taught using Lecture, Group Discussion and Simulation Techniques respectively. The study was quasi experimental in design. The population of the study was JSSIII students of social studies. The purposive sampling technique was used to select four (4) Junior Secondary Schools to participate in the study. A total number of One Hundred and Fourteen (114) students participated in the study. The data collection instrument was a Teacher-Made Achievement Test titled "Environmental Health Hazards Achievement Test" (EHHAT). The Pearson Product Moment Correlation test re-test formula was used to determine the reliability coefficient of the instrument using ten (10) students of JSSIII of Demonstration secondary school, Ahmadu Bello University, Zaria. The mean and standard deviation were used to answer the research question raise by the study and has been confirmed fit for the main work. The One Way Analysis of Variance (ANOVA) was used to validate the null hypothesis postulated by the study. The null hypothesis was validated at 0.05 level of significance. The study discovered that the cognition level of students taught by way of field trip was higher than those taught using other teaching techniques as used in the study. In the light of the above findings, the study recommends the use of Field Trips technique in the teaching of environmental health hazards to Junior Secondary school social studies students.

Keywords: Cognition Level, Environmental Hazards, Field Trip, Impact, Social Studies

INTRODUCTION

Background Statement

Man and his immediate environment lies at the heart of social studies. In this regard, social studies is defined as the study of man and his physical and social environment. Social studies study man in relations with his physical and social environment. The way man influenced his environment and how the environment in turn influences man is of critical importance to social studies. Human beings in an attempt to make ends meet create serious environmental health hazards that have serious consequences to their survival and well-being. Environmental hazard' is the state in which the surrounding natural environment is potentially threatened with severe consequences to human health and wellbeing. In a related development, Ibimilua & Ibimilua (2014) see environmental hazard as any form of harm, danger, peril or any risk of loss in the environment.

Environmental health hazards include traditional hazards of poor sanitation and shelter, as well as agricultural and industrial contamination of air, water, food and land. In relation to the above, Chen (2005) cited in (Ibimilua & Ibimilua, 2014) observes that humankind currently faces significant global environmental problems including climate change, shortage of clean and accessible freshwater, ecosystem degradation, soil erosion, and biodiversity loss.

Consequently, social studies teacher needs to acquaint himself with effective teaching techniques especially in the teaching of physical environment of man, issues, challenges, typology, spatial distribution and its repercussions on human settlement and wellbeing in order to enhance effective transaction and communication in the teaching and learning process. Field trip technique is one of such techniques that give learners first-hand experience on environmental issues and challenges.

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A field trip occurs when students leave school grounds for an educational purpose. It is a student trip for the purpose of curriculum related study. According to Shakil, Faizi and Hafeez (2011), field trip technique is a progressive method of learning by which the student goes through the necessary learning experiences under the leadership and guidance of the teacher. In a related development, Krepel and Divall (1981) in Salihu (2015) assert that educational field trip is a trip arranged by the school and undertaken for educational purpose in which the students go to places where materials for instruction may be observed and studied directly in their functional setting. The use of the term 'field trip' emphasizes some of the formal exercises, which are done outside the classroom usually in Biology and Geography, Social studies among others at secondary and tertiary levels. It is helpful in developing the complete personality of the students like their physical, mental, social and emotional development. Educational field trip gives students the opportunity to have first-hand experiences and to explore world. It helps students to interact with what they are learning (Salihu 2015).

However, buttressing the above point of views, Aggarwal (2003) in Salihu (2015) states that educational field trip is also helpful for the teachers to clarify, establish, co-relate and coordinate accurate concepts, interpretations and appreciations and enable him to make learning more concrete, effective, interesting, inspirational, meaningful and vivid. In the light of the above, it can be said that educational field trip is helpful in completing the triangular process of learning that is; motivation, clarification and stimulation.

The National Council for the Social Studies (1994) advocates that students explore real world issues and utilize the tools and resources of social scientists. These tools and resources abound in our natural physical environment. Thus, educational field trip is an opportunity for students to interact with and use these resources as well as practice various social studies skills, such as asking questions, gathering data, and drawing conclusions. This partly informed the study's decision to take students on a trip to their immediate natural physical environment to have first-hand experience on various typologies of hazards and their adverse effects on man and the environment.

Students need to be actively involved in their own learning. This will help them to become increasingly independent as learners especially in the 21st century teaching and learning where learner-centred approach is the most favoured. Experiential learning is a process by which students are actively engaged in authentic and relevant experiences that allow them to make their own discoveries and experiment with knowledge. Experiential learning is focused squarely on the students, and promotes research, experimentation, and problem solving. It is inquiry based and encourages students to reflect on their experiences, so as to develop new skills, attitudes, and ways of thinking that, in turn, can be reinvested in other learning experiences. Field-based experiences are but one of many activities that allow educators to apply the concept of experiential learning at all grade levels.

The problem of this study hinges on a determination of the extent to which field trip technique is used to achieve instructional effectiveness in teaching environmental health hazards among Junior Secondary School social studies students.

Objective of the Study

The main objective of this work was to examine the Impact of Field Trip Technique on Students' Cognition of Environmental Health Hazards in Junior Secondary Schools, Kaduna state-Nigeria. The study was guided by the following specific objectives:

i. To determine if there is difference on the cognition level of students taught environmental health hazards by way of field trip technique and those taught through other teaching techniques.

Research Question

The study answered the following questions:

i. To what extent does cognition level of students taught environmental health hazards by way of field trip technique and those taught through other teaching techniques differ?

Null Hypothesis

In the light of the above, it is hypothesized as follows:

H_{01}: There is no significant difference between the cognition levels of students taught environmental health hazards by way of field trips and those taught using other teaching techniques.

RESEARCH METHODOLOGY

Population and Sample

The study used Junior Secondary School (JSSIII) students' as the population of the study from which the sample was derived. The JSSIII students were chosen because the topic environmental hazards and related issues are within their syllabus covered at that level. A total number of 114 students of social studies were purposively sampled for the quasi experiment based upon their capacity and willingness to participate in the research. The choice of the sample size was supported by Olayiwola (2010) who asserts that 15 to 30 participants can be utilized as sample for this kind of study. The table below shows the sample distribution of the study participants according to teaching techniques.

Distribution of study participants by Teaching Techniques

S/N	Techniques	Sample Size
1	Lecture	40
2	Group Discussion	37
3	Simulation	22
4	Field Trip	15
	Total	114

In the light of the above, four (4) schools were selected to participate in the study as follows: Government Junior Secondary School, Zaria was used as Simulation Learning Environment (SLE), Government Junior Secondary School, Tudun-Jukun was used as Group Discussion Learning Environment (GDLE), the Government Junior Secondary School, Muchiya was used as Lecture Learning Environment (LLE) while Government Junior Secondary school, Dakace was used as Field Trip Learning Environment (FTLE).

Instrumentation and Statistical Analysis Procedure

The study used a Teacher-made Achievement Test titled "Environmental Health Hazards Achievement Test" (EHHAT) as data collection instrument. The instrument is organised in an objective format. The students were pre-tested to ascertain their previous knowledge before the applications of various treatments. The pre-test served as the basis for comparison after the post-test is administered. The instrument was validated and ascertained as adequate for the study. The mean and standard deviation were used to answer the questions raised by the study while the One Way Analysis of Variance (ANOVA) was used to test the null hypotheses postulated by the study at 0.05 level of significance.

RESULTS AND DISCUSSIONS

Answering Research Question

Research Question One: To what extent does cognition level of students taught environmental health hazards by way of field trip technique and those taught through other teaching techniques differ?

Tables 1.1: descriptive mean statistics on cognition level of students taught by diverse teaching techniques

Teaching Techniques	N	Mean	Std Deviation
Lecture	40	91.9250	9.30781
Group Discussion	37	100.0811	8.71263
Simulation	22	97.4091	7.93221
Field Trip	15	103.5333	6.92683

The details from table 1.1 above showed the mean cognition level of students taught environmental health hazards by way of field trip and those taught using lecture, group discussion and simulation techniques respectively. It shows the following mean score 91.9250, 100.0811, 97.4091 and 103.5333 for Lecture, Group Discussion, Simulation and Field trips groups respectively. This showed that differences existed between the mean cognition level of students taught environmental health hazards by way of field trips and those taught using Lecture, Group Discussion and Simulation techniques. This means that the mean cognition level of students taught environmental health hazards with field trip was higher than those taught with other teaching techniques.

Test of Null Hypothesis

H_{01}: There is no significant difference between the cognition levels of students taught environmental health hazards by way of field trips and those taught using other teaching techniques.

Tables 1.2: One Way Analysis of Variance (ANOVA) statistics on the differences on Cognition Levels of students taught by diverse teaching techniques

Interest group	N	Mean	Std Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
Lecture	40	91.9250	9.30781	88.9482	94.9018	78.00	115.00
G/Discussion	37	100.0811	8.71263	97.1761	102.9860	88.00	120.00
Simulation	22	97.4091	7.93221	93.8921	100.9260	82.00	109.00
Field Trip	15	103.5333	6.92683	99.6974	107.3693	89.00	112.00
Total	114	97.1579	9.46683	95.4013	98.8145	78.00	120.00

Analysis of Variance (ANOVA) statistics on the differences on Cognition Levels of students taught by diverse teaching techniques

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2022.575	3	674.192	9.151	.000
Within Groups	8104.583	110	73.678		
Total	10127.158	113			

The null hypothesis states that there was no significant difference between the cognition levels of students taught environmental health hazards by way of field trips and those taught using other teaching techniques (Simulation, Lecture and Group Discussion). This was carried out using Analysis of Variance (ANOVA) statistics because it involves more than one variable as shown in the tables above.

The results of the analysis of variance (ANOVA) statistics revealed significant difference between the cognition levels of students taught environmental health hazards by way of field trips and those taught using other teaching techniques (Simulation, Lecture and Group Discussion). This was due to the fact that the calculated P values of 0.0000 is less that the 0.05 alpha level of significance, while the calculated F value of 9.151 is greater than the F critical of 2.60. However, their mean scores were 91.9250, 100.0811, 97.4791 and 103.5333 for Simulation, Lecture, Group Discussion and Field Trip techniques respectively.

Consequently, the null hypothesis which states that there was no significant difference between the cognition levels of students taught environmental health hazards by way of field trips and those taught using Simulation, Lecture and Group Discussion teaching techniques is hereby rejected.

Major Findings

The study discovered that significant differences existed between the cognition levels of students taught environmental health hazards by way of field trips and those taught using Simulation, Lecture and Group Discussion teaching techniques. It was also discovered that the cognition level of students taught by way of field trip was higher than those taught using other teaching techniques as used in the study.

Discussion on Findings

The higher cognition level recorded for students taught environmental health hazards using field trips technique was not a coincidence. This is because of its potency in appealing to the senses of the learners and its ability to give learner first-hand experience of the subject matter. The findings of this study also concurred with that of Salihu (2015); Salihu and Tanko (2015) and Ajaja (2010) which show higher academic performance of students taught using field trips and those taught using lecture teaching technique in social studies and biology respectively.

This study filled the gap left by other studies as it compared field trips technique against other learner-centred teaching techniques like Simulation and Group Discussion techniques and found field trip technique to be more potent. Other studies like that of Salihu (2015) and Salihu and Tanko (2015) compared field trips technique with lecture technique and the outcome of the study was criticized as being pre-determined as lecture technique cannot be compared favourably with field trips technique. Therefore, this study filled the gap left unfilled by other studies.

CONCLUSION

Based on the findings of this study, it is concluded that field trips technique is more effective in teaching environmental health hazards to Junior Secondary school students.

RECOMMENDATIONS

In the light of the above findings, this study recommends the use of Field Trips technique in the teaching of environmental health hazards to Junior Secondary school students during social studies lessons.

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Developing Independent Learning Among Lower and Middle Basic Pupils: The Impact of Inquiry Teaching Strategy on Learners' Cognition Level

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ABSTRACT

Inquiry teaching strategy is widely acknowledged for its potency in developing independent investigative and study skills among learners. This study delve into the impact of inquiry teaching strategy on cognition levels of Lower and Middle Basic pupils in Kaduna state. The study used 120 pupils purposively selected from two schools in the study area. The Lower Basic III and Middle Basic VI pupils participated in the study. The study used teacher-made test called "Lower and Middle Basic Achievement Test" (LOMBAT) as data collection instrument. A mean standard deviation was used to answer the research questions raised by the study and the independent sample t-test was used to validate the null hypotheses and decision rule established at 0.05 level of significance. The study discovered that Inquiry Teaching Strategy enhances pupils' cognition level at Lower and Middle Basic levels in social studied lessons more than traditional didactic lecture method. This study recommends the use of Inquiry Teaching Strategy among Lower and Middle Basic pupils to build in them the capacity to investigate and take informed position on social issues.

Keywords: Cognition, Inquiry, Lower Basic, Middle Basic, Strategy

INTRODUCTION

Background Statement

The choice of effective, adequate and relevant teaching technique by a qualified social studies teacher putting into consideration the topic to be taught and the learners' level and ability is the starting point and a foundation for attaining effective transaction and communication between teacher and students in social studies classroom. This is because the success or failure of social studies lessons depends on the choice and utilization of effective teaching technique by the social studies teacher.

The teachers of social studies asserts Salihu (2015) are still accustomed to traditional methods of teaching especially the lecture and didactic techniques despite the availability of learner-centered and activity-based teaching techniques which encourage effective communications and transactions between teacher and the students. This has contributed to poor performances among students and their attitude towards social studies as a subject and inversely affected their performances in the subject.

One of the leading causes of students' poor performance in Social Studies in Nigeria as reported by (Ayodeji, 2009) and (Edozie, 2009) and(Okobia, 2012) in Tanko (2015) has to do with the instructional methods used by teachers, which are inadequate to bring about desired level of achievement and classroom participation in both male and female learners. Some of the methods used by teacher are expository and makes students to become very passive. (Edinyang, 2012, Osakwe and Oganwu, 2005, Eze, 2009) in Tanko (2015) also found that many Nigerian Social Studies teachers mostly used the Traditional Lecture Method that centers on the teacher, text book, the chalk and the chalkboard.

Salihu, J. J. ; Yahaya, I. A. & Abdullahi, M. B. (2016). Developing Independent Learning Among Lower and Middle Basic Pupils: The Impact of Inquiry Teaching Strategy on Learners' Cognition Level. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1280-1284

Several investigators recommended the use of learner-centred instructional strategies to improve performance in Social Studies lessons. One of such strategies is the Inquiry. Inquiry is an aspect of transformational teaching which has been spurred by the development of several learning principles and methods of instruction, including active learning, student-centered learning, collaborative learning, experiential learning, and problem-based learning (Tanko 2015). It is a student-centered method of teaching whereby students interact actively, question assumptions and provide their viewpoints on any area of subject matter. As described by (Akinlaye, 1998) in Tanko (2015), in this approach to instruction, the teacher facilitates and prompts students to conduct investigations and construct their own meaning. The problem of this study hinges on a determination of the extent to which inquiry teaching strategy impact on pupils at Lower and Middle Basic levels in social studies lessons in Kaduna state-Nigeria.

Objectives of the Study

The main objective of this study was to determine the Impact of Inquiry Teaching Strategy on learners' Cognition level in Lower and Middle Basic levels. The study was guided by the following specific objectives:

i. To determine the Impact of Inquiry Teaching Strategy on Pupils cognition level at Lower Basic stage;
ii. To find out the Impact of Inquiry Teaching Strategy on Pupils cognition level at Middle Basic stage.

Research Questions

The study answered the following questions:

i. To what extent does Inquiry Teaching Strategy Impacted on Pupils cognition level at Lower Basic stage?
ii. To what degree does Inquiry Teaching Strategy Impacted on Pupils cognition level at Middle Basic stage?

Research Hypotheses

In the light of the above, it is hypothesized thus:

H_{01}: Inquiry teaching strategy does not significantly impact on pupils' cognition level at lower basic stage;

H_{02}: Inquiry teaching strategy does not significantly impact on pupils' cognition level at Middle basic stage.

Scope of the Study

The study covered Pupils of Lower and Middle Basic levels in Zaria Metropolis, Kaduna state, Nigeria. Social studies lesson periods were used. Environmental Pollution was the topic used in the study.

METHODOLOGY

Design

The study was the non-equivalent comparison group design. The sample consisted of 120 pupils from Lower and Middle Basic levels. Therefore, 60 pupils were chosen from Lower Basic III out of which 30 were controlled and the other 30 were used for the experiment. This process was repeated at the Middle Basic Level using Middle Basic VI Pupils. Purposive sampling technique was used to select school for the study. However, Olayiwola (2010) states that 30 participants are adequate for each group in this kind of study. This guided the choice of 120 participants for the study.

Instrumentation

The instrument used for data collection was a teacher made test called "Lower and Middle Basic Achievement Test" (LOMBAT). The validity and reliability of the instrument was ascertained using table of specification and vetting by experts in Education Research, Test and measurement. The students were first pre-tested to check their knowledge base line. The students were then exposed to different treatment. The data collection covered the period of fifteen (15) working days.

Data Analysis

The data were analysed using mean, standard deviation and t-test independent sample. A mean standard deviation was used to answer the research questions raised by the study. The independent sample t-test was used to validate the null hypotheses postulated by the study. The null hypotheses were analyzed at 0.05 level of significance and 95 percent confidence level.

RESULTS AND DISCUSSIONS

Answering Research Questions

Research question one: To what extent does Inquiry Teaching Strategy Impacted on Pupils cognition level at Lower Basic stage?

Table1.1: Descriptive statistics on the mean cognition level of Lower Basic pupils taught with Inquiry teaching strategy and those taught with Lecture Method

Variable	Treatment Groups	N	Mean	Std. Dev
Cognition Level	Inquiry	30	68.2667	10.0685
	Lecture	30	52.2167	11.7566

Details of the descriptive statistics in table 1.1 above revealed the mean cognition scores of Lower Basic Level III pupils who were taught using inquiry teaching strategy and their counterparts taught with lecture method. Their calculated mean cognitive scores were 68.2667 and 52.2167 for Inquiry strategy and Lecture method respectively. The mean cognitive level difference was 16.05. This implies that Lower Basic Level Pupils taught with inquiry teaching strategy had higher mean cognition level than their counterparts taught with lecture teaching method.

Research question two: To what degree does Inquiry Teaching Strategy Impacted on Pupils cognition level at Middle Basic stage?

Table1.2: Descriptive statistics on the mean cognition level of Middle Basic Level pupils taught with Inquiry teaching strategy and those taught with Lecture Method

Variable	Treatment Group	N	Mean	Std.Dev
Cognition Level	Inquiry	30	32.4667	5.32873
	Lecture	30	26.0333	9.98096

The descriptive statistics in table 1.2 revealed the mean cognitive level of Middle Basic Level VI Pupils who were taught using Lecture teaching strategy and their counterparts taught through Lecture teaching method. According to the outcome, their computed mean cognition levels were 32.4667 and 26.03333 for inquiry teaching strategy (experimental group) and Lecture method (control group). The mean academic difference was 6.4334. This indicate that Middle Basic VI pupils taught with inquiry teaching strategy had higher cognition level than their counterparts taught by way of lecture method.

Test of Null Hypotheses

Hypothesis one: Inquiry teaching strategy does not significantly impact on pupils' cognition level at Lower Basic stage

Table 1.3: Independent t-test sample statistics on the mean cognition level of Lower Basic pupils taught with inquiry teaching strategy and those taught using traditional lecture method

Variable	Treatment Group	N	Mean	Std.dev	DF	t-cal	t-crit	Sig (p)	Decision
Cognition	Inquiry	30	68.2667	10.0685	58	5.679	1.96	0.000	H_{01}
Level	Lecture	30	52.2167	11.7566					Rejected

Calculated p < 0.05, calculated t > 1.96 at DF 58

The result emanating from the Independent sample t-test statistics in table 1.3 above showed that significant differences exist between Lower Basic pupils taught with Inquiry teaching strategy and their counterparts taught with lecture method in their mean cognition level. This was due to the fact that the calculated significance (P) value of 0.000 is less than the 0.05 level of significance while the calculated t value of 5.679 was higher than the 1.96 critical t value at DF 58. Their calculated mean cognition levels were 68.2667 and 52.2167 for inquiry teaching strategy and lecture method respectively. Therefore, the null hypothesis which states that Inquiry teaching strategy does not significantly impact on pupils' cognition level at Lower Basic stage is hereby rejected.

Hypothesis two: Inquiry teaching strategy does not significantly impact on pupils' cognition level at Middle Basic stage.

Table 1.4: Independent t-test sample statistics on the mean cognition level of Middle Basic pupils taught with inquiry teaching strategy and those taught using traditional lecture method

Variable	**Treatment Group**	**N**	**Mean**	**std.dev**	**Df**	**t-cal**	**t-crit**	**Sig (p)**	**Decision**
Cognition	Inquiry	30	32.4667	5.32873					H_{02}
Level	Lecture	30	26.0333	9.98096	**58**	3.114	1.96	0. 003	Rejected

Calculated p < 0.05, calculated t > 1.96 at DF 58

Results of the Independent sample t-statistics in table 1.4 above revealed that significant difference exist between the mean cognition levels of Middle Basic level pupils taught using Inquiry teaching strategy and their counterparts taught using lecture method. This is because the calculated significance (p) value of 0.003 is lower than the 0.05 level of significance while the calculated t value of 3.114 is higher than the 1.96 critical t-value at DF 58. Their computed mean cognition levels were 32.4667 and 26.0333 for Inquiry. Hence the null hypothesis which states that Inquiry teaching strategy does not significantly impact on pupils' cognition level at Middle Basic stage is hereby rejected.

Major Findings

The study discovered that Inquiry Teaching Strategy enhances pupils' cognition level at Lower and Middle Basic levels in social studied lessons. By implication, the study revealed that didactic traditional lecture method isn't good enough for Lower and Middle Basic level Pupils in Social studies classrooms.

Discussion of Findings

The study revealed Inquiry Teaching Strategy enhances the cognition level of pupils in the Lower and Middle Basic levels (primary school) compared to the traditional didactic method that is widely used by teachers in the study area. The findings of this study is not a surprise in view of the fact that Inquiry teaching strategy apart from promoting independent study attitude and skills in the pupils, is widely acknowledged for enabling the learners to gain first hand information about what they are learning. The findings of this study concur with those of Dauda (2015); Tanko (2015) and Yahaya & Salihu (2015). Although the above studies were conducted among Junior Secondary School students using Social studies lessons these study affirmed the potency of Inquiry teaching strategy on students' academic performances over traditional lecture method.

CONCLUSION

In the light of the above findings, this study concludes that the Inquiry teaching strategy is effective in raising the cognition level of Lower and Middle Basic level pupils in the study area.

RECOMMENDATIONS

This study recommends that use of Inquiry Teaching Strategy among Lower and Middle Basic pupils to build in them the capacity to investigate and take informed position on social issues.

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SUB-THEME FIVE

Physical Planning, Urban Renewal and Urban Poverty

Wealth Creation through Cassava Processing: Women Migrating from Poverty to Fortune in Ondo State, Nigeria

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ABSTRACT

An idle mind is the devil`s workshop, thus goes a common saying. This paper examines how women in selected locations in Akure, Nigeria created jobs for themselves thereby liberating themselves from poverty. Data for this study were sourced through administration of questionnaires from selected cassava processing centres. Direct participation and observation methods were employed. Field data were analysed using simple frequency, cross-tabulation and correlation analysis. Findings show that the driving force of the operations was as a result of their self-determination to break the york of poverty and to create wealth for their families. Socio-economic factors such as income, age, level of education among others have influence on the level of production and level of achievement of the operators. The paper recommends a more organized environment for the processing of cassava, an organized community based soft loan facility, an efficient export package system and a functional Agro-based mechanism to aid the local processing methods.

Keywords: Cassava processing, Poverty, Soft loan and Wealth Creation

INTRODUCTION

Background Information

Globally, the traditional use of cassava is changing from primarily human consumption to processing into industrialised products such as starch, flour and ethanol. Studies have shown that cassava has the potential to industrialise Nigeria more than any other product, if its potential is properly harnessed. Awoyinka (2009) affirmed that Nigeria can earn about US$5 billion per annum from cassava and its by-products, making it a key foreign exchange earner and instrument for job creation and catalyst for development. In Nigeria, cassava is currently being promoted as industrial raw material in the form of starch, flour and ethanol. Hence, many development initiatives are underway by government and private sector for the processing of cassava into intermediate products for use by local industries and for export. Nigeria is the largest producer of cassava in the world, Food and Agricultural Organisation (FAO 2002). Cassava has become a staple food for most Nigerians (Not only among rural people but also among the urban dwellers) possibly because of the ease with which its major food product (Garri) can be prepared and used as a source of food, International Institute of Tropical Agriculture (IITA, 2004).

A lot has been done by the Nigerian women in alleviating poverty in Nigeria. Nigerian women take job where and whenever they find it, that is, by the roadside, in the fields, in bazaars, in brothels and so on. Women combine works with wage labour in households with poor economic status (Duniya 2010). Nigerian women engage in works such as embroidery and formation of cooperatives. They are involved in various income generating activities such as small scale farming in processing of agricultural produce such as poultry, sheep and goats rearing among others, they also engage in borrowing money from relatives, joining groups such as “Esusu” in Yoruba land or “Adashi” in Hausa land in which individuals come together to contribute money on regular basis and collect on rotational basis.

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Worst still, Nigeria women sell assets acquired in the past in other to send their children to school, they deny themselves of food at times, they engage in cutting firewood, carrying load for money, going to ceremonies (parties) to pick left over foods etc. These and many more are practiced by Nigerian women in other to make ends meet and alleviate poverty. In this study, women's effort in Garri processing is the focus due to the fact that it is becoming common and a major source of job creation for women in the study area.

The primary target of every enterprise is to make profit that is sufficient to sustain the output as well as maintain a good standard of living. Cassava is grown in almost all the states and thrives in all agro-ecological zones in Nigeria. Its production is characterized by small scale producers who use old varieties and traditional production technologies which largely accounts for low yield. Oyebanji, *et al*, (2003) noted that these small-holders account for over 80% of cassava production in Nigeria. Over 90% of cassava produced in the country is consumed locally with less than 10% utilized for industrial purposes.

It is therefore clear that the success of a given innovation requires an analysis of the local situation and the creation of conditions that not only make the change feasible but people concerned to desire the proposed changes and identify them with their own personal and social goals. Improvement of simpler household user-friendly technological methods that will embrace agricultural productivity and economic growth is therefore necessary. Processing of a special flower called Garri a major delicacy serves as a major food source for both the high and low economic class of people, and currently, a major exportable food and industrial product. It is expected, thus, that demand for Garri will be very high and considered to be an essential commodity.

Therefore, this study focuses on cassava processing as a means by which women migrate from poverty to wealth in Akure, Nigeria. However, the study looked at the location of organized cassava processing industries, demographic characteristics of the respondents, assess the processing technology and the problems encountered in cassava processing in the study area.

STUDY AREA

Akure is a traditional Nigerian city and like other traditional Yoruba towns in the country, it has been in existence long before the advent of British colonial rule in the country. The city is located within Ondo State in the south western part of Nigeria. Ondo State is one of the 36 states of Nigeria. It lies approximately on latitudes 7^0 5`` and 8° 00`` North of the Equator and longitude 5^0 45`` East and longitude 6°00`` East of the Greenwich Meridian at an altitude of 370m above sea level. Akure is a medium-sized urban centre and became the provincial headquarter of Ondo State province in 1939. It also became the capital city of Ondo State and a Local Government Headquarters in 1979. Consequently, there was heterogeneous massing of people and activities in the city (M.W & H, 1980). The city's morphology has changed over time to assume its present status with its attendants land and housing problems, as experienced in similar medium sized urban centers in Nigeria.

Akure is located approximately 700 kilometers South West of Abuja, the Federal Capital of Nigeria and about 350 kilometers to Lagos the former capital of Nigeria. It is located within the tropical rain forest region of Nigeria where rainfall is high throughout the year. The increased relative political influence of Akure as a state capital since 1976 has greatly promoted its rapid growth and increased socio-economic activities resulting in its spatial expansion from an area of about 16 square kilometers in 1980 to about 30 square kilometers in 2000 (Ministry of Works, Lands and Housing, 2000). The population of the city grew from 38,852 in 1952 to 71,106 in 1963. Its population was estimated to be 112,850 in 1980

(DHV, 1985); and 157,947 in 1990 (Ondo State of Nigeria, 1990). The 1991 National Population census however, puts the population of Akure at 239,124 and its population in 2006 was 353,211 (NPC, 2006). At 2014, using a growth rate of 3.18 percent, the city was estimated to have 453,731 (Gabriel, 2014).

Scope of Study

The study focuses on Akure city where field survey was conducted on the effects of cassava processing on women migrating from poverty to fortune within the study area. This is with the view of collating much needed first-hand information on the subject matter over the study area. The survey constituted the major data source on which the research thrived. The study identified the location of organized cassava processing industries, examined the socio-economic traits of the respondents and assessed the processing technology. It also investigated the problems encountered in cassava processing in the study area. Apart from this, the study dwelt on extensive literature search on the research focus.

Concepts and Literature Perspective

A review of the massive literature on poverty shows that a standard concept of poverty remains elusive because of its multidimensional nature as well as its dynamic properties. It is always difficult to define the concept of poverty because drawing the line between the rich and the poor is not usually easy. Amaka (2007) sees poverty like an elephant which is easily recognized than defined. According to Garba, (2006), Poverty, like the term development and underdevelopment is a contested and politically sensitive term and how it is defined usually change from place to place and across time.

Garba (2006) refers to poverty as a lack of command over basic consumption needs, which means, there is an inadequate level of consumption giving rise to insufficient food, clothing and/or shelter, and moreover the lack of certain capacities, such as being able to participate with dignity in society. The World Bank has also defined the concept in the same context as the inability to attain a minimum standard of living (World Bank Report, 2008). Egware, (1997) viewed poverty as a state where individual is not able to cater adequately for his or her basic needs of food, clothing and shelter, unable to meet social and economic obligations; lack of gainful employment, skills, assets and self-esteem and has limited access to socio-economic infrastructures.

Poverty is a state of the mind. This state, psychologically places the person in question in want, either materially or spiritually. Materially, it involves the want of food clothing and shelter, spiritually, it involves want of peace of mind, the spirit and the inner man (Ogwumike, 2012). World Bank (1999) also sees poverty as lack of opportunity and freedom. It is hunger and malnutrition, disease and lack of basic social services. It is an equity gap between countries and within countries. Poverty is still the gravest insult to human dignity. It is the scar on humanity's face. According to Soludo, (2008), Poverty has predominantly female face, poverty particularly burden women because of their role in the economy, they work both inside and outside the home, as home makers and sometimes as head of households, they seek to provide the sole means of survival for their families or try to make up for their shortfalls in their males subsistence wages. Odebode (2006) pointed out clearly that poverty is the state of deprivation of fundamental human needs and desire and this involves the desire for sufficient food and water, adequate shelter, good health, long life, education and the capacity to provide materials for oneself and family through productive ventures.

Suich, (2012) view poverty as lack of originality to achieve, a socially acceptable standard of living and/or, the possession of insufficient resources to meet basic needs required for sustenance and wellbeing. It is a plaque that has eaten deep into different people across

nations of the world. Although it is a universal phenomenon that affects socio-economic and political wellbeing of its victims across board, available statistics shows that poverty in poor country is absolute and more pronounced in the rural areas (Yakubu & Aderonmu, 2010). Some people believed poverty of others is part of a divine order after all the Bible says "the poor shall not cease from the land" (Deutronomy 15:11).However, this study refers to poverty simply as the inability of an individual to live an easy and comfortable livelihood due to difficulty in accessing basic means of daily survival, such basics include things like food, shelter, clothing, education, health, employment, information etcetera.

Putting all these literatures together one can summarise that poverty is a state of the mind, lack of opportunity and freedom, it is a state of deprivation of fundamental human needs and finally it is the inability to achieve, a socially acceptable standard of living.

Effects of Poverty

Poverty contributes in no small measure to crimes in the society.The increasing rate of crimes such as armed robbery "419" corruption, prostitution, nepotism, drug trafficking, cultism and other social vices strongly correlates with the rate of poverty in the society(CBN 1998). In a society where most of its members are poverty-stricken, production may remain largely subsistence as the poor cannot afford capital to expand production. Mandama (2010) stated that persistent poverty has been responsible for most revolution. Poverty results in the general loss of confidence in the constituted authority which in turn renders government policies ineffective, this is because, as long as people feel un-catered for, their loyalty for the system will not be reciprocated. The poor suffer in many ways in Nigeria, among which are;

i. Consumer Problem: The poor pay higher prices in purchase of consumer items, this is because they buy in small pieces and do not enjoy any form of discount.
ii. Health Nutrition: The poor has less nourishing diets and more birth defects, accidents, diseases, and reported mental illness than others. These affect their productivity and quality of life.
iii. Politics: The poor are ill organized to influence or make any impact on contesting for an electoral office.
iv. Justice: The poor are likely to be arrested (rightly or falsely) and often receive stiffer sentences than non-poor for similar offences.

These and many more are the effects of poverty in Nigeria and Africa at large.

Causes of Poverty

The causes of poverty are divergent. The World Bank, (1996) categorized the major causes of poverty in Sub-Sahara Africa as follows:

i. Inadequate access to employment opportunities for the poor
ii. Inadequate physical assets such as land and capital and minimal access by the poor to credit even on a small scale.
iii. Inadequate access to the means of supporting rural development in poor regions
iv. Inadequate access to market where the poor can sell goods and services
v. Low endowment of human capital.
vi. Destruction of natural resources leading to environmental degradation and reduced productivity.
vii. Inadequate access to assistance to those living at the margin and those victimized by transiting poverty.
viii. Lack of participation, failure to draw the poor into the design of development programs
ix. Inadequate access to education, health, sanitation and water services.

Major causes of poverty in Nigeria according to Aigbokhan (2000) are; allocative inefficiency, particularly in the public sector, low rate of investment in the private sector, rapid population growth and use of inappropriate technology. Mandama (2010) also attributed causes of poverty in Nigeria to low level of savings and investment, subsistence orientation of production, unequal distribution of wealth of other productive assets, market imperfection and policy failure on the part of the government. These among others are responsible for poverty in Nigeria and Africa at large.

Women and Poverty in Nigeria

Women constitute a vital social group in all known human societies. Apart from playing a very significant role in the continuity of society through reproduction and socialization, their economic, social and political roles cannot be over emphasized. Yet, this vital group has been muffled with very harrowing challenges in their various respective societies. In Nigeria, the level and rate of poverty have skyrocketed over the years and women have continue to face intimidating and devastating challenges. Abject poverty has been associated with the history of women from time immemorial. In Nigeria and other parts of the world, the culture has been the responsibility of women, like other members of the underprivileged and downtrodden class, to fed, serve, work, and fight, even die for the privilege class.

Ogwumike (2012) reported that two-third of work in the world were done by women. Yet, women owned only ten percent of the world's income and one tenth of the world's property. In Nigeria, 70% of the population lives below the poverty line without any access to basic goods, services and commodities (NBS, 2012). Since women constitute almost half of the population going by the latest population census in the country, it is convenient to say that most women are the victims of poverty in Nigeria today. Most households in Nigeria are more concerned with the survival needs of their families' members due to the escalating poverty profile of the country, (Ogwumike, 2012). Poverty is not only a reality in Nigeria, but it is also saddened to know that most Nigerian women who ought to put a helping hand to their family's income are likewise poor. With low educational status, lack of basic skills and general unemployment condition, the poverty status of rural women in Nigeria is even worse.

In Nigeria today, poverty have spread across the nation, it can only be more degrading for women to access some common basic things such as good drinking water, food, toiletries, housing, employment, cooking utensils, drugs and medical attention, and other socio-psychological requirements that are needed for average quality living. Yet, some level of socioeconomic and psychological stability would be required by women for them to be able to effectively do their expected role to the society (Amaka 2007).Given their present situation of both absolute and relative poverty in the country; women can only do little or nothing both to themselves and to the society.

However, Nigeria as a nation is not poor, as this unfortunate poverty situation exist in the midst of abundant resources, which is enough to cater for the general needs of the entire citizens. According to Opeyemi, (2012), Nigeria is the sixth richest oil producing country in the world. In terms of agriculture, the country has great potentials owing to its highly fertile soil and it has abundant land mass adequate enough for any socioeconomic and technological activity. With over 150 million people, there is enough potential for adequate manpower which may be required for any kind of developmental activity. Again, the country boast of over 50 universities and that is beside other higher institutions that should be involved in manpower development (Okoh, 2004). Yet, poverty, especially among women, thrives in the country. Nevertheless, the reason for this paradox is not farfetched.

Onoge (2003) argued that structural forces within the societal class shape the way in which socio-economic resources are distributed. The ruling class in Nigeria control instruments of distributions of resources and instead of ensuring equitable distribution; they only serve their own class and personal interest to the disadvantage of the masses that constitute the majority. Incidentally, most women in the country fall within this structurally disadvantage group and this explains why there is wide spread poverty among women in Nigeria. In this process women end up with little or no income. The system unjustly treat the women, especially in the rural areas and the low ranked in their working places, without recourse to their basic survival needs and as such leaving them in helpless and hopeless conditions of poverty (Duniya (2010). As most women wallow in perpetual impoverishment, the ruling class members continue to enjoy their loot in their comfort zones.

Women like other Nigerian masses hoped for a better deal with the coming of democracy in the country in 1999, but this hope was dashed as the Obasanjo administration pursued and implemented anti-people economic and fiscal policies (Adelakun, 2008). Although women were included in the top echelon of government policies and programmes, however, resources supposedly meant for the provision of meaningful education, employment opportunities, and infrastructure that will better the living standards of the people, especially the women were diverted, siphoned, corruptly embezzled or mismanaged by the ruling class occupying powerful positions of influence in the society (Ribadu, 2006). Several billions of naira from the public treasury meant for overcoming poverty has been looted by political leaders. New York Times (2005) reported that Nigeria is the epitome of wasted potentials and squandered opportunity in Africa. This has negatively impacted on many generations of Nigeria women who with no good school to attend, no employment opportunities, and no sufficient basic infrastructures have to contend with poverty. The past administration of President Goodluck Jonathan has not done any better as incessant cases of corruption at all levels of governance is the order of the day.

The issue of poverty in Nigeria is heartbreaking, official sources shows it is a northern phenomenon (Soludo, 2008). The Nigerian economy, under the Obasanjo's Administration, was hurriedly pushed into the global neo-liberal capitalist economic system through programmes like privatization and commercialization of the public sector. Ake (2003), observed that the various liberalization programmes have succeeded in selling the Nigerian economy into the hands of a very few bourgeoisies to the disadvantage of the masses. It was followed by retrenchment of workers and sales of public properties. These actions of the government forced poverty on the people, especially women who will have to grapple with both personal and domestic challenges.

When women lag behind in their expected positive role as it is the case of Nigeria today, the society suffers greatly in terms of achieving profound peace, order, stability, growth and sustainable development. No wonder, Nigeria is currently militated by perpetual crisis as characterized by chains of social milieu ranging from corruption, to ethno-religious conflicts and terrorism, all threatening the very foundation of the corporate existence of the country as a political entity. A lot has been done by both the Nigerian authorities and other non-governmental bodies towards poverty alleviation specifically among women and Nigerians in general.

The creation of established poverty alleviation programmes such as the National Poverty Eradication Programme (NAPEP), National Directorate of Employment (NDE), Better Life Programme (BLP), National Land Development Authority (NALDA) are among many other good examples (Ogwumike and Amolaran, 2000). Nevertheless, all these schemes never made great impact in effectively addressing the problem. In fact, despite every efforts

made by the Nigerian authorities and other none-formal organizations towards poverty reduction in the country, this problem has continued to mitigate women from living happily and contributing their own quota to national growth and development. In actual fact, women's condition is becoming worse by the day and if drastic steps were not urgently taken towards effectively addressing poverty in Nigeria, especially among women, there is likely to be a wanton catastrophic impact on the country and perhaps Africa. Thus, this negative trend calls for urgent attention.

RESEARCH METHODOLOGY

Data for this research was sourced from both primary and secondary sources, the secondary sources include materials from the internet and published materials such as journals, articles, and text books while the primary data were obtained by personal observation, oral interview and the administration of multiple-choice questionnaires randomly on women engaged in Garri processing in selected organised (Garri Industries). The target population for this research includes women in organised Garri processing industries in Akure town, Ondo State.

The study identified Eleven (11) organised Garri processing centres in Akure and seven (7) out of the total identified organized Garri processing industries, that is, 64 % was randomly selected for administration of questionnaire. Therefore, five (5) questionnaires were administered at each of the selected centres and this gives a total of thirty five (35) questionnaires administered in the study area. The selection of the Garri processing factory was done by snow ball sampling method in which a subject nominates another subject with the same trait for sampling. Both descriptive and inferential statistics were used in data analysis. Tables and charts were employed to present the magnitude of occurrences of the variables that were obtained.

DATA ANALYSIS

Table 1 describes the socio-economic characteristics of the workers of cassava processing small scale industry sampled for the study. It was observed that majority of the workers were from the south-western part of the country, categorized as the Yorubas. They constituted about 85.7% of the workers while a small percentage of 14.3% represented the Igbos. The workers were majorly Yoruba because this study was carried out in Akure, south-western part of the country. Among these workers, 28.6% of them had stayed in the locality between 1-5 years, 14.3% had stayed between 6-10 years, and 14.3% had stayed between 11-15 years while 42.9% had stayed in the locality above 15 years.

Cassava processing has helped in alleviating un-employed people from poverty through wealth creation. From the analysis, 14.3% of the workers earned less than ₦20,000, 42.8% earned between ₦21,000 to ₦40,000, 28.6% earned between ₦41,000 to ₦60,000, 14.3% earned between ₦61,000 to ₦80,000 and 14.3% earned above ₦100,000. Cassava processing is dominated by females. 28.6% were male while 71.4% of them were female. Based on the age, 28.6% were between the 18 to 35 years, 42.8% were between the age 36 to 50 years and 28.6% were between the ages 51-56 years. In terms of marital status, 14.3% were single while 51.4% were married. Based on religion, 85.7 practiced Christianity while 14.3 practiced Islam. However, this type of job description does not require high level of education. 57.1% had primary education, 14.3% had secondary education while 28.6 % had tertiary education.

Based on the household size, 85.7% had a size between 4 to 6, 14.3% had a size from 10 and above. In terms of hours put to work, 14.3% spent between 4 to 6 hours, 85.7% spent from 7hours and above. Among these workers, 14.3% were marketers, 14.3% were firewood seller, 14.3% were clerk, and 42.9 were administrative officer. Some of these

operators engaged in other enterprise. For instance 28.6% were into trading, 28.6% were into farming, 28.6% were civil servant and 14.2% were artisan. This is to show that the enterprise allows for partial or part time operation. This makes it flexible for the operators to engage in other economic activities. 71.4% attended work daily and 28.6% attended work twice a week. This shows that majority (71.4%) are dedicate to cassava processing all through.

Table 1.0: Socio-economic characteristics

Ethnicity	**No. of respondents**	**Percentage**
Yoruba	30	85.7
Hausa	0	0.0
Igbo	5	14.3
Foreigner	0	0.0
Others	0	0.0
Total	**35**	**100**
Length of stay		
Since birth	0	0.0
1-5 years	10	28.6
6-10 years	5	14.3
11-15 years	5	14.3
Above 15 years	15	42.9
Total	**35**	**100**
Level of income		
<20,000	5	14.3
21,000-40,000	15	42.8
41,000-60,000	10	28.6
61,000-80,000	5	14.3
81,000-100,000	0	0.0
Above 100,000	0	14.3
Total	**35**	**100**
Sex		
Male	10	28.6
Female	25	71.4
Total	**35**	**100.0**
Marital status		
Single	05	14.3
Married	18	51.4
Widowed	05	14.3
Divorced	04	11.4
Separated	03	08.6
Total	**35**	**100**
Religion		
Christianity	30	85.7
Islam	05	14.3
Traditional	00	0.0
Others	00	0.0
Total	35	100
Level of education		
No formal education	00	0.0
Primary education	20	57.1
Secondary education	05	14.3
Tertiary education	10	28.6
Adult education	00	0.0
Others	00	0.0
Total	**35**	**100**

Hours put in	**No. of respondents**	**Percentage**
1-3 hours	00	0.0
4-6 hours	05	14.3
7 hours and above	30	85.7
Total	**35**	**100**
Enterprise participation		
Marketer	05	14.3
Firewood seller	10	14.3
Clerk	05	14.3
Administrative officer	15	42.9
Total	**35**	**100**
Other enterprise		
Trading	10	28.6
Farming	10	28.6
Civil servant	10	28.6
Artisan	05	14.2
Others	00	0.0
Total	**35**	**100**
Age		
18-35years	10	28.6
36-50 years	15	42.8
51-56 years	10	28.6
Total	**35**	**100**
Attendance at work		
Daily	25	71.4
Once a week	00	0.0
Twice a week	10	28.6
Thrice a week	00	0.0
Others	00	0.0
Total	**35**	**100**
Household size		
1-3	00	0.0
4-6	30	85.7
7-9	00	0.0
10 and above	05	14.3
Total	**35**	**100**

Table 2 below describes the processing technologies adopted by the cassava processing firms. Almost all of them engaged the use of one equipment or the other. Those that uses constituted a 85.7%, while 14.3% does not. Among the firms using these light equipments, it was discovered that all of them uses the mentioned light equipment. Example of the light equipment includes: Grater, Peeler, Fryer, Presser and Miller. It is also of note that 85.7% of them purchased their equipment while 14.3% hired. Also, in terms of monthly maintenance of these equipment, 34.3% spent ₦1000 to ₦3000 on maintenance, 42.9% spent ₦3000 to ₦5000 while 22.9% spent over ₦5000.

Table 2. Processing Technologies

Use of processing equipment	**Number of respondents**	**Percentage**
Yes	30	85.7
No	5	14.3
Total	**35**	**100**
Equipment		
Grater	0	0.0
Peeler	0	0.0
Fryer	0	0.0
Presser	0	0.0
Miller	0	0.0
All of the Above	35	100.0
Total	**35**	**100.0**
Source of equipment		
Hired	5	14.3
Purchase	30	85.7
Both	0	0.0
Others	0	0.0
Total	**35**	**100.0**
Maintenance cost of equipment		
1000-3000	12	34.3
3000-5000	15	42.9
5000 and above	8	22.9
Total	**35**	**100**

Table 3 describes the problems encountered by the cassava processing firm. Generally, most of them complained about three categories of problems. It was discovered that 31.4% of them complained of inadequate capital, 20% complained of lack of storage facilities while 11.4% complained of inadequate cassava supply while 5.7% chose others like erratic power supply. In a bid to find possible solutions to these problems, the study attempted to seek the respondents view for possible solutions. They proffered that government should ensure regular supply of electricity; availability of funds through provision of loans and provision of machine and equipment.

Table 3: Problems encountered

Problems Encountered	**Number of Respondents**	**Percentage**
Unavailability of inputs	03	8.6
Inadequate capital	11	31.4
High cost of transportation	03	8.6
High taxation	01	2.9
Poor road network	02	5.7
Price instability	02	5.7
Unavailability of labour	00	0
Exploitation by middlemen	00	0
Lack of storage facilities	07	20
Inadequate cassava supply	04	11.4
Others	02	5.7
Total	**35**	**100**

From the analysis of the result, it was observed that women where constraints by lack of market opportunities, access to credit facility, enabling environment, finance, poor road network, poor market information, poor managerial skills, inadequate information dissemination, poor equipments, high taxation and poor government policies on entrepreneurial development, all these deter not only the women but both youths and farming households from venturing into entrepreneurship world. Justifying inadequate credit facilities as a constraint to entrepreneurial development, it was also discovered that low productivity in quality Garri has led to limited market surplus which prevents the women from having enough cash to procure processing equipments and services. Again, the formal financial intermediaries are not helping issues as most do refuse this women from sourcing loan from their institutions due to lack of acceptable collateral, hence, branding the women as non-credit worthy.

CONCLUSION AND RECOMMENDATION

Based on the findings of this research, it was concluded that the women had been employing entrepreneurship skills in the organized Garri processing points. This has led to reduction of poverty among the women in this area. However, the extent of poverty reduction is still very insignificant, which is an indication that the women have not fully taken advantage of some of the entrepreneurial activities or have participated to a less extent. In these categories is branding and packaging of the processed Garri before taking it to the market. Hence, if the current transformation agenda of the present Federal Government on poverty eradication through farming activities must be actualized, there is urgent need to provide adequate entrepreneurship development programme for women and farmers while addressing factors that hinder the growth and development of farmers entrepreneur in the country.

The major conclusion of this paper is that the women Garri processors in the study area play major roles in alleviating poverty among the Nigerian women. Rather than going into prostitution and other social vices, these women have been able to assist in meeting the needs of their household. They have been able to assist their husbands in making sure there is food on the table. Some of them are even single parents who have been able to use the money earned to sponsor their children to school even up to tertiary institutions.

It is therefore, recommended that the efforts of women Garri processors be complimented with the formal financial Institutions and the government. It is believed that these will alleviate poverty and improve the standard of living of women Garri processors.

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Analysis of Factors Responsible for the Location Pattern of Petrol Filling Stations in Akure, Nigeria

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ABSTRACT

The technological initiative of man towards the development of automobile and the discovery of petroleum triggered the building of Petrol Filling Stations (PFSs) at strategic locations to meet the demand of vehicle owners. The aim of this study is to investigate those factors influencing the location of PFSs considering the following objectives; to investigate the land value, examine the socio-economic characteristics of the respondents and the level of compliance of physical planning standards in the study area. Two sets of structured questionnaires were administered on the residents and the Owners/Managers in charge of the PFSs in Akure, while oral interview was conducted on the Directors of physical planning at the Ondo State Development and Property Corporation and Ondo State Ministry of Housing and Urban Development. Simple Random Sampling Technique was used in the administration of 415 questionnaires on the residents, while a total survey was conducted on the 87 functional PFSs. All data collected were analyzed using univariate and multivariate analysis. The study clearly shown that weakness enforcement of planning standards, accessibility of PFSs to customers, occupation status and income of respondents are some of the factors responsible for the concentration and haphazardly location of PFSs in Akure. It is suggested that there should be a synergy between the approving bodies on how to effectively enforce the planning standards also government should assist in procuring modern planning equipments which could be used for effective development control activities. Workable planning standards policy on location of PFSs should be enforcement. In addition, the Akure Master Plan is long due for review.

Keywords: Factors, Location Pattern, Petrol Filling Stations, Planning Standards, Sustainability

INTRODUCTION

In recent times, there has been a sustained increase in the number of Petrol Filling Stations (PFSs) located in different part of the country. The reasons for such unprecedented increase are not far-fetched: first, the growing number of people in the country and the attendant increase in the purchase of vehicles. Secondly, the attractive price of petrol both at control price and black market prices which made more people to go into the petrol retailing business (Smart, 2002). In view of this development, many oil marketers take advantage of this need and build PFSs haphazardly without giving consideration to the possible effect of its locations. It is evident from different studies that PFS has high potential hazards to the site and the surroundings. The hazards may be environmental, hydrological, geological or socio-economic. It is obvious that Nigerian cities and towns are getting congested with every nook and cranny filled with PFSs. Even in residential areas, PFSs are built on little available spaces, in-between residential buildings, raising real fears of environmental hazards and fire outbreaks (Oladoyinbo, 2013).

However, there is the need to properly emphasize those factors that influence the location pattern of PFSs and how its understanding could facilitate a balanced and sustainable national development. Hence, this paper focuses on the analysis of factors responsible for the location pattern of PFSs in Akure.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Omole (2001) posits that a petrol filling station by definition is a commercial facility where fuel and lubricants for automobiles among other goods are sold. Fuels sold at petrol filling stations include Petrol (Premium Motor Spirit [PMS], Liquefied Natural Gas [LNG], diesel

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(Automated Gas Oil [AGO]) and Kerosene (Dual Purpose Kerosene [DPK]). Location in spatial planning connotes "situation" rather than "site" (Omole, 1994). The site is concern with the actual place or position of a particular activity, project or structure, while location is a term embracing the site with additional information on the location of the site relating to other existing surrounding site which influences the activity on site. This is because the systematic linkages among activities on land are to ensure sustainability. The linkages are such that a wrongful placement could mar the physical setting and siting of these facilities and services.

Losch's (1954) theory on location of an activity is one of the most realistic theories of urban facilities location. The theory was therefore concerned with finding place of maximum profit. His approach was known as profit maximization and market area approach. Maximization of profit is only possible when demand patterns are taken into consideration. The concept of maximization of profit is mostly directly relevant to the planner in the locations of services. The assumption from the location theory is that the PFSs marketers in quest to maximize profits concentrate their PFSs in certain areas including the study area.

Standards and regulations for PFSs are the requirements to be satisfied before locating or developing filling stations. Such standards and regulation may vary slightly among states, but they all tend towards achieving a high degree of compatibility and excellence in the location and design of filling stations (Alabi, 2004).

Concept of Physical Planning

One of the most acceptable and popular definition of physical planning was given by Keeble (1969) as the art and science of ordering the use of land and the character and sitting of buildings and communication routes so as to secure maximum practicable degree of economy, convenience and beauty. Similarly, Olujimi (2009) sees Land use as the spatial reflection of human activity on land; and whose efficient arrangement and harmonious coordination are basic to physical planning. The Nigeria Institute of Town Planners conceives physical or land use planning as requiring 'participatory and integrated processes of allocating land for promoting sustainable development' (Falade, 2012). Olajuyigbe and Rotowa (2012) opine that physical planning ensures compatible land uses, guarantees orderly development and provides functional and visually pleasing environment and satisfactory services in a sustainable manner. From the above definitions, Physical Planning is a conscious but comprehensive approach to orderly and healthy use and management of the natural environment of human settlements (Bakare, 2012). Location pattern of PFSs in the study area may be difficult to attain without the role of physical planning and how its understanding could facilitate a balanced and sustainable national development (NPC, 2009). As noticed in the study area that many of the PFSs were located within residential areas and also too close to residential buildings as against physical planning specification of the State Ministry of Housing and Urban Development. It is obvious that physical planning roles are to regulate and control the establishment and location pattern of PFSs.

Man and Environment Interaction

The environment is defined as those components (water, air, land, etc) which support the survival of man. The environment is very complex as there are many factors that shape it (Olajuyigbe, 2014). The word "environment" has been defined as the total outer physical and biological system in which man and other organisms live (Aina, 1991). The well being of man and the sustenance of his livelihood are closely associated with the environments. In planning parlance, George (2006) describes the environment as the spatial surrounding of the home, work place or public place which is the physical entity where both flora and fauna thrive, also is the natural environment which is very important to the sustenance of life, and it

must be ensured that development efforts are not harmful to environmental factors that support life.

Concept of Sustainable Development

Sustainable development can be defined as development that caters for the needs of people without compromising the needs for the future generations (Barrow, 2006). The quest for the quantification of the probable positive or negative influence of man on the environment is the genesis of the concept of Environmental Impact Assessment (EIA) (Ojo-Fajuru, 2001). EIA needs to include the social participatory and economic issues alongside the environmental issues. If these elements are included, the key links between EIA and sustainable development would be addressed. EIA is a planning and management tool that can be used to promote sustainable development and is aimed at providing decision makers with enough information on the consequences of projects, especially those with a potentially high impact as in the case of filling stations. EIA is therefore a crucial step toward a cleaner and healthier environment without compromising the need for development (Pretorius and Sandham, 2006).

The need for the development of filling stations must always be balanced with the need to protect the environment (Govender, 2009). As with other infrastructure developments, the development of filling stations forms part of a growing economy. An increase in development also results in an increase in employment opportunities, which results in a greater proportion of the population owning cars and utilising public transportation systems. The three basic components of sustainable development are economic, social and the environment, these components need to work together for the concept of sustainable development to function. If the economic aspect is not there to support the environment, there will be a malfunctioning, so also, if the social framework is lacking there will be a great abnormality. In turn, filling stations need to be developed to cater for the needs of the larger amount of cars on the road networks and not to the detriment of the environment (Govender, 2009).

THE STUDY AREA AND RESEARCH METHODOLOGY

The Study Area

Akure South LGA is located in Ondo State in the South-Western geopolitical zone of Nigeria. It occupies a land area of 37,134 hectares (35 sq.km). It lies between latitude 6^0 95' and 7^0 15' North on the Equator and longitude 5^0 15'and 5^0 40' East of the Greenwich Meridian (Macmillan, 2006). The study area is bounded by Owo Local Government Area in the East, Akure North and Ifedore Local Government Areas to the North, Ile-Oluji/Okeigbo Local Government Area in the West and Idanre Local Government in the South. Also the study area has some notable roads, which include; Akure/Owo express way, Ilesa road, Oyemekun road, Oja-Oba road, Arakale road, Ondo road, Alagbaka road and Ijoka road among others (figures. 2 and 3). The population growth in Akure agrees with the increase in vehicular ownership which gives rise to the number of PFSs in Akure. However, this increase of PFSs and their location pattern is of great concern to urban planners.

Research Methodology

Two (2) different sets of structured questionnaires were administered on the residents and the Owners/Managers in charge of the PFSs in Akure, oral interview was also considered where necessary. Simple Random Sampling Technique was used in the administration of questionnaire on the residents (household-heads) of the sampled buildings, while total survey (100%) was conducted on the Owners/Managers of the PFSs in the study area for detailed survey. Marta, *et al* (2011) measured the quotients for the levels of an aromatic compound

(benzene) and a hydrocarbon (n-hexane) at three Murcia PFSs and discovered that the distance at which the PFSs stop having an impact on the environment is about 100 metres. But the distance depend on the number of petrol pumps, the amount of fuel drawn from them, traffic intensity, the structure of the surroundings, and weather conditions. The same view was expressed by Blamah, *et al* (2012) in their study on Location Impact Assessment of PFSs, that residential, commercial and public/semi-public buildings within a distance of 150 metres stand the risk of hazards that emanate from PFSs.

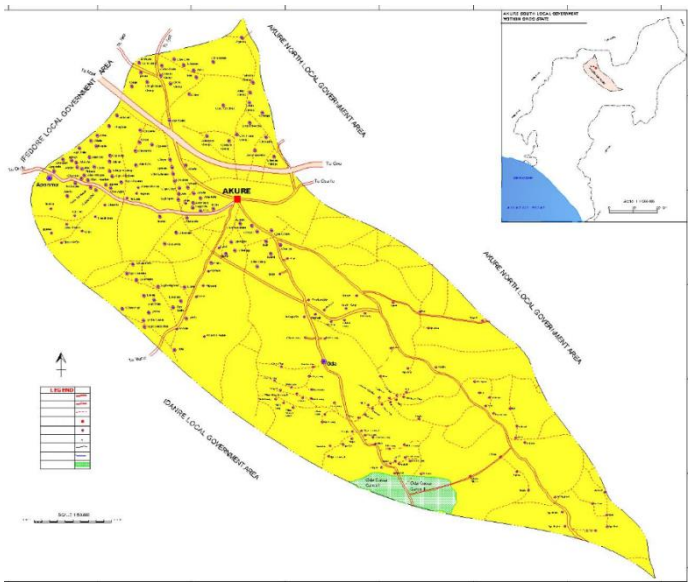

Figure 2: Akure South Local Govt. Area Map
Source: Ondo State Ministry of Housing and Urban Development, 2013. Digitized by the Author, 2015

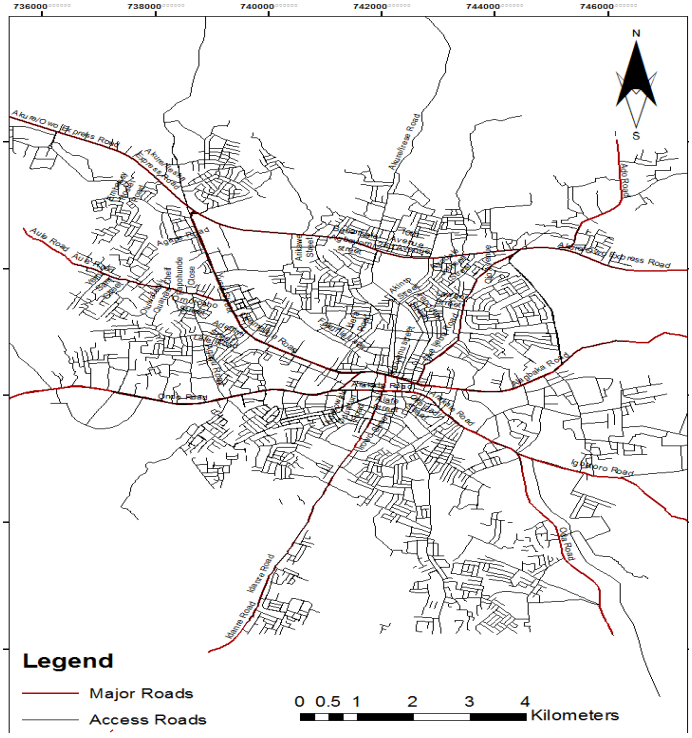

Figure 3: Road Network Map of Akure
Source: Ondo State Ministry of Housing and Urban Development, 2013. Digitized by the Author, 2015

DPR (2010) reveals in the planning criteria for the location of PFSs, that the minimum distance of PFSs to public and residential buildings should be 100 metres. On these premise, the researcher maintained 150 metres radius around all functional PFSs after the researchers

maintained 150 metres radius around all functional PFSs after dividing Akure the study area into its eleven (11) wards. These are existing political wards. The researchers only made use of the existing 11 wards out of which the 7 relevant ones were identified. The seven (7) wards identified during reconnaissance survey with concentration of PFSs were focused on. However, buildings within 150 metres radius form the basic sampling frame for the residents, while all the PFSs form another sampling frame (table 1, 2 and fig. 4, 5). This was captured using the Global Positioning System (GPS) in picking the coordinates of the PFSs on site, while the Satellite Imagery of the study area was gotten and updated by the researchers in order to know the total number of buildings within the 150 metres radius. From Table 2.7% (415) of the total buildings within 150 metres radius to PFSs were randomly selected for the administration of questionnaires. The sample size of 2.7% (415) is reasonable considering the fact that in similar studies on Akure, a sample size of 2.3% (150) was used by Omole (2001), while Emmanuel (1998) used a sample size of 5% (330) and got reliable results. Total survey was carried-out on the 87 PFSs. The analyses were done using Univariate, Bivariate and Multivariate analysis.

Table 1: Number of PFSs in the Eleven Wards of Akure the Study Area

S/N	Ward	Total number of PFS
1	Gbogi/Isinkan I	10
2	Apomu	-
3	Gbogi/Isinkan II	14
4	Oda	07
5	Ijomu/Obanla	20
6	Oke-Aro/Uro II	02
7	Oke-Aro/Uro I	11
8	Oshodi/Isolo	05
9	Owode/Imuagun	20
10	Lisa	-
11	Odopetu	03
	TOTAL	92

Source: *Author's fieldwork, 2015*

Table 2: *Number of Buildings within 150 metres radius in the Seven (7) Wards selected for Sampling*

S/N	**Ward**	**Total number of PFSs**	**Total number of buildings within 150metres radius around PFSs (Sampling frame)**	**7% of Buildings (Sample size)**
1	Gbogi/Isinkan I	10	764	53
2	Gbogi/Isinkan II	14	1098	77
3	Ijomu/Obanla	20	1526	107
4	Oke-Aro/Uro I	11	813	57
5	Oda	07	470	33
6	Oshodi/Isolo	05	181	13
7	Owode/Imuagun	20	1072	75
	TOTAL	**87**	**5,924**	**415**

It was revealed in the analysis on Table 3 that 8% of the respondents were retiree, 25% were traders also on the analysis are the artisans which accounted for 14%, while civil servant in the study area recorded 53% of the total respondents. This analysis implies that majority of the respondents are civil servants who are beneficiary of the minimum wage as well as loan from the government. These opportunities made it possible for some of the civil servants to have vehicles of their own which triggered the building of PFSs at strategic locations to meet the demand of vehicle owners.

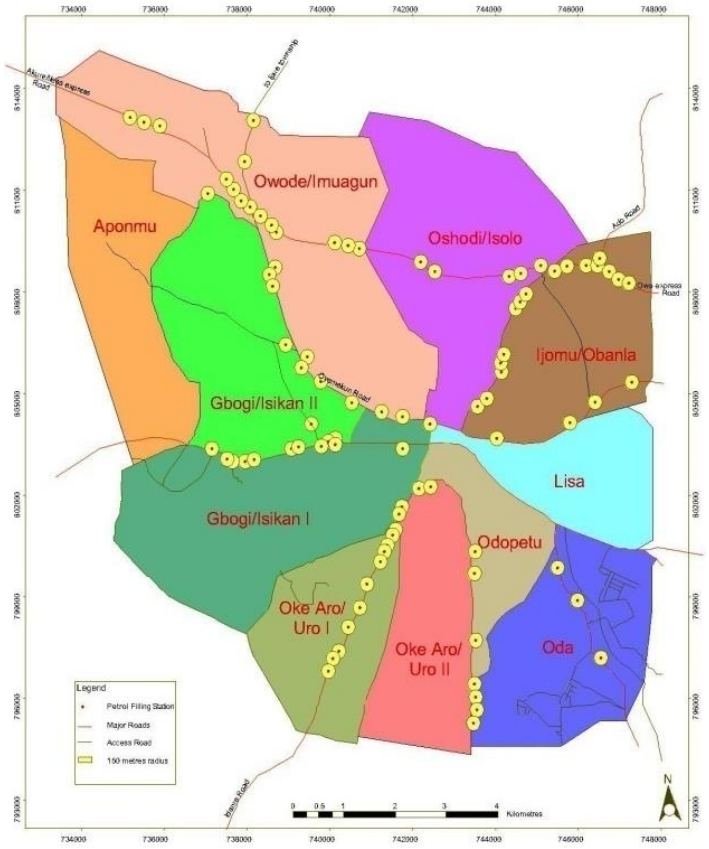

Figure. 4: *Location of PFSs in the Eleven Political Wards of Akure*

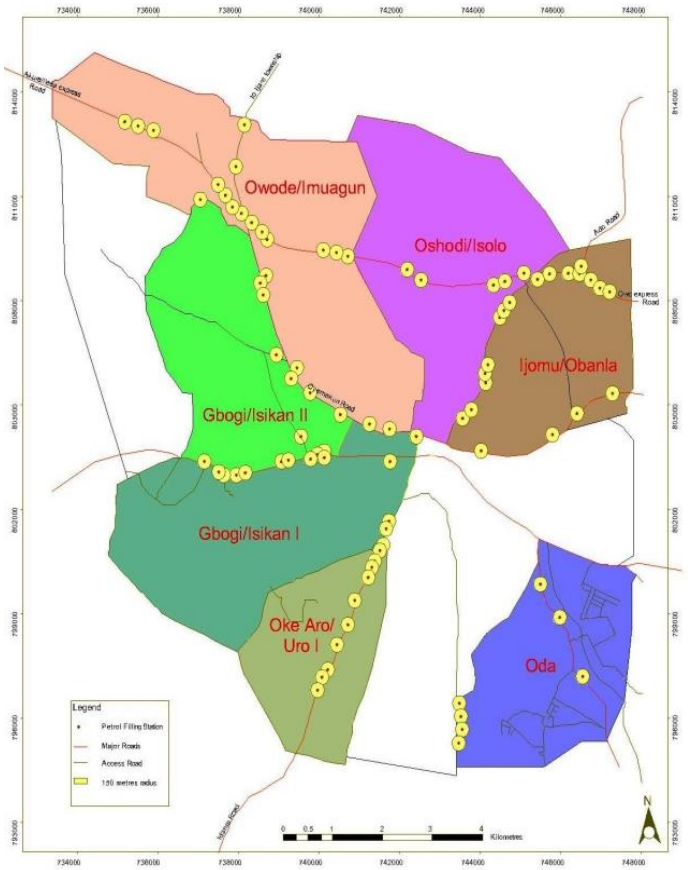

Figure. 5: Location of PFSs in the Seven Political Wards Selected as Sampling Frame

RESULTS AND DISCUSSION

Occupational status of respondents

Table 3: Occupational Status

Occupation	Frequency	Percent
Retiree	33	8
Trader	104	25
Artisan	58	14
Civil Servant	220	53
Total	415	100.0

Monthly income of respondents

The monthly income of the respondents in the study area as shown on Table 4 reveals that 22.6% was dominated by less than N20,000, the monthly income of N20,000-N40,000 accounted for 24.8%, also N40,001-N60,000 recorded 47.7% of respondents, 2.6% claimed to be receiving N60,001-N80,000 per month, while 0.8% of the respondents earn between N80,001-N100,000 per month and 1.5% earn above N100,001 in a month. This reveals that over 50% of the respondents live above one dollar per day and therefore enhances their standard of living which can also lead to increase in vehicle ownership; also there is tendency for each household or family to have a generating plant which operates on petrol so as to ease the problem epileptic power supply.

Table 4: Monthly Income of Respondents

Monthly income	Frequency	Percent
Less than N20,000	93.8	22.6
N20,000-N40,000	103	24.8
N40,001-N60,000	198	47.7
N60,001-N80,000 N80,001-	10.7	2.6
N100,000	3.1	0.8
Above N100,000	6.4	1.5
Total	415	100.0

Land Value in the Study Area

The oral interview conducted on the PFSs owners is revealed on Table 5 shows that the land value per plot in the study area varies, such that land value between N10.1m-N15m accounted for 55% of the total respondents, 40% of the respondents are of the opinion that land value in their area is between N5.1m-N10m while 5% reveals that land value in their area is between N1.1m-N5m. It is obvious from the analysis that the minimum cost of land in which PFSs are located is between N5m – N10m. This is based on the premise that there were no vacant plots in the core of the study area; therefore, some of the buildings in the core area that were in bad or dilapidating conditions were bought by some oil marketers at a very high cost of money. Most of these plots sizes are between 648m^2 – 1,295m^2 (1 plot and 2 plots) which are not within the recommended land area for siting of PFSs. As a result of this some of the PFSs owners did not seek for approval because of the political backing they enjoy.

Table 5: Land Value in the Study Area

Land Value	**Frequency**	**Percent**
N10.1m-N15m	48	55
N5.1m-N10m	35	40
N1.1m-N5m	4	5
N0.5m-N1m	-	-
N0.1m-N.5m	-	-
Total	**87**	**100.0**

Accessibility of PFSs to customers in Akure

Table 7 reveals that 82.8% of the respondents were of the opinion that their PFSs are highly accessible to customers while the remaining 17.2% of the PFSs were fairly accessible to customers. The above analysis infers that accessibility to customers is one of the important factors that is considered by oil marketers before locating PFSs. Apparently, accessibility of PFSs to customers determines the level of patronage.

Table 7: Accessibility of PFSs to customers in Akure

Accessibility	Frequency	Percent
Highly accessible	72	82.8
Fairly accessible	15	17.2
Poorly accessible	0	0
Total	**87**	**100.0**

Enforcement of Planning Standards on PFSs in Akure

The enforcement of planning standards on establishment of PFSs were not strongly enforced as indicated in the analysis. Planning standards were slightly enforced in the study area on the physical planning parameter highlighted on Table 8. Having obtained the standards for the location of PFSs from relevant authorities, the researchers then carry out field investigation to ascertain how many PFSs complied with the standards. It was discovered that many of the PFSs did not comply with the standards. The authorities in charge of the approval and enforcement of planning standards on location of PFSs were of the opinion that inadequate modern planning equipments such as Handheld Multigas Analyzer, Handheld Hydro Analyzer, Handheld Traffic Counter, etc and shortage of manpower that could effectively carry-out development control activities in the study area are the bane for the enforcement. These weaknesses on the part of the Institutions encourage PFSs owners to haphazardly locate their PFSs.

Table 8: Enforcement of Planning Standards on PFSs in Akure

Enforcement	Setback to road		Air space of 100m to residence		Maximum percentage Developed		Distance of 2 PFSs on the same lane		Distance of 2 PFSs on adjourning lane	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Strongly enforced	10	11.5	0	0	7	8.0	0	0	0	0
Enforced	19	21.8	13	14.9	20	23.0	8	9.2	5	5.7
Slightly enforced	58	66.7	65	74.7	48	55.2	32	36.8	29	33.3
Not enforced	0	0	9	10.3	12	13.8	47	54.0	53	60.0
Total	87	100	87	100	87	100	87	100	87	100

Regression Result on the Factors Responsible for the location of PFSs in Akure

Table 11 shows the regression analysis on the factors responsible for the location pattern of PFSs in Akure. five predictor variables were accommodated in the model which was developed for the study. These are: occupation (OCCU), enforcement (ENFORCE), land value (LAND), accessibility to customers (ACCESS) and income of respondents (INCOME). The overall regression using the five predictor variables was significant at 0.01 alpha level with F-value of 615.347, meaning that 5 major factors jointly contributed to the location pattern of PFSs in Akure. The coefficient of determination (R^2) is 0.775 signifying the combined influence of independent model parameters accounting for approximately 78% of the factors responsible for the location pattern of PFSs. Individually, variation occurs in the level of contribution of each factor. Highest here is accessibility to customers, followed by enforcement of planning standards and lastly occupation. The implication of this is that if

appropriate physical planning measures are not considered, the study area will be experiencing haphazardly increase concentration of PFSs.

Table 11: Regression Result on the Factors Responsible for the Location Pattern of PFSs

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
OCCU	-.181	.105	-.143	-1.722	.089
ENFORCE	.363	.233	.127	1.556	.124
INCOME	-.983	.178	-.465	-5.539	.000
LAND	1.267	.258	.497	4.908	.000
ACCESS	.023	.468	.004	.050	.961
Constant	-2.539				
R	0.735				
R^2	0.775				
df	6				
F-value	615.347				
Sig	0.000				

The regression equation is as follows;

(NUPET)=2.539+0.181(OCCU)+0.363(ENFORCE)-0.983(INCOME)+1.267(LAND) +0.023(ACCESS) …….....(i)

This model is helpful in making prediction with increase or decrease in the levels of predictors.

CONCLUSION AND RECOMMENDATIONS

It is pertinent to note that the subsequent increase in vehicular ownership and the use of petroleum products have resulted in the proliferation of PFSs in towns and cities today. The rapid growth in urbanization has produced greater demand of vehicles, which results in more fuel consumption. It is obvious that Nigerian cities and towns are getting congested with every nook and cranny filled with PFSs. Consequently, some insidious effects of the indiscriminate location of PFSs in Akure have been over-looked. Based on the findings of this research, the study has clearly shown that weakness enforcement of planning standards, accessibility of PFSs to customers, occupation status and income of respondents are the major factors responsible for the concentration and haphazardly location of PFSs in Akure. On this premise it is recommended that workable planning standards policy on location of PFSs be enforcement. There is also an urgent need of a policy framework that will strengthen the professionals in the ministry, local and state governments to fulfill their constitutional obligations. In addition, the Akure Master Plan should be reviewed in order to incorporate the existing physical development with the future, so as to prevent further physical deterioration of the town through indiscriminate location of PFSs. On the whole, it is recommended that modern planning equipments such as Handheld Multigas Analyzer, Handheld Hydro Analyzer, Handheld Traffic Counter, etc should be provided by the government which could be used for effective development control activities so as to create an enabling environment for living and qualified personnel should be recruited.

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Assessment of Housing Condition and City Liveability in Ogbomosho, South Western Nigeria

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ABSTRACT

This paper examines issues on housing condition and city livability in Ogbomosho, South Western Nigeria, with a view of determining and the contributions of housing provision to urban sustainability. No doubt, the modern age is an age of urbanization, where villages are fast growing into towns and towns into cities but the consequences are unimaginable. The research on one part, examined the socio economic characteristics of residents and the physical infrastructures in the study area. It also examines the condition of buildings in the area and carries out the assessment on the types of houses in the study area. Using systematic random sampling technique, data were collected with the aid of structured questionnaires. Interviews were held to complement data from questionnaire survey while descriptive statistic methods were employed to analyze the objectives set for the study. Findings reveal the socio-economic characteristics of residents and its effects on physical environment of the area. The study showed inadequate provision of facilities such as pipe – borne water, erratic power supply, poor solid waste management and presence of substandard houses in the study area. This study however, makes recommendation for the enforcement of planning regulations to improve the housing quality and facilities in the study area. It is therefore necessary for various organizations and government institutions to provide create and implement comprehensive and coordinated housing programmes for the area.

Keywords: housing, city livability, sustainable development, infrastructural facilities

INTRODUCTION

Cities are focal points in an economy where people come together primarily to exchange goods and interact. The alarming growth of urban population and poor response of government are factors that partly contribute to high rate of physical development mishap in cities (IFPRI, 2002). A city is considered a place with relatively large population that has a legal status, granted by the national or provincial government, and that is associated with specific administrative or local government structures (Brockerholf, 2000). It can be likened to the human body. The flesh of the city is the residential area. The blood circulation is the movement of people or commuters. The blood arteries and veins are the various circulatory systems and the heart is the central business district (CBD). Despite opportunities in cities, African cities over the years are experiencing increasing rate of urban infrastructural inefficiency. Interestingly, scholars perceive cities in its various manifestations as catalyst to development in the country. It had also been sounded over time that, nowhere in West Africa is the rate of urbanization in the last few years as unprecedented as the city of Lagos (Agboola and Agunbiade, 2007). This implies that the city has a persistent rate of growth with a resultant effect on the carrying capacity and ecological footprint of the city.

The rapid expansion of urban population has brought with it many problems associated with the difficulties of providing basic infrastructure such as electricity, inter-urban and intra-urban transportation and communication services and the problems of providing medical, educational, and recreational facilities (Abiodun, 1976). The rapid increase in the population of urban centers has resulted in an increase in the cost of living because of higher demand on urban commodities. There is a dearth and high cost of urban land, and high cost of housing, which is often in short supply and out of the economic reach of the majority of the urban

Enisan, G. & Omole, F. K. (2016). Assessment of Housing Condition and City Liveability in Ogbomosho, South Western Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1307-1314

households (Oladapo and Olotuah**,** 2007). The urban centers are populated by a large mass of people on low wage and who face irregular employment. This segment of the urban population is indeed poor, and is constrained to limited, insufficient, crowded, cold and dirty shelter and a generally degraded environment (Mabogunje, 1985). These are the urban poor who are subjected to a life characterized by precarious conditions of nutrition and health, little or poor material possessions.

The issue of livability has become very insistent of late, especially with the increasing environmental deterioration in the large metropolitan centers. It involves not only living conditions but also ease of circulation in the city. This is as a result of tremendous pressure of population on limited facilities and is manifested in growth of squatter settlements, overcrowded habitation, breakdown of waste disposal arrangements, inadequate power and water supply and generally poor condition of environmental sanitation (Mabogunje, 1974).

Many aspects of urban design and new approaches to city form are based on the concept of liveability. These approaches recognize that design and structure can be very influential in the life of a town or city and indeed to the building of community in and of itself. They also create novel contexts for a community to develop in a more sustainable way (Enisan and Rotowa, 2013). The formation and development of Ogbomoso was not planned and have gone through ages. The structures are old, the environment is unplanned and the infrastructure is dilapidating which tends to put more pressure on issue of liveability in the town.

Housing is one of the basic human needs and ranks third after food and shelter which therefore makes it a prerequisite for the survival of human beings (Onibokun, 1972). Housing is defined as "the process of providing a large number of residential buildings on a permanent basis with adequate physical infrastructure and social amenities, (services) in planned, decent, safe, and sanitary neighborhoods to meet the basic and special needs of the population. Adequate housing therefore should provide protection from the elements, minimize the risk of disease and injury, and contribute to the physical, mental and social wellbeing of the occupants. Housing provides the physical frame work and the environment in which the economic value of man, socio-cultural and aesthetic value of man and society are realized; enriched and integrated housing is an essential part of productive infrastructure item as a productive investment. Housing is expected to satisfy certain biological, psychological, social, cultural and economic needs of the people. Housing development in both rural and urban is therefore an important aspect of a nation's development program. Although housing problems exist in all nations of the world. These problems however differ in terms of their fundamental causes, magnitude and dimension from one nation to another (Ahianba, Dimuna, and Okogun 2008).

In Ogbomosho where the study area is situated, previous studies show that situation of housing has been deteriorating fast and there is no solution in sight by the land lords to improve the standards of their houses. Most of the good houses there are either built by rich individuals or provided by the government, the lack of quality housing in Ogbomosho has led to several environmental problems in the area. One of the major noticeable problems are improper disposal of human waste, open defection, this is caused by the lack of toilets by most houses in Ogbomosho. Another problem is the absence of an aesthetically pleasing environment; this is as a result of uncoordinated planning and building arrangement. Another point of note is high number of abandoned houses in, this is mainly due to the collapse of the buildings and it is caused by the poor construction materials and method used in building the houses (Toyobo, Muili, and Ige, 2011). These problems mentioned above led to the interest

of the study to focus on the provision of housing quality and also a livable city which makes Ogbomosho a place of interest.

THE STUDY AREA

Ogbomosho is a pre-colonial urban center and the second largest city, both in terms of population and spatial extent, in Oyo State, Nigeria. The city is located at a distance of about 100km north of Ibadan, the Oyo state capital and about 80km from both Ilorin and Oshogbo, respectively the Kwara and Osun State capital. It is one of the main gateways to the northern part of Nigeria from the Yoruba land. It is bounded by river Ora to the east, while no major physical barrier is encountered to the north, west and south. It develops laterally towards the north and south along Ibadan-Ilorin road. The city is surrounded by a number of villages and medium sized towns such as Ikoyi, Odo-Oba and Iressa Apa which all have organic linkage with it, but at distances considered far enough to be out of range of influence of expansion of Ogbomosho (Adeboyejo and Abolade, 2007). The town is divided into two local governments and they are; Ogbomosho North and the Ogbomosho South Local Governments with 10 political wards each and their headquarters are at Kinnira and Arowomole respectfully.

The city of Ogbomosho is one of such numerous Yoruba settlements, South-West of Nigeria, where urbanism as a way of life predates European Colonization of the country. Like the originand development of most Yoruba settlements in the early 18th century, the city emerged from the activities of five different waves of migrants, who settled in different areas of the present city. It was the last wave of migrants, led by Soun Ogunlola, who as a result of warring prowess, subjugated and pacified the separately developing villages and hamlets in the surrounding areas into a large settlement that is known today as Ogbomosho (Adeboyejo and Abolade 2007).

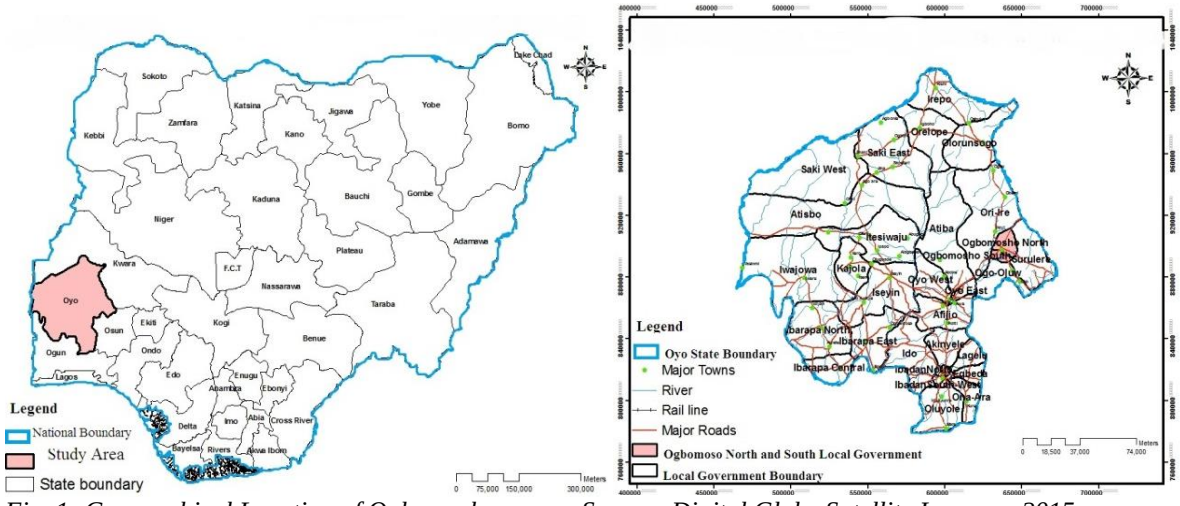

Fig. 1: Geographical Location of Ogbomosho *Source: Digital Globe Satellite Imagery, 2015*

Ogbomosho lies approximately, 8˚08′ North of the equator and 04˚15′ East of Greenwich Meridian.

MATERIALS AND METHOD

The data for this research project was collected from primary sources. A large proportion of the needed data for this research project were generated directly by the researcher. Information and data were obtained directly from the targeted populations at the research site using formal, structured questionnaires. A close ended type of questionnaire was adopted.

This is to enable the questionnaires to be easily subjected to quantitative analysis. The data obtained include such socio economic characteristics of respondents as number of male and female persons in the household; number of households in the house; age; sex; tenure status; occupation; educational status; income among other variables of home environment. The residential densities of the study area were identified and systematic random sampling was adopted within the stratum to capture the primary data and other relevant information to the study. Consulting extensively relevant textbooks, publications, records, maps, and dictionary were also done. These materials dwelled largely on housing generally and how it affects city livability. The survey covered notable areas in Ogbomoso.

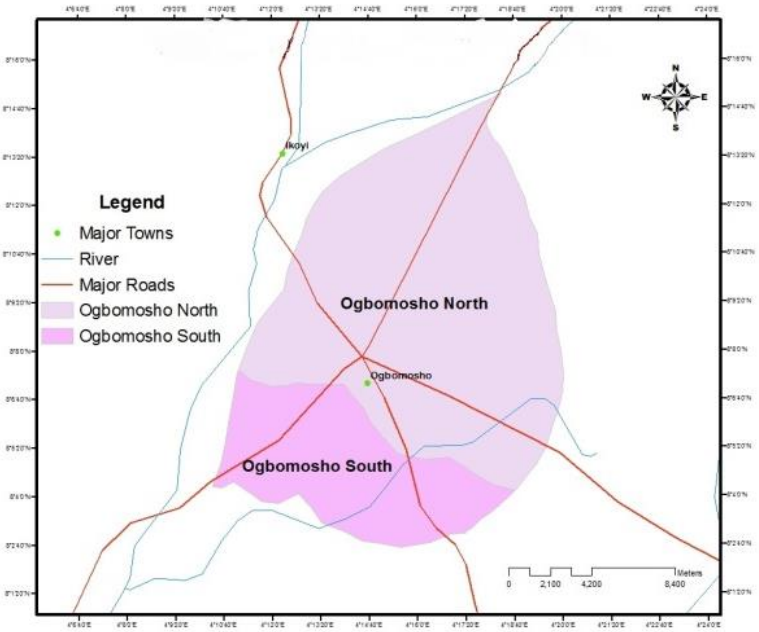

Fig. 2: Ogbomosho North and South Local Government Area
Source: Digital Globe Satellite Imagery, and Redigitized By Author, 2015

Table 1: Sampling Procedure

Selected Neigbourhoods	Residential Density	Number of Buildings	% Chosen	Sample Size
Ajegunle	57	823	2	16
Akata	37	510	2	11
Arinkinkin	17	248	2	5
Alapata	94	1, 346	2	27
Arowomole	34	489	2	10
Ibapon	25	356	2	7
Ijeru	21	307	2	6
Ilogbo	32	455	2	9
Esanu-Aje	33	472	2	9
Ita-Olola	63	904	2	18
Malete	74	1, 056	2	21
Oke-Apata	61	876	2	18
Sunsun	91	1, 305	2	26
Oragada	55	782	2	16
Isoko	51	721	2	14
Total	**745**	**10, 650**		**213**

Source: National Population Commission, Oyo State, 2014; Field Survey, 2015

A total number of 213 respondents were randomly sampled and interviewed during the field survey. The residential density is the population of building per 10,000square meters (buildings per hectare). Data obtained from the study was analyzed with the aid of relevant quantitative techniques using appropriate software that produced accurate result on the

relationship between housing and city livability. All the data collected from the field were collated, processed and presented in form of tables and charts. The used of Statistical Package for Social Sciences (SPSS) was employed for data analysis and presentation. The use of Microsoft Excel was used in the collation of data. Information was given on frequency distribution of the variables for proper comparison.

FINDINGS

The role of housing in human survival cannot be over emphasized. Every person is affected in his day to day activities by the type of house where he or she lives. This study was concerned with a survey of houses and the facilities available in Ogbomoso, Nigeria. For this research, houses in Ogbomoso were classified as follows: family house, single house on one lot occupied by one family, apartment in a building with more than one apartment, duplex and brazillian houses. Analysis also revealed that majority of the residents in the family and brazillian houses were of low income category and residents in the apartments and single house on one plot occupied by one family belonged to middle income category while bulk of residents in duplexes belonged to the high income category. This study also revealed that socio economic characteristics such as education, occupation, monthly income of respondents and household size determined the choice of housing types (See Table 2).

Table 2: Livability Structure in the Study Area

Type Of House	**(%)**	**Monthly Income (N)**	**%**	**Household Size**	**%**
Brazilian Bungalow House	40.8	Less Than 10,000	32.4	Above 7	38.7
Brazilian Storey House	27.2	10,000-20,000	47.4	5-7	30.3
Flat	20.7	20,000-30,000	15.5	3-5	22.1
Duplex	11.3	Above 30,000	4.7	Below 3	8.9
Total	**100.0**		**100.0**		**100.0**

Fig. 3: Example of the Type of Building Common in the Study Area

The study established that there are more of untarred and dusty roads which are always slippery during rainy season in Ogbomoso. Even out of the ones that were tarred, some due to lack of maintenance quality, are already worn out and filled with pot holes. Self-employment is most rampant form of occupation with little income per month, which rates poverty at high level. The survey showed that respondents are mostly craftsmen and self-employed and under this category, we have trading, farmers, tailoring, mechanic, bricklaying, carpentry, furniture making, hairdressing, bead making, Ifa divination , civil servants represents a little percentage owing to the fact that most of the inhabitants are illiterates with low education which limits their income.

The presence of low income earners coupled with the level of education of respondents are factors that contributed to the quality of housing standard in the study area. Findings show

that hand-dug well is the main source of water supply in the environment. This situation does not guarantee adequate supply of good quality water in the area. Most of the wells are located in unkempt surroundings, some of which are without cover while the water is used raw without treatment. The rain water used as substitute during raining season has the possibility of being contaminated as majority of the roofing sheets are rust and dirty.

According to the survey, pit latrine is the most rampant type of toilet found and used in the study area due to the building design and also the level of literacy which leads to neglect on part of the inhabitants. Water Closet is not common in the study area and the usage of open defecation also practiced in the area. Some of the respondents burn their solid waste, and some which are constituted mostly by educated people give their solid waste to waste disposal management, the most rampant practice amongst the inhabitants is the dumping of their refuse on refuse dumps. When refuse are dumped on the refuse dumps and are not taken care of properly, mosquitoes, rodents and small animals scatter, ruminate and spreads the refuse, which makes the city an eyesore and can propagate easy outbreak of diseases like cholera.

Table 4.19: Method of Solid Waste Disposal

Method of solid waste disposal	Frequency	Percent (%)
Open space	97	45.5
Waste management	73	34.3
Burning/incinerating	29	13.6
Stream/drainage channel	14	6.6
Total	213	100.0

Fig. 4: Indiscriminate Disposal of Wastes in Open Spaces in the Study Area

Table 4.31: Condition of Street Road

Condition of Street Road	Frequency	Percent (%)
Tarred	58	27.2
Not tarred	91	42.7
Tarred with potholes	64	30.0
Total	213	100.0

Fig 5: Condition of Access Roads in the Study Area

The findings revealed that Ogbomosho is an urban area in transit, that is, it is still a developing urban area. The reason is because Ogbomosho still possesses some rural area characteristics, the qualitative housing problem in Ogbomosho is a housing problem that is peculiar to houses in rural areas. The main problems of the houses include the lack of quality drainages by most houses in the area, lack of environmental facilities and poor environmental conditions of the housing environments. The government is also inactive when it comes to evaluating housing problems in Ogbomosho, most of the houses that are rented by the occupants are owned by the informal sector and aside the Government Reserve Areas (G.R.As), there are no housing estates in Ogbomosho. The study therefore, underscores the need for the overall improvement of housing environments in Ogbomosho and the provision of environment facilities like the waste disposal facilities in housing environments. It also highlights the importance of government participation in the improvement of housing quality in Ogbomosho.

RECOMMENDATIONS AND CONCLUSION

Based on the major findings in the study, the following recommendations are put toward as policy guidelines toward a sustainable management of the area of study. These include the development and upgrading program through rehabilitation/renovation approach as well as provision of urban basic services. This simply involves rejuvenation of the area by retaining some structures that are retainable; rehabilitate old buildings and structures, upgrading the roads that are not tarred and introduction of more roads. It also involves improving the existing infrastructures as well as providing new ones. These are improving the structural quality and aesthetic of the area. The issue of economic revitalization of the area will leads to the generation of employment opportunities. This will help to improve the level of capital base and potential for capital formation among the residents that will enhance their level of provision for basic household facilities and proper maintenance of buildings. This approach offers future proceed that can sustain any improvement effort that may be put in place to revive the area. Similar to this is the use of effective public enlightenment strategies to affect public awareness and community participation in area of personal hygiene and need for improving sanitary condition in the area. According to Owoeye (2013), an enforcement of environmental sanitation laws on citizens has a little prospect of success without an enlightened public. The starting point therefore is to educate the people on the dangers of poor sanitation on their health and the need for an improved healthy environment.

Beside all these, sanitary services in the areas need urgent attention, particularly water supply and waste disposal facilities. However, mini-water-works or boreholes and public toilets in strategic places in the area are recommended under urban basic service program. Also, the efforts of the Waste Management Authority should be well supported through adequate funding so that facilities for effective services to more areas can be enhanced. In the light of this, Local Government Authority should be called to their primary responsibility to ensure regular collection of refuse in these areas. Meanwhile, the reintroduction of old sanitary inspectors, called *'Wolewole'* would be needed to reawaken the unconcerned attitude of the residents towards sanitary laws and regulations. Inspections should be made without prior notice so that the people can always prepare to keep their surroundings clean at all times. Efforts should be made as well to ensure punitive measure on any culprit who violates such orders.

The study revealed the presence of low income earners, substandard buildings, different forms of housing development and inadequate facility and poor environmental management in the study area. It is therefore necessary for a vital agency(s) be assigned the responsibility of creating and implementing a comprehensive, coordinated housing program for

Ogbomosho town. It is difficult to specifically define the activities and elements of the program because of availability and funding uncertainties. However, the program should include rehabilitation grant and low interest loan program should be established in Ogbomosho. This program should be similar with the federal program that provides grants to individual for the development of dwelling units. An intensive code enforcement program requiring strict compliance with housing, building and other codes should be established for areas in Ogbomosho which are in need of this type of action. A capital improvement program should be initiated including a complete inventory of condition of existing facilities and the creation of plans and cost estimates for implementation. Those needed improvement should be programmed to provide the study areas with facilities and services at the earliest possible date. Government should make purchase of essential building materials in bulk for the distribution to members. This could be subsidized by government funding. Finally, there should be re-orientation of people for new construction towards a home improvement scheme for the rehabilitation of the existing housing stock.

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Environmental Assessment of Students Hostels in Federal University of Technology, Akure, Nigeria

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ABSTRACT

Student housing has been a major area of concern with increasing student population as a result of increasing demand for higher education over the years. The rise in student population has led to various problems in student housing which range from inadequate infrastructural facilities to overcrowding, has indeed met with renewed interest in sourcing and reaching the best practicable approach towards the enablement and efficient, conducive academic driven environment. This research assesses the student housing condition in Federal University of Technology, Akure, Ondo State, Nigeria. A total number of 152 questionnaires were administered and data collected was presented through the use of tables, graphs, and photographs. The study reveals that there is a high level of dissatisfaction with the state of available student housing facilities. The inadequacy of the existing housing facilities which has created high occupancy ratio which has invariably led to over utilization of the available resources putting the facilities in deplorable conditions. It is therefore recommended that the existing housing facilities need to be rehabilitated. In addition, more hostels should be built in order to meet the student bed-space population of two persons per room.

Keywords: Academic, Environment, Housing, Student, University

INTRODUCTION

Housing is often regarded as one of the basic human needs. It ranks third, after food and clothing. It is a pre-requisite for the survival of man (Onibokun, 1999). The importance of housing covers the entire aspect of human life. It involves physical protection from hazards which ordinarily may be regarded as shelter but also provides the setting for many of the biological and social processes necessary to sustain life, which permits the healthy growth and development of the mind. According to Aluko (2009), housing as a unit of the environment of man, has a profound influence on the health, social behavior, satisfaction and general welfare of the community. It reflects the cultural, social and economic values of a society as it is the best physical and historical evidence of civilization in a country.

Students' housing is a major form of accommodation for university students who are in a transitory stage of life. Akpan (2000) states that, student hostel has for long been thought of as a vital component of university campuses, further explains its necessity by reporting that a well-planned out housing facilities promote desirable educational outcomes and helps to achieve the broader objectives such as social cohesion and responsible citizenship. Objectives of Universities worldwide have been realized through development of facilities and infrastructure made towards housing (Hassanain, 2007).

Student housing has been a major area of concern due to increase in students' population as a result of increasing demand for higher institution of learning and this had made the issue of students housing a major area of concern. This rise in population had led to various problematic conditions of student housing. This ranges from inadequate infrastructural facilities to overcrowding. The basic infrastructural facilities needed by students include toilets, water, electricity, reading rooms, canteen, buttery, kitchenettes and recreation area among others. These facilities are expected in good working order but in contrary, they are either unavailable or in a state of disrepair.

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Nigeria has the biggest university system in sub-Saharan Africa with 114 accredited tertiary institutions and more than 50% of these facilities have over 20,000 students each (Okoh 2004). Nigerian universities have experienced a significant rise in student enrolments over the past decades. However, the surge in the number of students has not been matched by a corresponding growth in student accommodation and the available ones have not been properly managed. Figures from the National Universities Commission show that the provision of student housing is less than 30% of demand. The vast majority of students live in privately rented accommodation.

The bulk of "first generation" Universities in Nigeria have stopped funding student accommodation. Many of the newer universities have taken the private sector participation route, although the quality of accommodation varies widely. The student enrolment in tertiary institutions is growing at an average of 12% per annum and the provision of new purpose-built student housing is limited. This in itself creates opportunities for the development of student housing in many cities in Nigeria (Ubong, 2001).

It is obvious from the scarcity of literature on hostel accommodation for students in tertiary educational institutions in Nigeria that not much attention has been given to the problem in the past in spite of its enormity and sensitivity. Ubong (2001), had observed that hostel accommodation has not been receiving adequate attention in Nigeria Institutions, although it is an important component of pupil personnel management. This might be due to the national indifference arising from the people being used to general poor performance of social services.

In 2003, Hostel accommodation in Tertiary institutions in Nigeria became a topical issue following the decision of the Federal Government to increase hostel fees from the rate of N90.00 (less than$1.00) per session to N10,000.00 (about$73.43 at an exchange rate of N140.00 to $1.00). This announcement led to wide spread demonstration by students in Tertiary Institutions in Nigeria. Though the Federal Government eventually backed down, but many of the institutions have revised their rates upwards including the Federal University of Technology, Akure.

Regrettably, the institutions have over the years, not been able to keep the hostels even in minimum residential conditions because of lack of funds. According to Akpan (1998), the student population is increasing at a rapid rate, while the infrastructural amenities are declining in supply and their standard also depreciating. The facilities in Nigerian institutions (Hostels) are in deplorable conditions and are congested.

According to Okoh (2004), the complex problem of maintaining good hostels at 'near zero' charge to the users or charging realistic fees to enable the institutions maintain the hostels and risking violent demonstrations by students and possibly the Nigeria Labour Congress must have informed the directive by the Federal government to the tertiary institutions in 2004. The government directed that Tertiary Education Institutions must immediately withdraw from the management of students' hostels and hand them over to private operators who will determine the rent to charge to those who are willing to pay. The rational is that if the charges are high, and the services are low, the students will challenge the operators rather than the Management of the institutions and the governments that own the institutions. The view of the Federal Government is that a private management arrangement will free the administrators from the problems associated with hostel accommodations while focusing on the management of other aspects of institutional life. The question therefore is, should the institutions continue to run the hostels at the current level of fees or should economic rates be charged, or alternatively, should hostels come under Federal Government's privatization arrangements?

The need for effective and conducive housing facilities in the Federal University of Technology, Akure, Nigeria cannot be overemphasized due to the fact that students are expected to be in a sound state of mind to excel in their academic endeavors which can be achieved by a good student housing system. Since student housing provides not only physical protection but also a healthy social and behavioral stability, the productivity of a set of students may not be totally unconnected with their housing condition.

Olawunmi, Akinjare & Oluwatoyin, (2012) affirm that adequate provision of students hall of residence within a university has notable advantages which include: reduction in the rate of vagabond, punctuality to classes as against having to come from outside the university campus, which most times, is prone to traffic congestion fostering perpetual lateness to school. The peace and tranquility derivable from a campus environment is also very important in an institution where adequate housing is being provided and students from various parts of the country can be attracted to because of infrastructural provision such as security, internet connectivity, functional public utility, constant power supply and portable water. This will ultimately increase human productivity in terms of output.

The objectives of the study are to assess the physical environment. The aim of this study is to assess the environmental sanitation, housing condition and user's satisfaction of student housing in the Federal University of Technology Akure, with a view to proffering solutions to the housing problems identified. In order to achieve this aim, the following objectives are formed. They are to: assess the physical environment of the hostels; examine the infrastructural facilities in the students hostels; identify the problems facing the students housing in Federal University of Technology, Akure; investigate the level of student's satisfaction of housing provided; and suggest possible strategies to solve the housing problems in the hostels.

Most large universities facilitate dormitories for its students. While a few mandate the students to live in dormitories, most keep it optional for the students to choose. As established by various studies, it is obvious that the benefits enjoyed by college and university students who reside on-campus housing are many and significant. Those who have lived in hostels provided by schools will appreciate the usefulness of the facility for students. In addition to convenience, these benefits include greater academic success and enhanced social/personal development. Some of these benefits are explained in details below.

In term of enhancement of reading and learning, living in the school hall of residence or hostel gives students an academic edge as it enhance the desire to read. There are fewer distractions. It is also easier to relate with colleagues who are close by or teachers where a student has a difficulty on a subject matter. In addition, students who reside in hostels have a greater chance of participating in sports, games, club, and social activities that are expected to make them more rounded individuals and citizens than those living off-campus who may find themselves forced into domestic activities once they are at home.

Students are more secure on campus than off-campus despite the presence of cult activities in higher educational institutions in Nigeria. Reasons being that institutions maintain security personnel on campus and do monitor the activities of students. Some private Universities lock their gates early and do insist on students obtaining exit permits before they travel home. Graduates from tertiary educational institutions are graduated based on satisfactory performance 'in character and in learning'. Moral training includes individual behavior in group situations as in hostels. All institutions have Codes of Conduct that guide and regulate student behavior in hostels.

It is one of the desires of the Federal Government of Nigeria to use education as a means of attaining national integration as stated in the 1998 National Policy on Education. Hostel accommodation is one of the ways though which this can be achieved as students from various parts of the country Reside together in the same hostel. Private relations in hostel rooms could blossom into live- time positive relationships that would be beneficial to both parties.

MATERIALS AND METHODS

Research Locale

The study was carried out at the Federal University of Technology, Akure, in Akure South Local Government Area of Ondo State, Nigeria. The University is one of the Federal Universities of Technology established by the Federal Government of Nigeria in 1981 in a quest for technological development. The Institution is located between latitude 07^{o} 16^{i} and 07^{o} 18^{i} N and longitudes 05^{o} 09^{i} and 05^{o} 11^{i} E. It lies along Akure-Ilesa expressway, with Awule and Ibule as the neighbouring villages.

The University as at present has a population of about 15,000 students, with the undergraduate students making up about 13,000 while the post-graduate is about two thousand (2,000) students. The School's undergraduate halls of residence have 1,923 bed spaces meaning they were built to accommodate 24% of the total undergraduate population (Student Affairs Division, 2014). The population of students in the undergraduate hostel is currently 1,923). The post graduate hostel on the other hand has 50 rooms and 90 bed spaces which means about 4.5% of the total population of post-graduate students can reside there.

The land use of Federal University of Technology, Akure can be classified into two broad types which are built up areas (developed) and the forest area (undeveloped). The forested area include all the vegetative areas of the University which include forestry and wood technology plantation/nursery site, teaching and research farms including livestock section, cocoa plantation, natural forest, farm lands and wildlife park/fish pond among others. The developed areas include academic area, administrative area, residential area, commercial area, communal facilities area including religious area, parking and sporting areas among others.

Database Description

The research made use of primary and secondary data. Oral interview was conducted with the student affairs officer, hostels hall warden, and questionnaires were administered to the students in various hostels after the recognizance survey of the students` hostel environment. The secondary data include documented information from textbooks, dissertations, theses, magazines, journals, maps and information from the net.

Table 1: Questionnaire Distribution for Respondents

Hostel/Stratum	Category	Bed Space	No. of Rooms	8% Sample Frame Per Hostel	Sampling Interval
Akindeko	Male	630	157	50	3
Abiola	Male	315	78	25	3
Adeniyi	Male	188	47	15	3
Jibowu	Female	330	82	26	3
Annexes 1,2,3	Female	240	60	19	3
Jadesola	Female	220	54	17	3
Total		1,923	478	152	

The research population comprises all students in the Undergraduate hall of residence in

Federal University of Technology Akure. The hall of residence in the study area has a population of 1,923 undergraduate students and this form the research population. Aluko (2011) in his research on student hall of residence in the University of Lagos made use of a sample size of 3% per hostel. On the basis of this, this research made use of 8% sample size. It is believed that this sample size is more manageable and evenly represented. 8% percent of students in the selected hostels were interviewed at a fixed interval of three (3).

Stratified sampling technique was employed for this research. Each selected hostel represents a stratum. A random sample is taken from each stratum in a number proportional to the stratum's size when compared to the population.

RESULTS AND DISCUSSION

This research investigated the environmental sanitation, hostel condition and the user satisfaction level of undergraduate halls of residence in Federal University of Technology, Akure (FUTA). FUTA has seven (7) undergraduate halls of residence

Sex of Respondents

Earlier, it was reported that there were 1943 bed spaces provided by the university. Out of this, 58% were for males, while 42% were for females. This research in line with the above shows that 59% of the respondents were male, while 41% are female. This shows that we have more males in hostels than female. This is a reflection of the fact that there are more male hostels than that of the females in FUTA.

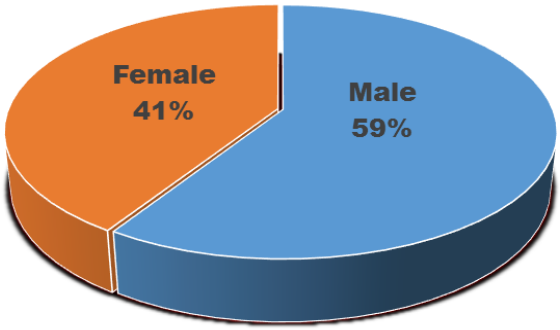

Figure 1: Percentage Rate of Male and Female

Toilet Facilities

The study carefully assessed the level of students' satisfaction with toilet facilities and the following findings were discovered; 65 percent of the students sampled were of the opinion that the toilet facilities were not satisfactory, 9 percent were indecisive, while the remaining 26 percent were of the opinion that the toilet facilities were satisfactory.

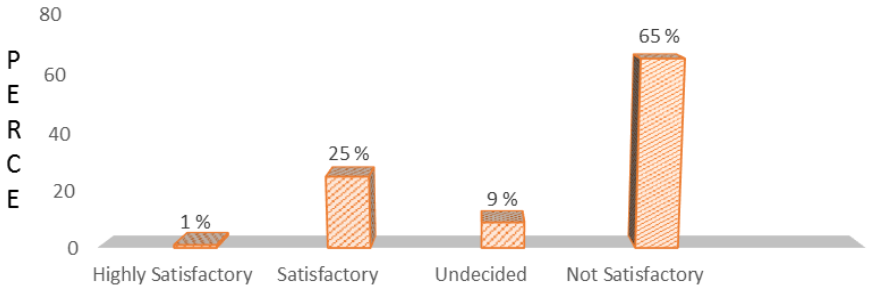

Figure 2: Level of Satisfaction with Toilet Facilities

Plate 1: Recently Used Toilet in Jadesola Hostel

Plate 1 shows the condition of toilet facilities in one of the hostels (Jadesola Hostel). It can be observed that the floor and the surrounding of the toilet is messy. This is not appropriate, which might be due to inadequate supply of water. There is the need for proper monitoring of toilet facilities and provision of toiletries in the student hostels.

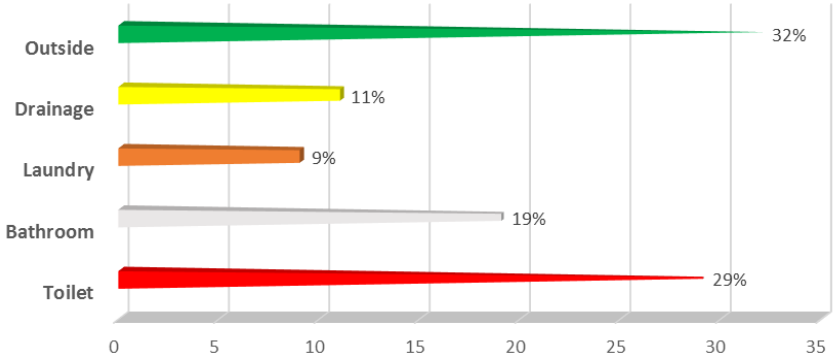

Fig 3 Locations Where Respondents Ease Themselves at Night

The research evaluated the various points where respondents ease themselves at night in the hall of residence and the following were identified. Figure 7 shows the frequency and percentage of each option. 29% of the respondents ease themselves in the toilet, 19% use the bathroom, 9% use the laundry, 32% ease themselves outside and 11% use the drainage. This depicts that more students go outside to ease themselves at night than using the toilet. The reason being that most of the toilet facilities are not well kept hence are in a very deplorable condition. Some of the students also complain about scarcity of water, this account for reasons why the toilets are easily soiled. Additionally, some of the toilets have been vandalized, such that they can no more control water and are blocked.

Bathrooms

The level of satisfaction of students with the bathroom facilities shows that 47 percent of the students interviewed agreed that the toilet facilities are satisfactory, while 48 percent states that the toilet facilities are not satisfactory, only 5percent were indecisive.

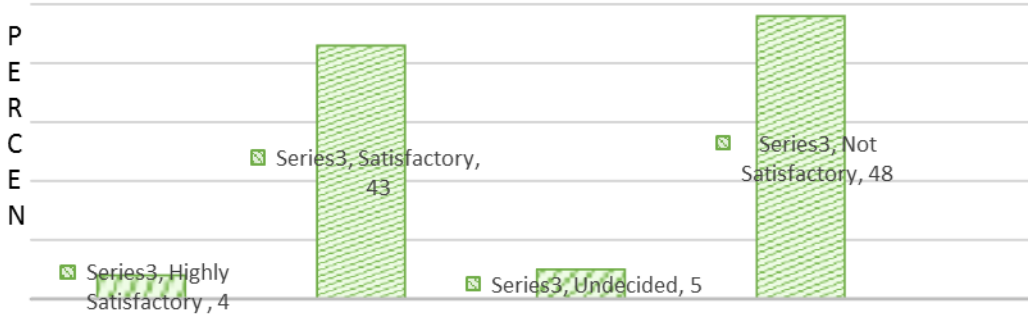

Fig 3: Level of Satisfaction with Bathroom Facilities:

Plate 2: Bathroom facility in Adeniyi Hostel

Solid wastes management

The level of satisfaction with the facilities provided for solid waste disposal was assessed and the result shows that 39 percent of the sampled students agreed to the fact that the facilities provided for solid waste disposal was satisfactory, the same percentage (39 %) states otherwise while we have 10 percent respondents who were indecisive.

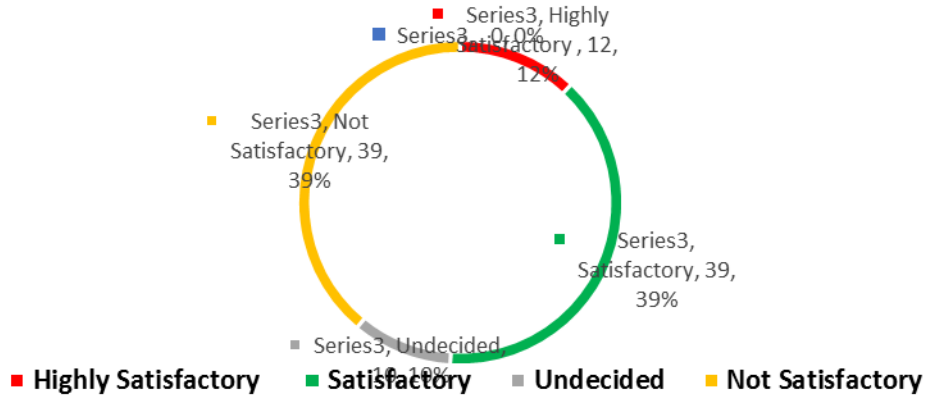

Fig 4: Level of Satisfaction with Facilities Provided for Solid Waste Disposal

The research also finds out the percentage of rooms with waste paper basket (dustbin). Findings show that 67% percent of the respondents have dust bins to their room while only 33% of the respondents are without dustbin in their room.

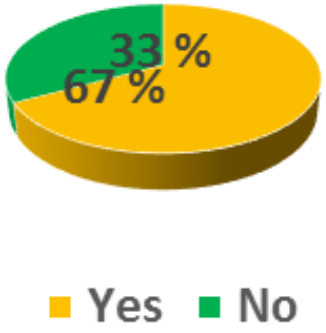

Fig 6: Availability of Dustbins in Hostel Rooms

Plate 3: Overflowing Dustbin in Jadesola Hostel

Laundry facilities

Respondents satisfaction on laundry facilities shows that 53% of the respondents are satisfied the laundry facilities while 10 % were indecisive and 37% were not satisfied with the laundry facilities.

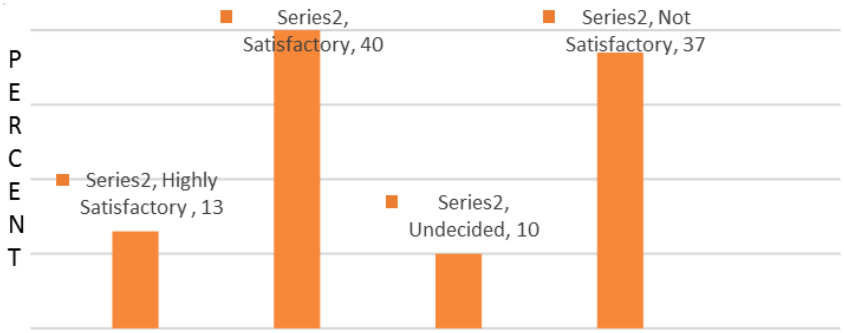

Fig 5: Level of satisfaction with Laundry Facilities

Table 2: Frequency and percentage of responses on utilities

S/No.	Facilities	Assessment	Frequency	Percentage (%)
1	Electricity	Highly Satisfactory	42	28
		Satisfactory	62	45
		Undecided	00	00
		Not Satisfactory	41	27
2	Water Supply	Highly Satisfactory	18	12
		Satisfactory	53	35
		Undecided	6	4
		Not Satisfactory	75	49
3	Water quality	Highly Satisfactory	7	5
		Satisfactory	34	22
		Undecided	25	16
		Not Satisfactory	86	61
4	Security	Highly Satisfactory	20	13
		Satisfactory	42	28
		Undecided	20	13
		Not Satisfactory	69	46

Electricity

Some utilities within the University hostels were assessed to determine their level of satisfaction. Table 2: explains the respondent's satisfaction about each of the facilities assessed. Electricity within the university is provided by Benin Electricity Distribution Company and Generating set maintained by the university. It was discovered that when there were no electricity, the university do provide it at crucial hours of study. These are between 8am and 4pm and between 8pm and 10pm, In terms of electricity supply, 73 % of the respondents were satisfied with the number of hours they have access to electricity per

day while only 27 percent of the respondent were not satisfied with the situation of electricity supply in the hostels.

Water supply

Water is very Germane to human existence, the water supply within the Federal University of Technology, Akure is through the Bore-hole maintained by the institution. It was discovered that in periods when there were no electricity, water scarcity do occur. 49% of the respondents were of the opinion that the frequency of water supply in the University hostels were not satisfactory whereas, 47% agreed that the frequency of water supply is satisfactory. The study further revealed that 27% of the students agreed that the water supplied in the hotel is drinkable and satisfactory. Contrariwise, 61% of the respondents were of the opinion that the water supplied in the hostels are not drinkable. The reason adduced to this was that the water is tasty and sometimes turbid.

Security

Security in the university hostels are provided by the staff of the university from the security section. This outfit is run specifically as a civil service outfit, hence most of them were not ex-service personnels. The opinion of the 46% of the students was that they were not satisfied with the performance of the security personnel. The reason been that they are nonchalant about their work. On the other hand, the study reveals that 28% were satisfied with the performance of the security personnels, while 13% were highly satisfied.

CONCLUSION AND RECOMMENDATIONS

The findings of this research show that there is need for the following recommendations;

i. There is need for the rehabilitation of the existing toilets and baths. There is need for increase in the frequency of water and electricity supply, cleaning of the hostels both in and outside the surrounding environment.
ii. It is recommended that the management should build more hostels in the institution in other to meet up with the increasing number of students being admitted yearly by the institution.
iii. It is suggested that the management of the hostels should be left in the hands of a private manager as it is believed that closer attention towards the management of the hostels would be ensured.
iv. It is necessary to introduce an effective internal evaluation system in order to build a feedback mechanism by which the state of facilities and their performance can be monitored periodically. It is believed that this will ensure a high level of users' satisfaction.
v. The management should make sure toilets and bathrooms including bedrooms are disinfected regularly, to prevent/reduce the outbreak of bedbug, mosquitos, cockroach etc.
vi. The university should encourage equity participation with private investors to site private hostels at affordable prices within the school premises. Under such arrangement, a proportion of their annual profit would be collected for the development of the instituttion.
vii. In conclusion the school management need to pay a closer attention to the welfare of students in the institutions hostels as it would affect their performance in school as well as other aspects of their lives.

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Environmental Impact of Shoreline Changes and Coastal Flooding on Victoria Island in Eti-Osa Local Government Area, Lagos, Nigeria

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ABSTRACT

The study identifies and assesses the environmental impact of shoreline changes and coastal flooding on Victoria Island in Eti-Osa Local Government Area of Lagos State, Nigeria. This was with a view to suggesting an integrated strategy and management plan for sustainable environment in the study area. Structured questionnaires were administered specifically in Victoria Island where flood hazard was prominent. There were 3248 buildings in the study area which constitute the research population. The sample size of 10% was adopted; hence 325 copies of questionnaires were administered for the study. The study adopts Geographical Information System (GIS) to examine flood hazard and shoreline changes in the study area. Digital Elevation Model (DEM) and slope map was generated from the topographical map of the study area. Topographical map of 1962 was used as the base map; Landsat TM of 1984, ETM+ 2000 and 2011 of Eti-Osa was used while all geo-processing operations and analyses were carried out in ILWIS 3.1 and ArcGIS 9.3. Findings show that, narrow drainages coupled with high rainfall in the study area are the major causes of flooding. DEM map shows that the study area is between 0-33.33m, while the slope map shows the Elevation range, revealed that about 90% of the study area were between the heights of about 0-16.667m. The results also reveal that between 1962 and 1984 there was loss in landmass while between 1984 and 2011 there was increase in land gain overtime. The study recommended construction of standard paved surface and drainages, law enforcement on waste disposal, integrated approach to flood management and control.

Keywords: Coastal flooding, DEM, GIS, Shoreline, Victoria Island

INTRODUCTION

Current research in Environmental Science has linked flooding with Global Warming effect. Global warming can be described as the greatest threat facing humanity, evidence of climate change impacts is strong and most comprehensive for natural systems. Some impacts on human systems have also been attributed to climate change, with a major or minor contribution of climate change distinguishable from other influence, the weather has been unpredictable; seasons have been shifting, fairly unpredictably (Ayo, 2009). The effect of global warming include: the melting of the polar ice and glaciers, warming of the oceans which expands the ocean volume and raises sea level, consequently floods the coastal regions, and even entire islands. Coastal erosion and shoreline changes are two consequences of sea level rise and coastal hazards working separately or together. Loss of land, including important tidal marshes, is due partly to active erosion of the shoreline and partly to passive submergence caused by the natural component of relative sea level rise. Sea level rise makes coastal areas even more susceptible to hazards such as flooding, wave inundation, or erosion from storms, hurricanes, and tsunamis. Consideration of sea level rise impacts is one of the many adaptation planning measures to protect life and property. Sea level rise affects the erosion zone by moving the shoreline inland. Proper shoreline change analysis requires a thorough understanding of the coastal processes that cause the change as well as coastal mapping methods (Intergovernmental Panel on Climate Change, IPCC, 2007).

Coastal flooding is generally caused by a combination of high water levels, which may be caused by tides and storm surges, together with waves, which can lead to overtopping of coastal defenses and inundation of low-lying areas, potentially causing damage to life and

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property. Waves and storm surges are caused by storm events with high winds blowing over the adjacent sea. In some areas such as deltas and estuaries, precipitation and river flow may also contribute to coastal flooding. Tsunamis, caused by undersea earthquakes, landslides, volcanic eruptions and meteorites can also be important in causing coastal flooding in some areas of the world, notably the islands (Adegbasa and Ige Olumide 2012). Coastal flooding causes salt water to inundate the soils and impregnate them with soluble salts, thereby rendering the soils and subsoil water saline. Salinity causes unfavorable environment and hydrological situation that restricts normal crop production. In general, soil salinity is believed to be mainly responsible for low land use as well as crop intensity (Rahaman and Ahsan, 2001).

Coastal Flooding has been examined as one of the phenomena that are threatening human race and physical environment. The recent occurrences of flooding in Nigeria such as Sokoto flood in 2010, Ibadan flood in 2011, Lagos flood in 2011, and most parts of the country in 2012 had shown that flooding is one of the major environmental problems faced in Nigeria. Floods in Nigeria occur in three main forms, viz; coastal flooding, river flooding and urban flooding (Ologunorisa, 2004). Offiong, Atu, Njar Amuyou (2008) pointed out that, flood hazards occur basically in two distinct areas: coastal areas and areas bisected by rivers (water-fronts). In the coastal area, flooding may be caused by volume of water within the body of water, for example in case of river or a lake which overflows or breaks levees and water escapes its usual boundary. This is a correlate of body/volume of water with seasonal changes (Henson, 2010). In the study area, the bar beach suffers ocean surges, often resulting in; disruption of communication, structural damages to buildings and loss of lives. The high rate of urbanization in the area also means a high rate of housing construction and encroaching on open spaces and wetlands. The generally low lying terrain, coastal influences on its micro-climate, heavy precipitation, blockage of drainage, all coalesce to exacerbate coastal flooding in Victoria Island in Eti-Osa Local Government Area. The study is therefore designed to assess the environmental impact of shoreline changes and coastal flooding on Victoria Island in Eti-Osa Local Government Area, Lagos State using remotely sensed data, with a view to ensuring sustainable living environment. The objectives are therefore to:

i. identify factors responsible for coastal flooding in the study area
ii. examine the effect of coastal flooding on the physical, social and economic status of Victoria Island in Eti-Osa Local Government Area; and
iii. assess the extent of coastal flooding and shoreline changes in the study area using remotely sensed data.

REVIEW OF EMPIRICAL LITERATURE

The term coastal and water front community refer to the settlements which are built along the seacoast, estuaries, mangrove, swamps, lakeshore, and riverbeds and in most cases extended right above the surface waters (Intergovernmental Panel on Climate Change, IPCC, 2007). Coastal flooding occurs when normally dry low-lying land is flooded by sea water. Flooding always occurs in coastal areas, high tides or storms cause the water level to rise, if the water level is higher than the level of the coastal lowland, flooding will occur. The extent of coastal flooding is a function of the elevation inland flood waters penetrate which is controlled by the topography of the coastal land exposed to flooding. Coastal flooding can result from a variety of different causes including storm surges created by storms like hurricanes and tropical cyclones, rising sea-level due to climate change and tsunamis (Doorkamp, 1998). Storm surges are main cause of coastal flooding. The biggest floods occur when larger than normal tides (‘king tides’) and storm surges occur at the same time caused by forces generated from a severe storm's wind, waves, and low atmospheric pressure. Storm surges are extremely

dangerous, because they are capable of flooding large coastal areas. Sea level rise is a relatively slow process, connected to Climate Change, which may increase the frequency and severity of storms, bringing unusually high tides, and changes in winds, waves and currents. Sea level rise may also increase the severity of tsunami. In some low lying areas, stop banks have been erected to protect against coastal flooding. However, many of these have not been designed to be effective against a significant change in sea level. Tsunami is giant waves that can flood coastal areas. They can occur after earthquakes, volcanic eruptions, and deep sea landslides. Coastal flooding can also threaten lifeline services such as water, power, telecommunication and transportation networks.

Shoreline changes generally are the intersection of the land with the water surface (NOAA, 2000), For marine and coastal applications, base elevations typically refer to local tidal datum that are defined in terms of specific tidal phases (NOAA, 2000). Calculated as the average or mean of a specified tidal height, tidal datum vary locally in response to local topographic and hydrographic characteristics such as the geometry of the landmass, the depth of near shore waters, and the distance of a location from the open ocean

Shoreline change, which refers to the gradual movement of shorelines and dune features in a landward direction, though not necessarily with any decrease in size or perceptible erosion. The causes of shoreline change are both natural and human-induced. Many factors caused shoreline changes on the beaches. The most important factors according to Trembanis and Pilkey (1998) that caused these changes are: Human activities; lack of sand deposits in the nears shore area; increase in tropical storm occurrence in the vicinity of the island; local wave regimes; flood events of all magnitudes and frequencies; and the presence of submarine canyons. Coastal erosion due to sea level rise along the shoreline is becoming especially in developing countries such as Nigeria.

Several studies have been conducted on the adverse effects of coastal flooding and shoreline changes in both developed and developing countries. Trembanis and Pilkey (1998) prepared a summary of identifiable beach nourishment projects in the Gulf Coast region that had been conducted before 1996. These records were used to identify shoreline segments that had been influenced by beach nourishment. Beaches along the west coast of Florida are some of the most frequently nourished beaches in the U.S. The frequent nourishment is reflected in the slow rates of shoreline retreat or stability, even though the natural rates of erosion may be higher (Trembanis and Pilkey 1998). Bilan (1993) reported that the erosion rate in the northern part of Jiangsu Province in China is serious and as high as 85 metres/year; in Hangzhou Bay the rate is 40 metres/year, while in Tianjin it is 16–56 metres/year. Erosion persists even where preventive measures such as sea dykes are constructed. Beach scour has been found along coasts with sea-dyke protection. This erosion is attributable to many factors such as river damming and diversion, that leads to less sediment supply to the coast, and the clearing of mangrove forests, which makes coastal areas more susceptible to the hazard.

Fan, Guo, Wang and Shi (2006) analysed cross-shore variations in the morphodynamic processes of an open coast mudflat in Changjiang Delta, where waves play a dominant role in shaping the tidal-flat profile during typhoons. Each year, roughly seven out of 16 typhoons directly strike China's coast with a 95 percent probability of hitting southwards and the coast of the Chanjiang Delta; they generate waves up to 6.2 metres in height. One-third of the mudflat is colonized by *Spartina alterniflora*, followed by scirpus (*Scirpus mariquete* and *Scirpus triquiter*), and then gradually transits into a less-vegetated pioneer zone behind the bar mudflat. In Thailand, intensification of coastal erosion came to notice during the past decade (Thampanya *et al.*, 2006). Overall, the net erosion is approximately 1.3 to 1.7 metres/year along the southern Thailand coastline. Total area losses amount to 0.91 square

kilometres/year for the Gulf coast and 0.25 square kilometres/year for the western coast. Most of the eroded areas increase with larger areas of shrimp farms, less mangrove forest area, and when dams reduce riverine inputs and coastal land subsidence transpires. In areas where erosion has prevailed, the presence of mangroves has reduced erosion rates.

In Indonesia, coastal erosion started in the northern coast of Java Island in the 1970s when most of the mangrove forest had been converted to shrimp ponds and other aquaculture activities, and the area was also subjected to unmanaged coastal development, diversion of upland freshwater and river damming. Coastal erosion is prevalent throughout many provinces (Bird and Ongkosongo, 1980; Syamsudin *et al.*, 2000; Tjardana, 1995) such as Lampung, Northeast Sumatra, Kalimantan, West Sumatra (Padang), Nusa Tenggara, Papua, South Sulawesi (Nurkin, 1994).The rapid erosion of the coast of Sagar Island in West Bengal, India, is caused by several processes that act in concert; these are natural processes that occur frequently (cyclones, waves and tides that can reach six metres in height) and anthropogenic activities such as human settlement and aquaculture that remove mangroves and other coastal vegetation. The erosion rate from 1996 to 1999 was calculated to be 5.47 square kilometres/year (Gopinath and Seralathan, 2005). The areas that are severely affected by erosion are the northeastern, southwestern and southeastern faces of the island. Malini (2004) reported coastal erosion and habitat loss along the Godavari Delta front owing to the combination of the dam construction across the Godavari and its tributaries that diminish sediment supply to the coast and continued coastal land subsidence. According to Othman (1994), nearly 30 percent of the Malaysian coastline is undergoing erosion.

Many of these areas are coastal mudflats, fringed by mangroves. Behind the mangroves there are usually agricultural fields protected from tidal inundation by bunds (dykes). Locally, mangroves are known to reduce wave energy as waves travel through them; thus, the Department of Irrigation and Drainage has ruled that at least 200 metres of mangrove belts must be kept between the bunds and the sea to protect the bunds from eroding. Sri Lanka's experience with coastal erosion dates back to 1920 (Swan, 1974). It has become more serious because mangroves are being eradicated by encroachment (human settlement), fuelwood cutting and the clearing of coastal areas for intensive shrimp culture. Mangrove forest cover was estimated to be approximately 12 000 hectares in 1986; this dwindled to 8 687 hectares in 1993 and was estimated to be only 6 000 hectares in 2000 (Samrayangke, 2003).

Approximately US$30 million has already been spent on breakwaters and other construction to combat coastal erosion on southern and western coasts (UNEP, 2006); however, coastal erosion still persists in some coastal areas. Mazda *et al.* (2002) also analysed coastal erosion caused by tidal forces at Loang Hoa, South Viet Nam, which is located in a wide, flat alluvial fan and lies between two major tidal rivers – the Mui Nai River and the Nga Bay River. Based on field and numerical studies, they found that degradation of mangroves along the tidal rivers led to intensification of tidal currents at the mouths of the rivers and erosion on the coast. This study reached the same conclusion as a study carried out by Wu, Falconer and Struve (2001) for Merbok Estuary, Malaysia. Coastal erosion and shoreline changes are natural processes; however, they may become a problem when exacerbated by human activities or natural disasters. They are widespread in the coastal zone of Asia and other countries in the Indian Ocean owing to a combination of various natural forces, population growth and unmanaged economic development along the coast, within river catchments and offshore. This has led to major efforts to manage the situation and to restore the ability of the coast to accommodate short- and long-term changes induced by human activities, extreme events and sea-level rise (Olanibi, 2014)

Many researchers have used Geographical Information System (GIS) in monitoring Shoreline changes and in the management of flood. Okude and Taiwo (2006) carried out an investigation on the Lagos shoreline change pattern using Geographical Information System; their study showed that, there is varying annual loss of land to coastal erosion and the attendant environmental and socio-economic implications of the changes. Oyedepo and Adeofun (2012) also carried out a research on environmental sensitivity index mapping of Lagos shorelines and concluded that animal biodiversities such as shorebirds, sea turtles, white crabs and other important biodiversities are more prominent on the western shores, therefore, there is a great need to protect the coastal environment from environmental hazards such as flooding and shoreline changes

Olamiju (2009) carried out a research on the application of Geographical Information System in Disaster Management on Ala river flood plain in Akure. He concluded that the major disaster in the flood plain is flooding and the causes were identified, that buildings are too closed to the river, poor refuse disposal practice, and construction of buildings by non-professionals among others and that most of the buildings in the floodplain did not secure approval before construction. Also Oyinloye and Olamiju (2011), carried out a research on Flood risk mapping and vulnerability analysis using GIS: empirical evidences from New Town area, Ondo, Ondo State, Nigeria; They concluded that, flood plains and river corridors have been misused resulting into severe environmental hazards; Eludoyin, Obafemi, and Oduore (2013), carried out a research on the Comparative Analysis of Shoreline Changes of Bonny and Andoni Islands, Nigeria using Remote Sensing and Geographic Information System. The results of their analysis revealed that the percentage loss of land due to sea level increase overtime as a result of erosion by wind which propelled ocean waves that hit the shores forcefully, which may also account for coastline erosion and influences sea-level rise. Ologunorisa and Abawua (2005), reviewed some techniques of flood risk assessment such as meteorological, hydrological, hydrometereological, socio-economic and those based on Geographic Information System (GIS) technique, using some case study from different countries of the world. They concluded that GIS technique appears to be most promising as it is capable of integrating all the other techniques of flood risk assessment.

MATERIALS AND METHODS

Research Locale

Lagos State lies specifically on Latitude 6˚27´11″ N and Longitude 3˚23´45″E. It lies in the South-Western Nigeria on the Atlantic coast in the gulf of Guinea, as shown in figure 1 and 2. Lagos State has a population of about 7,937,932 (NPC, 2006).

Eti-osa is one of the 16 local government areas in Lagos State as shown in figure 3 which has a population of about 283,791 (NPC, 2006). Figure 4 shows Victoria Island (the study area), which is one of the notable areas in Eti-osa Local Government. The location is governed by the general circulatory patterns in the tropical equatorial areas, which is associated with the apparent movement of the sun and the relative position of the Inter tropical Discontinuity (ITD), the front between the prevailing two air masses (the maritime South -West monsoon winds and the dry North-East winds from the continental origin). The climate is therefore, determined largely by the influence of these two air masses; the South-West monsoon winds and the North-East winds. The former are due to the hot and humid tropical maritime air mass blowing from the Atlantic Ocean, while the latter are due to the warm and dry air mass from the Sahara Desert, in the North.

The rainfall pattern in the study area can be explained in terms of the movement of the ITCZ. This movement explains the observed double rainfall maxima which characterizes the study

area. The apparent movement of the sun over the equator twice in a year is responsible for the occasional and localized rainfalls that are experienced over the area throughout the year. Table 1 shows the average monthly rainfall is about 151.83mm, with a high percentage of falling between the months of April and October. During the rainy season, the lowest monthly rainfall is December, while the highest monthly rainfall is June, July, September and October.

Table 1: Average monthly rainfall pattern in the study area over 1990-2010

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	28	46	99	145	277	450	267	66	142	208	69	25

Source: Nigerian Meteorological Service (1990-2010)

The terrain of the study area is typical of that of most parts of North-Eastern part of Lagos State. The entire area has "light" surface in terms of degree of roughness of terrain and slopes. The terrain could be described as almost flat. However, there are patches of elevated areas and depressions. The geological history accounts for the almost flat terrain, where most land areas are between 18 and 25 meters above the sea level. Victoria Island and the entire axis are surrounded by Atlantic Ocean. Expectedly, the areas drained by the various water bodies are low lying. The water bodies are key ecological elements in the area, with great impacts on temperature and humidity. The mass of water around the town is believed to have also influenced the pattern of growth on Victoria Island and the adjoining development Water Bodies.

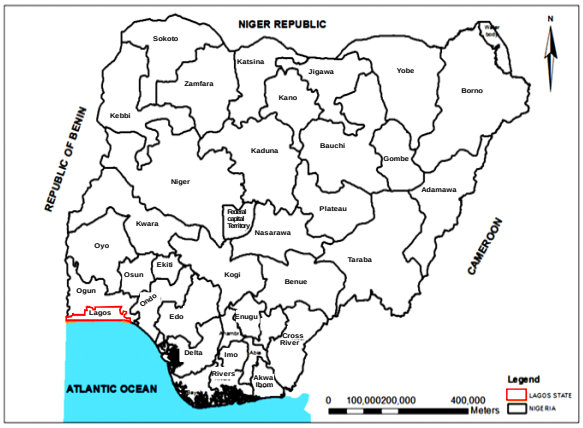

Figure 1: Map of Nigeria, Showing Lagos State

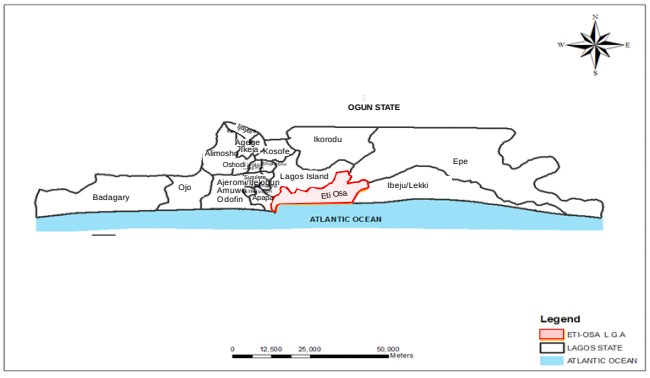

Figure 2: Map of Laggos State, Showing Eti-Osa L.G.A

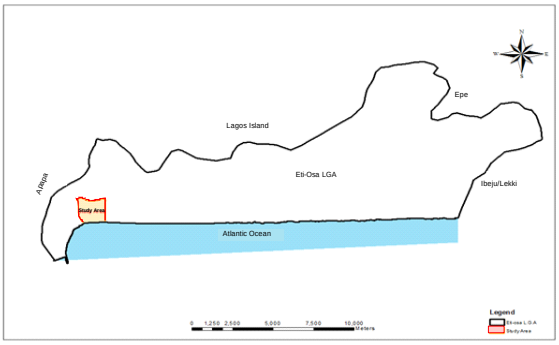

Figure 3: Map of Eti-Osa Local Government, Showing the Study Area

Figure 4: Map of Victoria Island, Eti osa Local Government)

Database Description

Data was collected through instrumentality of structured questionnaire to identify factors responsible for coastal floding as well as to examine the effect of coastal flooding on phsical, social and economic status of Victorial Island in Eti-Osa Local Government Area**.** The study area was divided into four (4) zones demarcated by major roads. Zone 1 has 799 buildings, zone 2 has 813, zone 3 has 749 and zone 4 has 887 buildings making totalof3248 buildings in the study area. However, in order to have reliable and manageable size, the sample size of 10% was considered. The justification for the use of 10% as sample size for this study was informed by many authors who believed of its reliability and efficacy in a research work. Casley and Lury (1991), opined that 10% sample size is considered reasonable for the purpose of a research work. Zone 1 has 799 buildings, zone 2 has 813, zone 3 has 749 and zone 4 has 887 buildings. 10% of the total buildings in each zone serve as the number of questionnaires administered in each zone. Three Hundred and twenty-five (325) samples were taken from all the four zones of the study area as shown in table 2.

Table 2: Questionnaires administered in each zone of the study area

ZONE	AREA (Hectares)	AREA (square/metres)	NO OF BUILDINGS	Questionnaires administered 10% of Building
A	55	550507.12	799	80
B	73	734400.04	813	81
C	65	653565.27	749	75
D	68	679382.51	887	89
Total	261	2617854.94	3248	325

The data acquisition also include topographical Map of Lagos State 1962 with the scale 1:50,000 produced by the Federal Survey Lagos served as the base map and collateral information with the satellite imageries used for the analysis of the shoreline changes. Landsat satellite imageries of Lagos shoreline (Eti-Osa) such as LANDSAT (Thematic

Mapper TM) and ETM (Enhance Thematic Mapper) at medium resolution was acquired for three Epochs; 1984, 2000 and 2011. The images were geometrically corrected and ground control points obtained through ground surveys permitted the co-registration of all images to a Universal Transverse Mercator (UTM). The satellite images were made to pass through process of image enhancement, geo reference, resampling, image classification and digitizing. A supervised classification was performed on false colour composites (band 4, 3 and 2) into built-up area, cultivation, dense vegetation, exposed soil, water body and wetland. All the questions were carefully analysed with GIS analysis to arrive at a desired results and conclusion.

RESULTS AND DISCUSSIONS

The results of the administered questionnaire and the GIS outputs are as presented below:

Socio-economic Traits of the Respondents

The age structure shows that, 16.6% of the respondents were 35 years, 37.2% falls within the ages of 36-45 years and 46.2% were 46 years and above. This shows that majority of the respondents are adults between the age of 36 -45 years and 46 years and above. This implies that majority of the respondents are likely to bear the burden of coastal flooding menace. The children and the aged rely on these set of people for their livelihood. Any adverse effect of coastal flooding on this set of people will surely have backwash effects on the social and economic life of the general populace.

The level of education of majority of the inhabitants in the study area is high. 1.5% of the respondents are not educated, 16.9% attained the level of primary education, 32.9% secondary education and 48.6% attained the level of tertiary education. Critically looking at the level of education of the respondents, it is revealed that 48.6% of them attained the tertiary education level. This may be as a result of the fact that the study area is a civilized and urban area, where it is expected that most of the residents should be educated, as it is supported by Ogbe (2011) that, rural dwellers are deficient in knowledge than the urban dwellers. This shows that most of the residents in the study area are educated.

However, investigation shows that 1.5% of the respondents received below N20,000 monthly, 15.4% received between N20,000-N30,000, 35.4% received between N40,000-N50,000 while 47.7% received above N50,000 monthly. The level of monthly income of the respondents shows that majority of the respondent still live below one dollar per day as indicated by the United Nation and this may affect the people's standard of living, their ability to demand for standard housing and requirement for other service (Agbola, and Agunbiade,2007). The variation in the monthly income of the respondents revealed why some of the respondents could not invest huge amount of money in the construction of standard drainage system meant for this type of environment (coastal area), which can convey freely large volume of water and in turn militate against flooding of the environment.

Environmental Impact of Coastal flooding and shoreline changes on Buildings

Table 3 shows the distance of buildings from the flood plain. The study revealed that 5.8% of the sampled buildings fall between the distances of 20-50m from the flood plain while 94.2% of the buildings were above 50m away from the flood plain. This revealed that most of the buildings in the study area have set- backs above 50m from the flood plain. This may be as a result of the compliance of the building to stream set back standards, that the minimum distance between a building and a stream or other water body or a gorge shall be determined by the peculiar circumstance of each case, but shall not be less than 30metres in any case (Oduwole, 2005).

Table 3: Distance of Building to flood plain

Distance of Building to flood plain	Frequency	Percentage
between 20-50m	19	5.8
Above 50m	306	94.2
Total	325	100.0

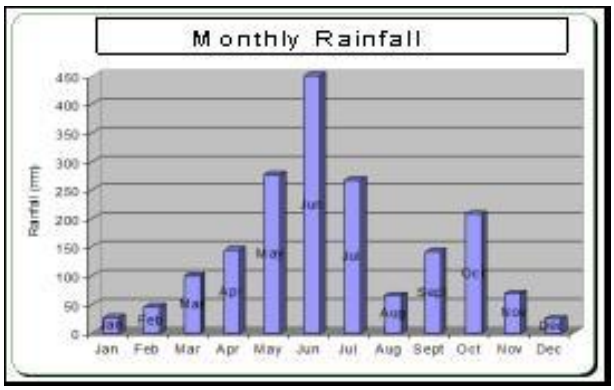

Figure 5: Average Monthly Rainfall Pattern in the study area over 1990-2010; Source: Nigerian Meteorological Service (1990-2010)

Figure 5 shows the pattern of rainfall in the study area. The average monthly rainfall in the study area is about 151.83mm, with a high percentage of its falling between the months of April and October. During these periods the effects of coastal flooding is very high in the study area. The reason for the high rainfall may be as a result of the proximity of this area to the sea, because, the impact of South-West Trade wind which brings rainfall to Nigeria is very high in this area. This wind blows across the Atlantic Ocean towards the coast of Nigeria, Lagos in particular. The implication of the above is that, areas closed to the Atlantic Ocean such as the study area will experience more rainfall than the area that is far from the coast.

Table 4 shows the condition of the drainage system in the study area. 0.6% of the respondents observed that there are well-drainage system in the study area, 24.9% observed it to be moderately drained, 67.4% observed the drainage system to be poor and narrow, while 7.1% observed that drainage system is absent. From the above, it was revealed that majority of the respondents claimed that most of the drainage systems in the study area are poor and narrow. This may be the reason for the incessant flooding in the study area, as poor and narrow drainages can lead to flooding resulting in property loss (Kolsky, 1998).

Table 4: Assessment of the drainage system in the study area

Assessment of the drainage system	Frequency	Percent
Standard-drainage	2	0.6
Moderately drained	81	24.9
Poor/ Narrow drainage	219	67.4
Absence of Drainage system	23	7.1
Total	325	100.0

Table 5 shows the critical investigation into the mode of waste disposal system of residents in the study area. It was revealed that 26.2% of the respondents claim that the mode of refuse disposal is dumping in the drainages, 8.9% claim that they rely on natural course of the river, 6.2% claim they rely on communal refuse dump site system while 58.8% observed that the disposal of waste through government agency. This implies that the major means of waste disposal in the study area is through government agency. Despite waste can be disposed through government agency, some of the residents especially the illegal occupants of the sand

filled part of the sea in the study area still dispose their wastes indiscriminate along water ways, impeding the free flow of water as seen in figure 6.

Table 5: Type of refuse disposal system

Type of refuse disposal system	Frequency	Percent
Disposal of waste in drainages	85	26.2
Disposal of waste along natural course of rivers	29	8.9
Disposal of waste in refuse dump site	20	6.2
Disposal of waste through government agency	191	58.8
Total	325	100.0

Figure 6: Flooded Plain due to refuse disposal beside the Ocean in Eti-osa

Table 6 shows the major causes of coaster flooding in the study area. The table revealed that, 7.1% of the respondents observed that lack of drainage facilities is the major cause of flooding, 34.2% attributed the major cause to block and narrow drainages, 9.5% observed the major cause as a result of building close to river flood plain while 48.6% attributed the major cause of flooding in the study area as result of heavy rainfall. From Table 6, it was discovered that the major causes of coaster flooding in the study area are blocked/narrow drainages and heavy rainfall. This may be as a result of narrow constructed drainages which cannot support the large volume of water flow during heavy rain fall resulting to the overflow of water from the drains thereby flooding the streets, roads and buildings in the study area. Example of this is seen in figure7 along Bishop Oluwole Street in the study area.

Table 6: Major causes of flooding in the study area

Major causes of Flooding	Frequency	Percentage
lack of drainage facilities	23	7.1
blocked/narrow drainages	111	34.2
buildings close to river flood plain	31	9.5
heavy rainfall	158	48.6
high paved surface	2	0.6
Total	325	100.0

Figure 7: Poor drainage in off Bishop Oluwole Street, Victoria Island in Etio-osa

Table 7 shows the impacts of Coastal flooding on the buildings in the study area. It was revealed that 17% of the respondents said the impact of flooding is causing damage and deterioration to buildings, 16% viewed it as causing deterioration of environmental infrastructure ,2% viewed it as carrying away of building, 11% claimed that it results to homelessness, 9% claimed that it results to dirty environment, 14% claimed that it results to Soaking and making water mark on the wall of the building while 15% viewed that it causes prevalence of malaria and diseases and 16 % of the respondents claimed that flooding obstruct movement and economic activities. The implication of this is that, damage and deterioration of buildings, deterioration of environmental infrastructure, continuous soaking and wetting of the wall of a building gradually weakens the wall and this may reduce the life span of the building and finally result to the unexpected collapse of the building. Obstruction of movement and economic activities may hinder mobility, break social ties, affect the business of the residents and may finally result to poverty. The prevalence malaria disease may result to incessant suffering from malaria diseases by the residents .This may be as a result of the fact that, the study area is closed to water body; as such area closed to water body cannot be devoid of stagnant water which serves as breeding ground for mosquitoes.

Table 7: Impacts of Coastal flooding on the Study area

Impacts of Coastal flooding	Frequency	Percentages
Damage and deterioration of buildings	56	17
Deterioration of environmental infrastructure	52	16
Carrying away of building by flood water	7	2
Result to homelessness	37	11
Result to dirty environment	30	9
Soaking / water mark on the wall of the building	44	14
Prevalence of malaria disease	48	15
Obstruction of movement and economic activities	51	16
Total	325	100

Geographical information System (GIS) Analysis of Coastal flooding and Shoreline Changes in the Study Area

Figure 8 shows the positions of shoreline in Eti-osa in the years 1962 and 1984. The base map of the shoreline position of 1962 was glued and crossed with the Eti-osa coastline supervise classified Landsat TM of the shoreline position in the year 1984, to analyze the variation in the shoreline position between these two years. The analysis shows that the water body-coastland is the volume of water that have been reclaimed to land between these years, water body- water body is the volume of water that remain unchanged, coastland- water body is the landmass in the coast that has been lost to water body while the coastland-coastland is the amount of the landmass that remain unchanged between these years. Also figure 9 showed the statistical results of the classification of the position of shoreline in the years 1962 and 1984. The analysis revealed that, between 1962 and 1984, 542.65 ha (4.91%) of land was lost to water-body, while 280.36 ha (2.54%) of water-body was gained as landmass. From this analysis, it was discovered that between the years 1962 and 1984, about 542.65 ha (4.91%) of landmass (shoreline) was lost to water-body than the landmass gained. The landmass lost to water between these years may be as a result of dominating fluvial deposits of mostly fine grained and loose sediments.

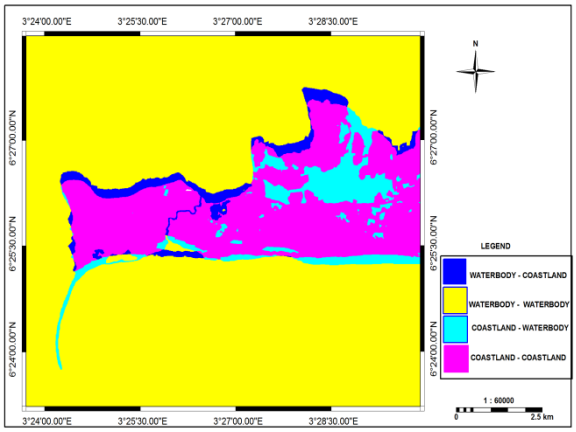

Figure 8: Shoreline position of Eti-osa (1962 and 1984)

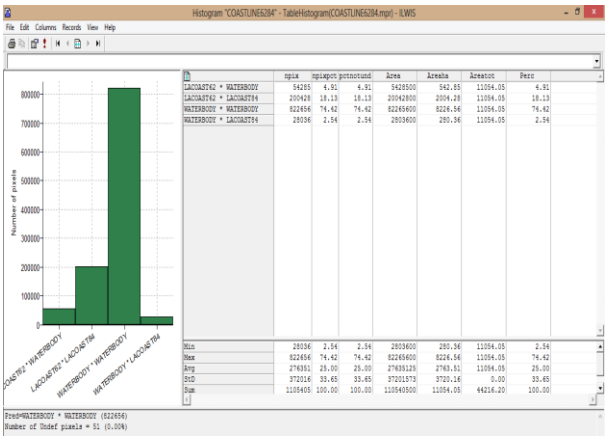

Figure 9: Statistical Results of the positions of shoreline in Eti-osa in the years 1962 and 1984

Figure 10 shows the positions of shoreline in Eti-Osa in the years 1984 and 2000.The Eti-Osa coastline supervised classification of Landsat TM shoreline position of 1984 was crossed with the supervised classification of Landsat ETM+ shoreline position in the year 2000 to analyze the variation in the shoreline position between these two years. The analysis shows that water body-coastland is the volume of water that has been reclaimed to land between these years, water body-water body is the volume of water that remain unchanged, coastland-water body is the landmass in the coast that has been lost to water body while the coastland-coastland is the amount of the landmass that remain unchanged between these years. Figure 11 shows the statistical results of the classification of the data set. The analysis revealed that, between the years 1984 and 2000, there was 476.18 ha (4.32%) landmass gained from water body while 47.00 ha (0.43%) of landmass was lost to water body. It was discovered that between the years 1984 and 2000, about 476.18 ha (4.32%) of water body was reclaimed to landmass than the landmass lost to water body. This more gain in landmass between these years may be as a result of spatial expansion and land reclamation exercise for different purposes especially for industrial and building purposes by the Lagos State government (Eludoyin, Obafemi, Oduore 2013).

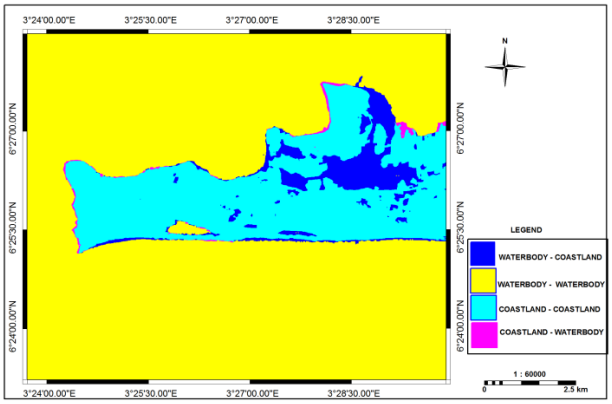

Figure 10: Shoreline position of Eti-Osa (1984 and 2000)

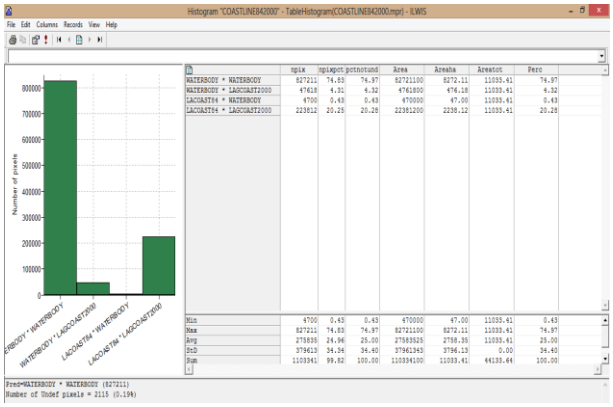

Figure 11: Statistical Results of the positions of shoreline in Eti-osa in the years 1984 and 2000

Figure 12 shows the positions of shoreline in Eti-Osa in the years 2000 and 2011.The Eti-Osa supervise classified Landsat ETM+ showing the shoreline position of the year 2000 was crossed with the supervise classified Landsat ETM+ of shoreline position for the year 2011, to analyze the variation in the shoreline position between these two years. It was revealed that the water body- coastland is the volume of water that have been reclaimed to land between these years, water body- water body is the volume of water that remain unchanged, coastland-water body is the landmass in the coast that has been lost to water body while the coastland-coastland is the amount of the landmass that remain unchanged between these years. Figure 13 showed the statistical results of the classification of the two years. The analysis shows that, between 2000 and 2011, about 490.47 ha (4.45%) landmass was gained from water body, while 114.84 ha (1.04%) of landmass was lost to water body which means that 114.84 ha (1.04%) landmass has been lost to water body. From the analysis, it was discovered that between the years 2000 and 2011, about 490.47 ha (4.45%) of water body was gained (reclaimed) to landmass than the landmass lost to water body. This more gain in landmass between these years may be as a result of the on-going land reclamation exercise in Lagos State especially in Victoria Island Atlantic Ocean and other areas of Eti-Osa by the Lagos State government.

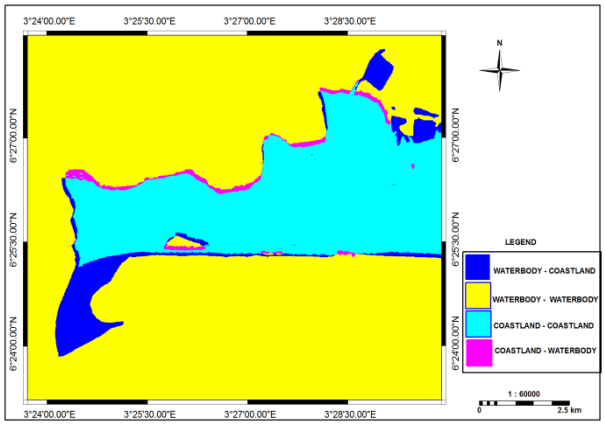

Figure 12: Shoreline position of Eti-osa (2000 and 2011)

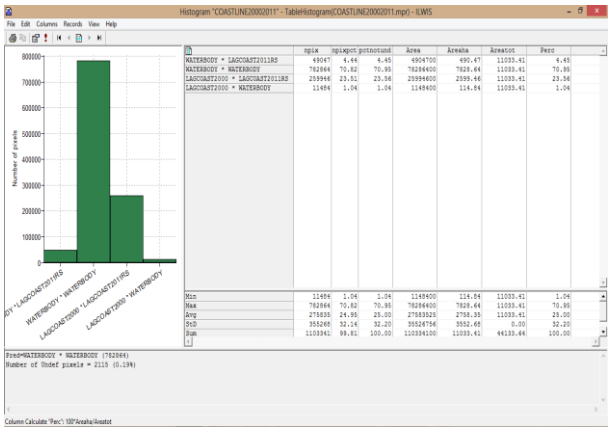

Figure 13: Statistical Results of the positions of shoreline in Eti-osa in the years 2000 and 2011

Table 8 shows the summary of the statistics of the Temporal Changes of Shoreline in the entire Eti-Osa. During the period between 1962 and 1984, the entire shoreline shifted seaward (gain) with 280.36 ha (2.54%) while the shore shifted landward (lost) with about 542.65 ha (4.91%), resulting to shoreline difference of 262.26 ha (2.37%). As a result of this 31.87% of landmass was lost to water body. Between 1984 and 2000, the shoreline shifted seaward (gain) with 476.18 ha (4.32%) while the shoreline shifted landward (lost) with 47.00 ha (0.43%), amounting to shoreline difference of about 429.18 ha (3.89%). As a result of this, 82.03% of land was gained. Also between the years 2000 and 2011, the shoreline shifted seaward (gain) with 490.47 ha (4.45%) while 114.84 ha (1.04%) has shifted landward (lost), resulting to shoreline difference of 375.63 ha (3.41%). As a result of this, about 62.06% of landmass was gained.

From table 8 also, it was discovered that, the shoreline situation was totally different between 1962 and 1984 because during these years, the shoreline shifted landward with percentage loss in landmass of about 31.4%.

Table 8: Temporal Shoreline changes in Eti-Osa between 1962 and 2011

Periods	Advanced (Gain) (ha)	Advanced (Gain) (%)	Retreat (Loss) (ha)	Retreat (Loss) (%)	Change Diff. (ha)	Total Change (ha)	Total Change (%)	% Change
1962-1984	280.36	2.54	542.65	4.91	262.26	823.01	7.45	-31.87
1984-2000	476.18	4.32	47.00	0.43	429.18	523.18	4.75	+82.03
2000-2011	490.47	4.45	114.84	1.04	375.63	605.31	5.49	+62.06

Digital Elevation Model Generation (DEM)

Figure 14 is the Digital Elevation Model (DEM) map of the study area. This map is generated from the contour map of the study area, and it shows and determines the flood plain. Figure

14 shows that the Elevation range of the study area is between 0-16.667m.This reveal that the height of the study area above the sea level is between 0-16.669m. Lagos is a State below the sea level and constantly being threatened with the challenge of climate change and ocean surge (Punch Newspaper 23rd September 2014),

The implication of this is that, the area is a flood plain, which makes it prone to incessant flood hazard due to the fact that the height of the area above the sea level is low. Victoria Island is between the height of 1.1m and 4m above the sea level, this height value is low and insignificant, which means that everywhere in this area is liable to coastal flooding, because water level can rise anytime thereby flooding the entire parts of Victoria Island especially during the raining season.

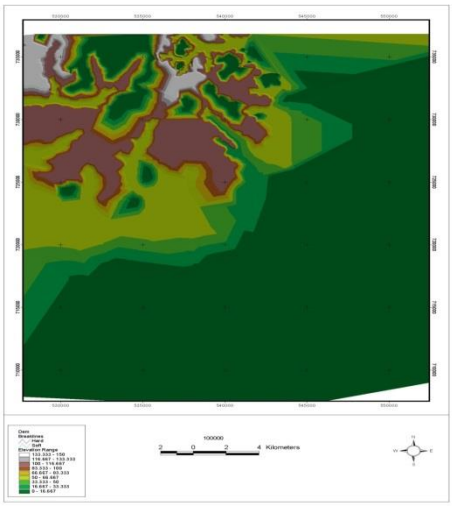

Figure 14: Digital Elevation Model (DEM) of Victoria Island and its Environs

CONCLUSION

The study has highlighted the problem of coastal flooding and shoreline changes in Victoria Island in Eti-Osa Local Government Area of Lagos State and its implication on the environment and the people of the area. Coastal flooding in the study area revolves around poor refuse disposal practice, encroachment on flooding, heavy rainfall, blocked and narrow drainages, indiscriminate waste disposal, lack of adequate set back from oceans among others.. It was also discovered that the inhabitants living in the floodplain lack waste disposal thereby forcing them to dump wastes in drainage channels. The digital elevation model (DEM) map of the study area reveals that the study area is between 0-33.33m while the surrounding area is higher between 116.667-133m. The Elevation range revealed that about 90% of the study area is between the heights 0-16.667m while the surrounding area is higher; this revealed the reason for the incessant flooding in Victoria Island.

RECOMMENDATIONS

This study has established that there is high correlation between coastal flooding and shoreline changes. The GIS analysis has also revealed that the topography of the study area has a role to play in the areas that are susceptible to coastal flooding. The land-cover map of the study area also shows floodable and swampy areas. Based on these findings, the study offers the following recommendations:

Construction of standard paved surface and drainages in the study area will help to combat flood hazard especially in the built up areas. It was discovered that the available drainages in the study area are not wide enough to convey the large volume of water especially during high rainfall. Therefore, standard pavements and drainages are considered as useful options

for combating flooding in the residential, commercial and industrial areas. When these are done, it will prevent flooding, water will move freely to the right channels there by reducing flooding to the minimal level (Olanibi, 2014).

Government should come to terms with its duty of enforcing environmental laws. Pollution should never be encouraged indirectly by bearing full cost of waste management. People should be aware of their social responsibility of caring for the environment. Part of the means of achieving this is charging a fee for wastes generated to complement the waste management efforts of government. Drainage ditches should be cleared regularly to allow unrestricted storm water passage.

There is a need for interdisciplinary cooperation at all governments' levels for a co-ordination of sectorial policies regarding environmental protection, physical planning, land use planning, agriculture, transport and urban development, and a co-ordination regarding all phases of risk management, risk assessment, mitigation planning and implementation of measures.

All envisaged measures concerning flood prevention and protection should be compiled in a comprehensive action plan covering up to several decades. An integrated action plan for reducing flood damage must draw long-term conclusions for preventive action in water management, land use, settlement policy and finance.

Flood maps should be used for the reduction of damage potential by integrating its outputs into spatial planning and emergency planning. Both type of utilization requires that the flood hazard / zoning / risk Increase coastal edge elevations through the Construction of Hard and Soft Structural Engineering Options to Prevent Coastline/ Shoreline Change maps should include the worst-case scenario as well.

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Analysis of Activities of Cooperative Societies and House-Ownership in Nigerian Cities: The Case of Akure

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ABSTRACT

In Nigeria and in most African countries, the desire to own a house is an indication of social and economic status that constitutes one of the strongest incentives for saving and capital formation. Since finance is an important determinant of success and failure of housing ownership, it therefore becomes very necessary to identify viable sources of funding that can promote house-ownership. This paper examined the activities of Cooperative Societies in the promotion of house ownership in Nigeria with a focus on Akure, the Ondo State capital. The study identified all the registered Cooperative Societies in Akure. Four (4) different sets of questionnaires were designed and used in the collection of data from the four (4) identified research target population. These are chairmen, and members of the registered Cooperative Societies, Ondo State Ministry of Community Development and Cooperative Services; and House-Owners in Akure metropolis. The data were subjected to statistical analysis. The findings revealed among others that majority of the House-Owners in Akure were not members of Cooperative Societies. However, all members of Cooperative Societies in one form or the other invested loans secured from the Cooperative Societies in housing and housing-related projects. This calls for strong advocacy to promote increasing enrollment of membership in Cooperative Societies among urban residents in Akure with a view to promoting house-ownership.

Keywords: Akure Nigeria, Cooperative Society, House-ownership, Housing

INTRODUCTION

Housing is not only a basic human need, it constitutes a vital component of man's welfare, life sustenance and survival. In the hierarchy of man's needs, housing has been ranked second to food. It has a profound influence on the health, efficiency, social behaviour satisfaction and general welfare of the community. Housing has a significant role to play in the individual, local and national economy. In most cases, it constitutes the first major capital investments and life ambition of individuals (Bello, 2003). The desire to own a house constitutes one of the strongest incentives for saving and capital formation (Ozo 1990, Olujimi 2008a). The purpose of this paper is to examine the activities of Cooperative Societies in Akure, the Ondo State capital as a typical Nigerian urban centre with a view to promoting house-ownership. The hypothesis on the lending policy of the Cooperative Societies was formulated and tested. Thus,

$H_{01:}$ The lending policy of Cooperative Societies in the study area is not in favour of housing construction.

$Ho_{1:}$ The lending policy of Cooperative Societies is in favour of housing construction.

The results of the analysis are reported in the research findings as contained in the paper.

LITERATURE REVIEW

Housing Problems

Housing problem is a global phenomenon confronting developed and developing, rich and poor nations. Habitat (1990) stressed that in all countries, regardless of the average standard of living, there is a large section of the population that cannot afford what could be regarded as an adequate or standard housing. Therefore, a substantial part of the population has to live

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in accommodation that is severally substandard (Agbola, 2005). Nigeria is not exempted from this phenomenon. The manifestation of these housing problems are in form of overcrowding, homelessness, substandard housing, slum and squatter development. Other housing problems manifest in form of high rent in the housing market, inadequate mortgage finance and inaccessibility to mortgage loans. These have cumulatively resulted to a low home-Ownership rate of 25 percent in Nigeria, which is lower to that of Indonesia (84 percent), Kenya (73 percent), and South Africa (56 percent) (CAHF, 2015).

Alternative Sources of Housing Finance

Prior to the colonial era, many methods of housing finance were adopted in Nigeria. Amongst these were Village Development Scheme, Social Club Contributions, Loans from Traditional Money-Lenders and others. Olujimi (2008b) has confirmed that all these methods were initially successful in the provision of funds for housing and its delivery in the traditional setting. However, with the growing complexity in economic activities, these financing methods faded away and were replaced with more modern forms of financing. These modern forms of financing are regarded as the formal sector that comprises of institutions operating within the guidelines stipulated by the federal government (Nubi, 2000). The formal sector includes the Federal Mortgage Bank of Nigeria (FMBN), Commercial Banks, Insurance Companies, and recently added to the list is the Pension/Provident Funds Administrators.

The saving culture and habit particularly among the average Nigerians is fast becoming low. Many got their savings trapped in the distressed Banks for years without being adequately compensated while the on-going revelations of alleged gross mismanagement levied against most Managing Directors of Banks in Nigeria are making customers and investors to lose confidence in the banking sector as reliable source of housing finance. Furthermore, the statutory conditions attached to lending for housing financing in the sector are mostly not within the reach of most prospective home-owners (Arewa, 2007;). Recently, Zanin (2016) specifically confirmed that high mortgage cost has reduced affordable housing development; yet housing is a basic need of man. All these constraints call for the re-visitation of the informal sector; of which cooperative society constitutes a main pillar.

Cooperative Society and Housing

The existence of Cooperative society dates back as far as when human beings have been organizing for mutual benefit. Tribes were organised as cooperative structures, allocating jobs and resources among each other, only trading with the external communities. Cooperative Societies like other business organizations are established to perform certain tasks. It can be classified according to king (2002) into four broad categories such as service, purchasing, marketing and processing associations. In all the four categories, the activities of Cooperative Societies can be linked directly or indirectly to housing. The benefits of cooperative societies to membership among others include; access to quality supplies and services at reasonable cost; increased clout in the marketplace; share in the earning of cooperative business; enhancement and protection of local economy; and provision of monetary loan for re-investment into many other sectors such as housing.

It is certain from the above exposition that in Nigeria, housing shortage exists and Nigerians deserve to live in liveable accommodation. One of the hindering factors in the realisation of this intention is non-availability of funds to embark on individual housing project(s). The peculiarities of cooperative societies provide a stable platform to pool substantial funds together that could be mobilised for housing provision. The question is, can cooperative societies provide leverage for housing delivery through house-ownership? This paper provides answer to the question using Akure as a case study.

AKURE: THE STUDY AREA

Akure is a traditional Nigerian city and like other traditional Yoruba towns in the country, it existed long before the advent of the British colonial rule in the country. Akure is located between latitude 6^0 $95^1$and 7^o 15^1 North, and longitude 5^o 14^1 and 5^0 40^1 East of Greenwich Meridian. It occupies about 35 square Kilometres of land. Akure is about 700 km South-west of Abuja, the Federal Capital of Nigeria (see Figures 1).

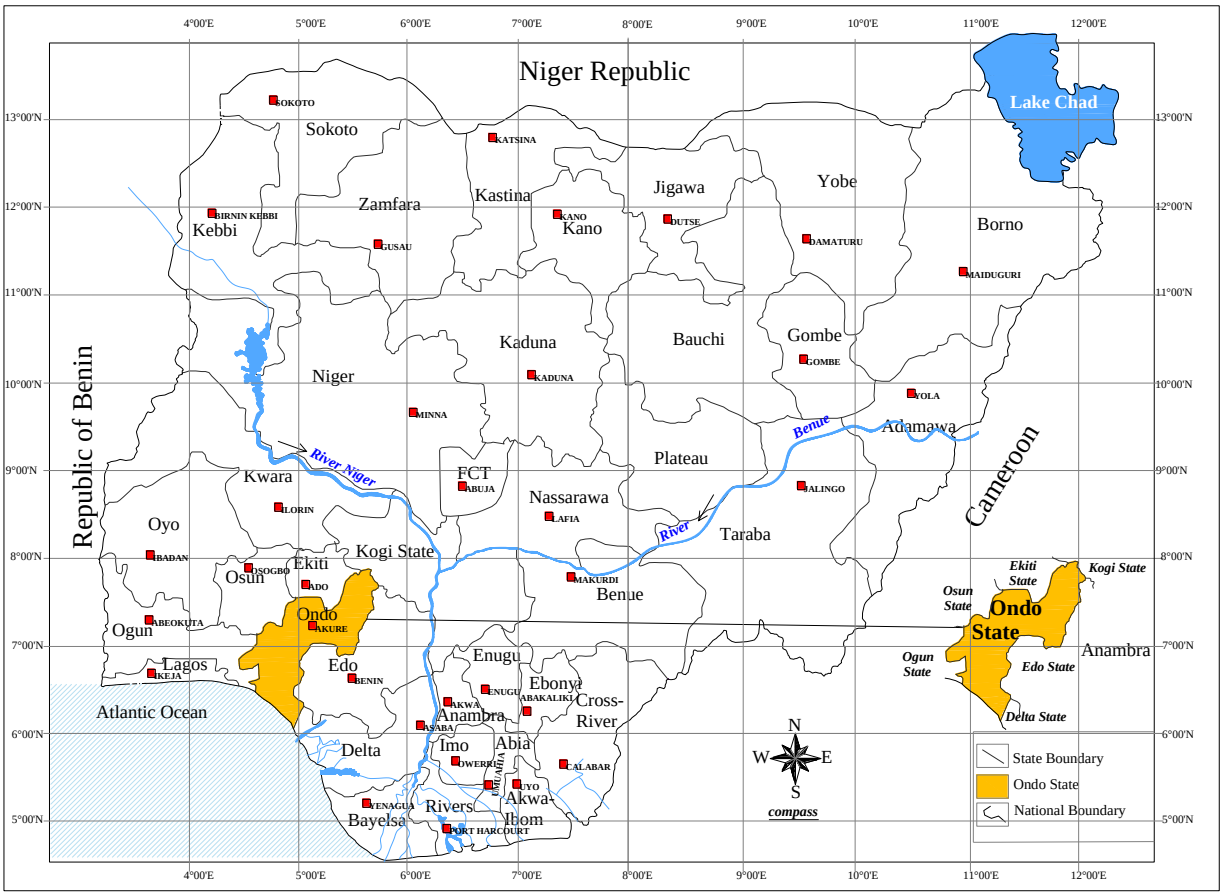

Figure 1.1: Map of Nigeria: Showing Ondo State in the National Setting
Source: Ministry of Works, Akure (Reproduced in AutoCAD by the Authors), 2012

Akure was originally the headquarters of Ondo province until 3rd February, 1976 when its status changed to a State Capital of Ondo State and coincidentally the Local Government Headquarters of Akure South Local Government Council. This led to a phenomena change in the political, social, economic and administrative roles as well as the population of the town. The increased relative political influence of Akure as a state capital and local government headquarters since 1976 have greatly promoted its rapid growth and increased socio-economic activities resulting in its spatial expansion from an area of about 16 squares kilometres in 1980 to about 30 square kilometres in 2000 (Ministry of Works, Lands and Housing, 2000); and at present, it occupies about 35 square kilometres.

The population of the city grew from 38,852 in 1952 to 71,106 in 1963. Its population was estimated to be 112,850 in 1980 (DHV, 1985); and 157,947 in 1990 (Ondo State of Nigeria, 1990). The 1991 national population census however, puts the population of Akure at 239,124 and its estimated population in 1996 was 269,207 (NPC, 1996). However, with the use of 3.5 percent as the growth rate, and the population was projected to 2012 by the time the surveys for this study were conducted at 459,716 persons. The increasing population had not been adequately housed because of the shortage in the supply of housing units to cope

with the housing needs (Olujimi, 2008b). This has been responsible for the shortage of residential accommodation which correspondingly led to skyrocketing of rent for the available residential properties most of which are devoid of necessary infrastructural facilities.

METHODOLOGY

Data collected for the study were from primary and secondary sources. The primary data were sought from the field surveys conducted through the administration of questionnaire designed for each of the research target population. These are the Presidents of the registered Cooperative Societies; members of Cooperative Societies; House-Owners in Akure, and the Akure Zonal Officer of the Ministry of Community Development and Cooperative Services. Only 95 of the registered societies were viable and strictly operating within Akure metropolis. Fifty percent of the 95 registered Cooperative Societies which is 47.5 (i.e. 48) registered Cooperative Societies were randomly selected for the study. However, when the questionnaire for the Cooperative Societies was administered on the 48 randomly selected societies, only 38 of the societies responded.

In each of the selected Cooperative Societies, 5 members were randomly selected for the study since only 38 societies responded; this amounted to a total of 190 members for the administration of the questionnaire for members of Cooperative Societies. Only 179 of the copies of the retrieved questionnaire were usable for the final analysis. The remaining 11 copies were either wrongly filled or inadequately filled to convey any meaningful planning information.

For the conduct of House-Owners' survey, all the residential buildings in Akure metropolis were considered. The peculiarities of house-ownership in Akure made it very difficult to locate or meet owners of residential buildings in their houses for the conduct of House-Ownership Survey. For instance, many of the residential buildings are non-owner-occupiers because they were either built for rental purpose, inherited by group of surviving children, or purchased from the original owners.

Therefore, a systematic random sampling method was used in the conduct of House-Owners' survey; and one (1) residential building in every 30 residential buildings in each of the zones was selected and the owner of the residential building was picked for the administration of the questionnaire. In situation where an owner was not located in a selected residential building, such building is subsequently substituted with any of the 30 residential buildings. Overall, 212, 249, 163, and 59 House-Owners were selected in the core, transitional, peripheral and government Estates' residential zones correspondingly and administered with House-Owners' questionnaire.

The total number of questionnaire administered was 683 on the sampled House–owners in Akure. For the administration of the questionnaire meant for the Ondo-State Ministry of Community Development and Cooperative Services; the Zonal Office of the Ministry in Akure South Local Government area was contacted. By the operational modalities of the office, it is closer to the Cooperative Societies in Akure and their members. The requested answers to the questions in the questionnaire were adequately supplied. The secondary data were materials on the research subject obtained from published and unpublished sources.

The processing of the primary data was carried out through the use of computer, using the Statistical Package for Social Sciences (SPSS) version 8. The analysis was done at different levels and Chi-square analysis was used to test the formulated hypothesis.

FINDINGS AND DISCUSSION

House Ownership in Akure

In this study, the ownership of houses was reported among the cooperative members and non-cooperative members. Home ownership in Akure metropolis can be divided into whether they are members of a cooperative societies or non- members of cooperative societies. A total of 683 house-owners were selected for the survey exercise. In all, 30.2% of the respondents i.e. house-owners were members of cooperative societies while 69.8% were non-cooperative members (see Table 1).

Table 1: Distribution of House Ownership by Cooperative and Non-Cooperative Membership in Different Zones in Akure

Residential Zones	Cooperative Members (n=206)		Non Cooperative Members (n=477)		Total (n=683)	
	Fr	%	Fr	%	Fr	%
Core	82	39.8	130	27.3	212	31.0
Transitional	61	29.6	188	39.4	249	36.5
Peripheral	44	21.4	119	24.9	163	23.9
Government Estates	19	9.2	40	8.4	59	8.6
TOTAL	206	30.2	477	69.8	683	100.0

House Ownership by Cooperative and Non-Cooperative Membership in Different Zones in Akure

Our findings as shown in Table 1 also revealed that members of the cooperative societies constituted the highest proportions of house-ownership (39.8%) that resided at the core residential zone of Akure. The next higher proportion of members of cooperative societies resided at the transitional zone where about 29.6% of respondents were captured in the survey. In addition, 21.4% of cooperative members resided at the peripheral, others (9.2%) resided in the government estates that dotted the metropolis. On the other hand, the highest proportion of non-cooperative members that owned house at the transition residential zone of the metropolis was 39.4%. The core residential zone is the next zone where 27.3% non-cooperative members resided. The third higher proportions of respondents who were non-cooperative members were located at the peripheral zone, where about 24.9% of respondents resided. The least proportion of respondents (8.4%) resided in the government residential estates as at the time of the survey. Overall, the distribution of house-ownership in the study areas showed that 36.5%, 31.0%, 23.9% and 8.6% are correspondingly located in transitional, core, peripheral and Government residential estate zones of the study area.

Year of Construction of the Residential Buildings

In Akure, Table 2 reveals that the highest proportion of residential buildings (57.4%) was constructed between 1 and 5 years ago. This is followed by buildings that were constructed less than one (1) year ago (30.5%). Buildings that were constructed between 6 and 10 years were 5.7%, while the rest of the buildings 6.4% were older than 10 years. In term of their spatial analysis, it was discovered that among Cooperative members, 59.7% of the buildings were built between 1 and 5 years ago. Consequent to this, are buildings that were less than 1year old that constituted about 27.7% of buildings in Akure metropolis. Furthermore, buildings that were between 6 and10 years old were 6.3% and buildings that were older than 10 years were 6.3%. Among the non-cooperative members, the highest proportion of buildings were those constructed less than 5years ago (56.4%). This is closely followed by buildings that are less than 1year (31.7%). The next higher proportion of residential buildings were the ones constructed between 6 and 10 years ago (6.6%) while 6.5% of the residential buildings sampled for the survey were built more than 10 years ago.

Table 2: Year of Construction of Residential Buildings in Akure

Construction Year	Cooperative Members (n=206)		Non Cooperative Members (n=477)		Total (n=683)	
	Fr	%	Fr	%	Fr	%
<1 Year	57	27.7	151	31.7	208	30.5
1 – 5 Years	123	59.7	269	56.4	392	57.4
6 – 10 Years	13	6.3	26	6.6	39	5.7
Over 10 Years	13	6.3	31	6.5	44	6.4

Sources of Funding Residential Building Projects

Funding of housing projects is not restricted to a single source. It is always augmented by other sources. The sources of funding of residential building projects by members of the cooperative societies are shown in Table 3. This reveals that accumulation of funds through personal savings (82%), loans from cooperative societies (100%), and Bank loans (0.97%). Others sources include assistance from friends and relatives (32%), gifts in cash and kind (28.6%) and housing loans from Government establishments (i.e. places of work of the members who are government workers) was 2.43%. It is necessary to note that when all members had the opportunity of obtaining loans from their societies (and they all took advantage of this and obtained loan invested in their housing project at one stage and the other), at least 0.97% still went ahead and took loan from the Bank. The implication of this is that building houses needs much money that the developer may not in all cases source funds from just one source alone; and it also requires a very substantial amount of money.

Besides the fact that non-cooperative members did not receive funds from any cooperative society, sources of funding house construction by them do not differ much from those that were cooperative members. However, higher proportion (93.7%) of non-cooperative members accumulated their housing funds from personal savings. This is followed by 27.9%, those who augmented the funding of their housing construction through gifts in cash and kind, and funds from friends and relatives were 26.6% loans from government ministries and parastatals was 10.5% and while Bank loans was 11.1%. It is necessary to note that among the two groups, higher proportion of the non-cooperative members (11.1%) took loans from the Bank for their housing projects when compared with the members of cooperative that constituted just 0.97%.

Plate 1: One of the Residential Buildings Built by a member in FUTA Staff Cooperative Multipurpose Society Housing Estate in Aule, Akure

Total Numbers of Houses Built with Cooperative Assistance

Overall, 80.1% of the House-owners confirmed that they got assistance from cooperative societies in building one house. The proportion of cooperators that built two (2) houses with the financial assistance of a cooperative society was 11.2% while 5.8% built three (3) houses

and 2.9% built more than 3 buildings through the same approach. This supports the fact that Cooperative Societies provide financial assistance to members towards encouraging house-ownership among members.

Table 3: Sources of Funding Residential Building Projects in Akure

Sources of Funding	Cooperative Members (n=206)		Non Cooperative Members (n=477)		Total (n=683)	
	Fr	%	Fr	%	Fr	%
Personal Savings	169	82.0	447	93.7	616	90.2
Cooperative societies	206	100.0	0	0.0	206	30.2
Bank loan	2	0.97	53	11.1	55	8.1
Friends and Relatives	66	32.0	127	26.6	193	28.3
Gifts in Cash and Kind	59	28.6	133	27.9	192	28.1
Housing loan from Govt establishments.	5	2.43	50	10.5	55	8.1

Percentage of Total Cost of Building Project Sourced from Cooperative Societies

It is not doubtful that loan obtained from Cooperative Societies was part of the funds used in housing projects by cooperative members. The findings on House-Ownership revealed this fact as indicated in Table 3. Therefore, it becomes necessary to identify the percentage of the total cost of the building which the loan was used to upset by the house-owners. Table 4 reveals that 23.3% of cooperators secured loans running to less than 30% of the total cost of their building project, while 31.1% of the cooperators claimed that between 31 and 60% of the cost of their buildings were sourced through their cooperative societies. This was followed by 45.6 % of the cooperators that confirmed that over 60% of their building cost was sourced from cooperative societies. The implication of this is that all respondents who are members of cooperative societies secured loans (funds) from cooperative societies for their building projects. Again, if more than 45% of cooperators were able to fund over 60% of the total cost of their residential buildings with loans obtained from their cooperative societies, it would not amount to over statement to say that securing funds from this particular source posit a reliable source of housing finance in Akure.

Table 4: Percentage of Cooperative Loan Contribution to the Total Cost of Building Projects

Percentage contribution of cooperatives to total cost of building projects	Cooperative Members (n=206)	
	Fr	%
Less than 30%	48	23.3
31 – 60%	64	31.1
Above 60%	94	45.6
Total	206	100.00

Testing of the Hypothesis

H_{02}: The lending policy of cooperative societies in the study area is not in favour of housing construction.

H_{a2}: The lending policy of cooperative societies is in favour of housing construction.

Table 5: Results of Chi Square Analysis between Criteria for Housing Loan and Number of Members Given Loan

Factors	Calculated χ^2 value	df	p- value	Decision
Members have no existing loan	4.62	3	0.20	Not significant
Members have evidence of land development	4.05	3	0.26	Not significant
Members have certificate of occupancy	4.73	3	0.19	Not significant
Members have collateral	4.05	3	0.26	Not significant

The results of the chi square analysis test conducted between the different criteria which the cooperatives societies followed in approving loans for members and the actual number of members given loans is shown on Table 5. The decision column reveals that none of the

criteria was significantly related to the loans given for housing projects. This is because all the p-values were higher than the 0.05 level of significance at which they were tested in the study. This implies that none of the criteria used by the cooperative societies discouraged members from accessing loans for housing projects. Therefore, the null hypothesis is rejected and the alternate hypothesis accepted which states that the lending policies of cooperatives societies are favourable to members and not a limitation to their accessibility to loans. The leading policies of the cooperative societies encourage and promote house-ownership.

CONCLUSION

The findings of this study had revealed that most of the Cooperative Societies in Akure, Ondo State are viable and they derived their operational funds from salary account of members and membership financial contribution on regular basis. The interest rate chargeable was very low and the conditions for leading are easy to meet by members, thus made access to loanable funds less difficult. This has made funds available for housing construction and housing related projects; thus, promoting house-ownership in Akure city.

RECOMMENDATIONS

i. The formation of Specialized Cooperative Societies should be encouraged, especially Housing Cooperative Associations. The activities of Housing Cooperative Association are essentially designed towards assisting members in the provision of their own houses at avoidable cost. These amongst others include ensuring easy accessibility of members to loanable mortgage funds at drastically reduced interest rates; provision of buildable residential plots (that are free from encumbrances) at avoidable cost to members; provision of building materials at control prices; and assist members in the processing or securing land titles, and building plans approval.

ii. Cooperative societies in their operational activities should emphasise on integrity, vision, dedication, perseverance, and openness as a pre-requisite for people aspiring to leadership positions in their societies. This is to ensure sustainability in the management of the affairs of their different Cooperative Societies with a view to guide against fraud.

iii. Poverty alleviation is a multi-dimensional issue hence, it is imperative that cooperative societies can engage in a wide variety of activities. These activities include: gaining access to markets through the supply and marketing of building materials and household consumable goods. The Cooperative Store located along Ondo road in Akure essentially deals in the sales of drinks and household items. It is therefore suggested that the scope of trading should be widened to include building materials such as cement, plumbing materials, roofing-sheets, paints and tiles among others. Members should be made to enjoy reduced prices, credit purchase facility and soft repayment terms for housing materials purchased in the Cooperative store. Every Cooperative Society should be encouraged to operate Cooperative store facility whenever its capital permits.

iv. In Akure, like other towns and cities in Nigeria, the problem of power supply and distribution is becoming very frustrating. It is therefore necessary to consider the option of promoting green-buildings among members of Cooperative Societies. Green building involves the use of simple technology in providing roofing system that would convert solar energy to power and supply the electricity needs in such residential building. Besides the fact that it reduces cost of power supply to buildings, it also reduces the resulting effect of climate change on the residential environment at the micro-level.

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Crime Mapping and Analysis in the Core Area of Akure, Nigeria

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ABSTRACT

Urbanization and increase rate of poverty coupled with the challenges of insecurity in most developing countries have led to increase of crime incidence. This phenomenon is not new to residents of Nigeria cities; it has created unrest and great burden. Consequently, this calls for the development of new approaches to tackle crime incidence in cities. This study therefore focuses on the application of Geographic Information Systems (GIS) as a tool for mapping out the area liable to crime in the core area of Akure, Nigeria. The study employs the use of secondary data. Secondary data includes: literatures, journals and crime incidence reports gotten from internet, archives and Nigeria Police Force (NPF) respectively. Both spatial and statistical analyses were carried out using the appropriate tools such as Neighbourhood and Correlation Analysis respectively. This study revealed that the transport route cutting through Akure metropolis is prone to crime activity. Finally, the study recommends that police officials should be trained on how to use GIS to fight crime.

Keywords: Akure metropolis, Crime, Mapping, Poverty and GIS

INTRODUCTION

The traditional and age-old system of intelligence and criminal record maintenance has failed to live up to the requirements of the existing crime scenario. Manual processes have neither provided accurate, reliable and comprehensive data round the clock nor does it help in trend prediction and decision support, asides resulting to lower productivity and ineffective utilisation of manpower. The solution to this ever-increasing problem lies in the effective use of Information Technology (IT) to crime management especially in the cities.

A crime is an international act or omission in violation of criminal law, committed without defence or justification and sanctioned by the state as a felony or misdemeanour (Reid, 1991). Crime is largely an urban phenomenon peculiar to cities, but the specific urban area dimensions of the social processes that are connected with crime have been seriously understated in much recent criminological work (Baldwin and Bottoms, 1976). Urban crime is a composite and multi-dimensional phenomenon which includes behavioural, physiological, managerial, and spatial factors and other various scopes. Correspondingly, Sutherland, Cressey and Luckenbill, (1992) affirms that the study of crime in its various scopes is a vital area of interest to different groups of people. Sociologists and criminologists believe that crime results from societal anxiety. They associate crime with socio-demographic factors, indicating that the rates of crime in any urban neighbourhood are highly influenced by demographic and socio-economic contexts such as income, ethnic composition, youth concentration and level of education and a host of others without any regard for the spatial configuration of the settings of crime (Reith, 1996). Crime, in the social and legal framework, is the set of facts or assumptions (causes, consequences and objectives) that are part of a case in which they were committed acts punishable under criminal law, and the application of which depends on the agent of a sentence or security measure criminal).

Crime has serious negative effects on societies in both developed and developing countries of the world. Fear of victimization, loss of life and assets, drop in income, unemployment, displacements, evictions, emotional depression and diversion of investment and development funds towards security cost are all impacts of rising incidences of crime in our societies. Despite huge investments in social interventions and crime prevention measures all over the

Olajuyigbe, A.; Omole, K.; Bayode, T. & Adenigba, A. (2016). Crime Mapping and Analysis in the Core Area of Akure, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1351-1358

world, the crime problem is still unresolved, as crime rate around the globe continues to escalate due to increasing growth in poverty and the inequality in urban neighbourhoods, manifest through the proliferation of slums and unplanned urban areas in towns and cities. Crime presents a major challenge for the social, economic and physical development of cities and towns all over the world. Hence, the need for more advanced way, technology and methodology to combating crime in which application of GIS will help a great deal through crime mapping.

Crime mapping is an integral and an essential part of crime monitoring, control and management (Alex and Kate 2011), and Geographic Information System (GIS) plays an important role in crime mapping and analysis. Response capabilities often rely on a variety of data from multiple agencies and sources. The ability to access and process information quickly while displaying it in a spatial and visual medium allows agencies to allocate resources quickly and more effectively. In the 'mission-critical' nature of law enforcement, information about the location of a crime, incident, suspect, or victim is often crucial to determine the manner and size of the response. In addition, Yeung, et al (2007), also emphasised that GIS software helps co-ordinate vast amounts of location-based data from multiple sources. It enables the user to stack layers of data and view the data most critical to the particular issue or mission. It is used world over by police departments, both large and small, to provide mapping solutions for crime analysis, criminal tracking, traffic safety, community policing, Intranet/Internet mapping, and numerous other tasks (Johnson, 2000). Crime analysis involves the collection and analysis of data pertaining to a criminal incident, offender, and target. Crime analysis can be used to evaluate the effectiveness of programs such as community policing and crime prevention, develop policy through research, justify budget requests, and help identify or define a problem (Philip, 1999). Geographic Information System (GIS) and Remote Sensing (RS) provide the medium for the integration of spatial data. GIS and remote sensing have been widely recognized as an effective tool for planning and decision-making tasks. They allow for effective storage, manipulation and analysis of geographical data (Michalak, 1993; Trotter, 1991).

In a strict legal definition, however, a crime is a violation of criminal law which in most societies can be defined broadly as any 'act or omission forbidden law on pain of punishment' (Carvell and Swinfen, 1970). The cost of crime is another aspect relating to urban violence. Two costs of violence can be identified; these are monetary as well as non-monetary otherwise referred to as social cost (Agboola, 2001). Perceptions of crime are not determined by an objective indicator of the degree of injury or damage but by cultural values and power relations (UN, 1995).

In Nigeria, a good number of facts and incidents aid and abet the awareness of crime rate, analysis and mapping. The awareness that crime is not evenly distributed across cities, but often concentrated in certain areas has been the focus of crime study since 1940s, thus given prominence to environmental criminology as a field of the study of the influence of situational factors (social and physical) on crime and travel behaviour of criminals across urban neighbourhoods (Herbert, 1989, Davies et al, 2007). Crime mapping and analysis is a relatively new area with the origin in United State of America and spreading to the United Kingdom in the recent times. Little or nothing had been written about the effectiveness of crime mapping and analysis generally in Nigeria and in particular to the security maintenance and functionality in Nigeria.

Research evidence suggests that both physical and social conditions of the environment may influence crime incidents and make certain neighbourhoods crime prone and others less crime prone thus generating different patterns of crime and crime analysis travel across a city

(Greenberg, Rohe and Williams, 1985; Newman, 1976; Formosa, 2010). The geography of crime with its emphasis on mapping and spatial analysis has emerged in recent years as a growing area of research. However, 'cartographic criminology' involving the production of maps indicate the distribution of crime is found not enough for the modern day crime analysis, rather, the requirements today involves the need to explore the relationship between socio-spatial phenomenon and crime pattern through a more robust spatial and statistical analysis tools present in the modern day Geographic Information System (GIS) and Remote Sensing (RS) (Herbert, 1989)

The immediate response of most people to crime is fear. Although several factors have identified as the cause of fear in relation to crime, one general feature of crime is that high level of fear are not only dependent on actual personal victimization. A study confirmed that there is little difference in the levels of fear of crime between victims and non-victims. In essence, the high level of fear of crime perceived by the residents may not necessarily match the risk of personal victimization. A comparison of the historical situation with the present suggests that recent interest in crime mapping is likely to have a more substantial and lasting impact on crime prevention theory and applications. A review of literature shows that a combination of different physical and social variables may impact crime at various stations in a specific area, neighbourhood or regions. Researchers have argues that defensible space characteristics of residential apartment design (such as lighting, fencing, specific security hardware, and open design that allows opportunities for surveillance) can discourage crime activities (Harries 1971).

This research further shows that the urban characteristics of neighbourhoods are important for crime. Particular land uses (e.g. schools, bars, stores, and abandoned buildings) have been found to attract more crime in their vicinity (Block and Block, 1995 and 2000; Byrne, 1986; Greenberg, 1986). The presence of physical disorder and incivility, signified by deteriorating building stock and public environments, with concentration of graffiti and litter is also likely to have an impact on neighbourhood crime (Perkins et al. 1993; Skogan, 1990).

As previously noted, researchers have also hypothesized that compositional characteristics of the neighbourhood surrounding densely populated area, income levels, age, educational level, and unemployment level of residents have a likely correlation with crime operations. A violent crime or crime of violence is a crime in which the offender uses or threatens to use violent force upon the victim. This entails both crimes in which the violent act is the objective, such as murder, as well as crimes in which violence is the means to an end, (including criminal ends) such as robbery. Violent crimes include crimes committed with weapons. With the exception of rape (which accounts for 6% of all reported violent crimes), males are the primary victims of all forms of violent crime.

Spatial or geo-information in the form of maps, plans, aerial photographs, satellite imageries among others have always formed the physical base on which settlements development planning is undertaken. It has earlier been emphasized that the ability of cities to manage urban growth is increasingly dependent on timely access to spatial information and the competence of turning these data into information to support decision-making. The rapid advancement and proliferation of GIS has increased interest in crime mapping and analysis due to its ability to aggregate different data sources and converting them into useful information in understanding and predicting a pattern (Longley and Clarke 1995, Bowers and Hirschfield 1999). Furthermore, the analytical application of GIS and RS can be used in either an exploratory or confirmatory capacity.

Crime mapping is a term that has been used for the past few years to refer to research analysis using GIS in a law enforcement setting. Crime analysis mapping is used to describe this

process because using a GIS to analyze crime is not just the act of placing incidents on a map but also of analysis (Racheal, 2001). It is also the process of using a geographic information system in combination with crime analysis techniques to focus on the spatial context of criminal and other law enforcement activity. Maps offer crime analysts graphic representations of crime-related issues. An understanding of where and why crimes occur can improve attempts to fight crime. Mapping crime can help police protect citizens more effectively. Simple maps that display the locations where crimes or concentrations of crimes have occurred can be used to help direct patrols to places they are most needed. Policy makers in police departments might use more complex maps to observe trends in criminal activity, and maps may prove invaluable in solving criminal cases (Johnson, 2000). To this end, this paper demonstrates the effectiveness of GIS to crime mapping in the core area of Akure, Nigeria.

MATERIAL AND METHODS

The Study Area

The study area falls within Akure south, the capital of Ondo State, Nigeria. Akure is located between between latitude $7^0 17'$ N and longitude 5^0 4' E with a coverage area of 318.0 km^2. Akure is about 370m above the mean sea level. Akure is bounded to the South by Idanre; to the East by Owo and to the North by Ifedore Local Government Area. The easy access and geographical centrality of Akure to these neighbouring towns have enhanced the growth prospects of the city. Okoko (2002) asserted that, this influx was necessitated by the development attracted to the state capital. With the presence of government seat in Akure, job opportunities, provision of community facilities such as roads, water etc and social facilities such as hospitals, schools, markets etc precipitated the migration of youths from the surrounding towns/settlements for job opportunities among others, leading to increase in population. In 2006, the population of Akure was 387,100 (NPC, 2006). However, the population of Akure is estimated to be 1.8million by 2015. This growth will be as a result of industrial growth; its classification as among oil producing state and millennium development city. Akure falls within the tropical rain forest region of Nigeria where rain fall is high. The mean annual rainfall is about 250cm, the atmospheric temperature ranges between 28°C and 31°C and a mean annual relative humidity of about 80 per cent (Ajibefun, 2014).

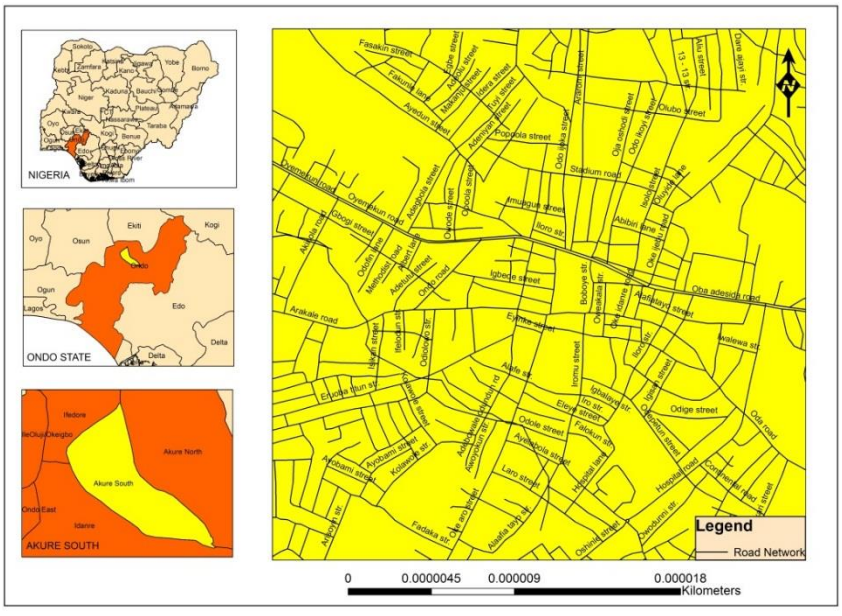

Figure 1: Study area map

The Data Base

This study is descriptive in nature, involving the use of secondary and primary data with the integration of Geographic Information System techniques. Secondary data used for the study were sourced from journals, archives, library and institutions. They include: analogue maps of the study area, crime data in the region from the Police Headquarters and Crime Reports. Primary data which include field data was gotten with use of Global Positioning System (GPS). The data were analysed and presented by the use of maps to explain the distribution of crime incidents in the study area. The software used for data analysis include: ArcGIS 10.0, CrimeStat III, Global Mapper 13.0, Map Source, Transfo (used for converting geographic (angular) coordinates to UTM coordinates).

Analysis using Geographic Information System (GIS)

For this study, GPS Garmin 76 was employed to obtain co-ordinates of major landmarks in the study area in other to register these landmarks; which comprises of police stations, banks, markets, liquor stores, and place of worship. The crime data gotten on field through GPS were transferred into Microsoft Excel and imported into ArcGIS 10 for geocoding. Advanced spatial analysis such as hotspot and black spot analysis using Geostatistical Analyst which includes Inverse Distance Weight analysis, Kriging and Cokriging.

Geostatistical Analyst provides tools that make the best prediction possible by examining the relationship between all the sample points and producing a continuous surface of crime concentration, standard errors (uncertainty) of prediction, and probabilities that critical values are exceeded. This analysis tool bridges the gap between geostatistic and GIS. Examples of geostatistical operations includes: Inverse Distance Weighing (IDW), Kriging, Kernel Kriging, Cokriging etc. They are all interpolation techniques.

ANALYSIS OF FINDINGS AND DISCUSSION

As asserted earlier, IDW was adopted for this study to interpolate the data gotten through the GPS. From the analysis as shown in Figure 2, the study revealed that the intensity of crime is on the increase along the major transport route cutting through Akure metropolis, and also to some specific areas such as Post-Office, Oke-Aro, Odo-Ikoyi and Isolo etc. This is as a result of the poor policing and concentration of activities in these areas. From the study, it was also revealed that police protection with respect to crime and violent act is poor taking into consideration the affected areas in the study area. The ineffectiveness of the police with regards to the respondents view was paramount around various strategic centre of attraction such as the God's Plaza (Nao Supermarket), LASCO, First Bank, WEMA Bank, Ricobin House, BIZ Leonac Mega Plaza etc and even to some interior part of the Akure city core.

From the result of analysis using the cokriging factor, the multiple datasets to investigate cross-correlation and autocorrelation, shows that analyzing of multivariable proves to be a useful way of deducing crucial factors. The combination of these variables (gang activity in the area, paramount property crime and paramount personal crime) shows that the flux of crime in the study area is at a peak level. The major event areas are carried out along the Oba Adesida road and gradually reducing to the exterior part of the Akure Metropolitan core.

Police security management in the area is grossly below average. From the analysis, the respondent strongly believed that police security management is rather poor as the Force does not have sufficient manpower and combating factor to keep the study area healthy from the unrest of crime and violent act.

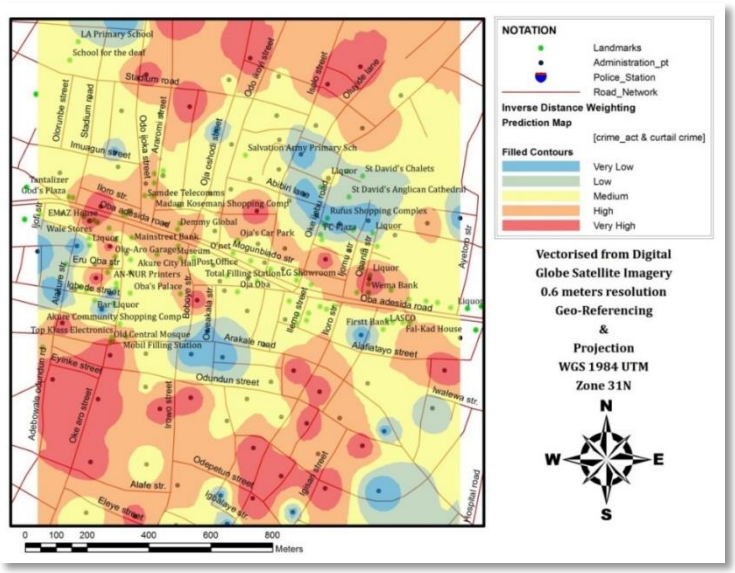

Figure 2: Map showing geospatial analysis of level of crime in the study area

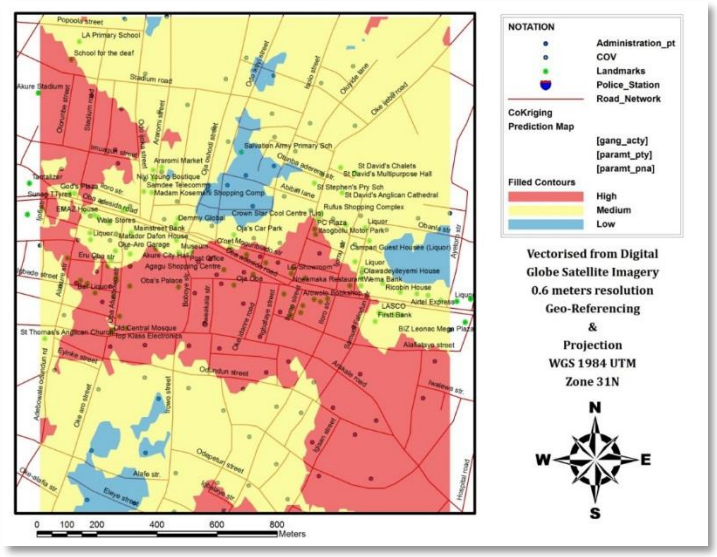

Figure 3: Geospatial analysis of gang activity with respect to property and personal crime

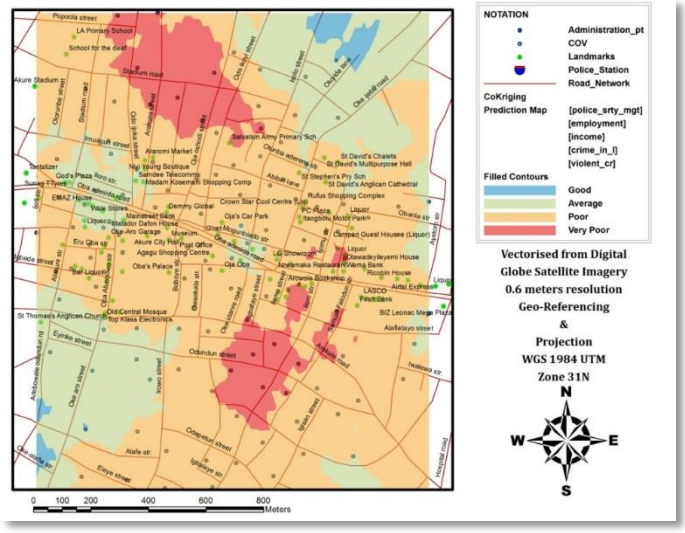

Figure 4: Map showing geospatial analysis of police security management in the study area

RECOMMENDATIONS AND CONCLUSION

This study is based on crime mapping and analysis in Akure city core centre. The occurrence of such activities must be curtailed through a viable planning to increase the security apparatus of the state capital. Again, the police force has not being able to apprehend the occurrence of criminal activities in the study area due to weak capacity. From the field survey, it was revealed that the crime activities are more dominant in some part of the city core compare to others. This study has been able to develop crime database system that could increase security around the Akure city core. Such system will achieve greatly in the detections of hotspots and black spots, generation of maps indicating neighbourhoods that lack security facilities, knowledge of crime pattern and occurrence, crime prediction among others. This system will not only assist Ondo State in crime reduction but other states in the country if adopted.

Based on the findings, the study recommended that the state government promptly embark on the provision of security in the state capital. This is an urgent need in the study area because the reoccurring events of criminal acts are unending. The government should recognise the importance of life and property to economic growth. This can be actualize if the government should invest adequate funds in the Nigerian Police Force including capacity training programme and mind-set change as a means to curtailing crime activity in the state capital. There should be constant police patrol in the city core. Recruitment of man power into police force should not be based on the need for employment at all cost, but on the passion and desire to be a protector of the safety of the people.

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Problems Associated with the Management of Public Infrastructure in Ondo West Local Government Area, Ondo State, Nigeria

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ABSTRACT

Public infrastructures are the basic facilities and services essential to both rural and urban societies, economic and social development. The aim of this paper is to examine the problems associated with management of public infrastructure in Ondo West local government, Ondo State. The objectives were to identify the various types of public infrastructure available in Ondo west local government, the agencies in charge of the management of these public infrastructures focusing on the procedural approaches used and also the problems associated with management of infrastructure. Data was selected using stratified sampling method and selection made from the surveyed political wards and the agencies in the study area. Random sampling was adopted to collect data and information from the households and from the officers of the agencies. 250 questionnaires were structured on the socio-economic characteristic of respondents at the five surveyed wards and agencies. It was revealed that lack of maintenance culture was a major problem associated with the deterioration of the available public infrastructure. The management agencies also do not have sufficient staff strength to carry out the necessary monitoring of the infrastructure. The paper recommends that beneficiaries as well as concerned agencies of public infrastructures should be enlightened on the benefits of maintenance of public infrastructure. Also a monitoring committee should be set up to monitor various public infrastructures so as to ensure adequate maintenance on the part of the agencies and finally the issue of staff strength should be addressed as more qualified persons are to be employed.

Keywords: Management, Public infrastructure, Maintenance culture, Monitoring, Ondo state

INTRODUCTION

The state of civilization of the inhabitants and the efficiency of workers within an area is reflected by extent to which their neighborhoods have been provided with infrastructural facilities. The performance or effectiveness of an infrastructure depends on the nature of their management (Obateru, 2003). Public Infrastructure by definition are the basic facilities and services essential to both rural and urban societies, and to economic and social development. The

Infrastructure include transportation facilities, telecommunication facilities, water supply, po wer supp ly, waste and sewage disposal facilities, education, health and recreational facilities, Housing, schools etc. The growth of urban economy and population has rapidly increased the demand for urban infrastructure; the management of urban infrastructures in Nigeria cities presents a frightening picture of decay, obsolescence and acute shortage (Babawale, 2004). To complicate the problem of inadequate infrastructures, new development has dominated the attention of our planners and decision makers, giving no serious thought to maintenance of the existing facilities. Consequently, over utilization of some of the existing infrastructures leads to poor or loss of value among other effects. Infrastructure refers to our national physical assets, which are the basic structures and facilities necessary for a country or organization to function efficiently. The management of these assets which include; transport, water, electricity, etc, is to preserve the new state and good appearance of the facilities as far as it is economically viable and practicable so that it can effectively serve the purpose for which it was built (Omuojine, 1997). One of the factors that militate against effective management of infrastructure is poor maintenance culture as most infrastructural facilities

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deteriorate rapidly due to over utilization. According to Environmental Watch (2007), it is critically explained that nonchalant attitude of people towards maintenance of Infrastructures is a problem. The wrong attitude of beneficiaries to maintenance of infrastructure reflects situations of non-challancy to public infrastructure. Increase in reported cases of vandalism of facilities such as telecommunications and electricity power infrastructures has been recorded in Urban centres (Akuruju, 2004). Another critical problem confronting effective management of infrastructures is lack of adequate fund and materials, projects have been abandoned due to insufficient funding while the responsibilities for maintenance of the existing facilities have in many cases been neglected (Babawale,2004). Therefore, this study examines the various problems associated with the maintenance of public infrastructures in Ondo West LGA, suggesting possible measures that can be put in place to improve the maintenance of the public infrastructures.

The aim of this study is to examine the problems associated with the management of public infrastructure in Ondo West Local Government Area, Ondo State, Nigeria. The objectives of the study are to identify the available infrastructures in the study area as well as identifying the agencies responsible for the management. Also to examine the procedures for managing the available infrastructure focusing on the various problems that could be associated with the management of public infrastructure in Ondo west Local government Area.

THE STUDY AREA

The present Ondo West is generally bounded in the North by Bolorunduro, in the East by Idanre, in the West by Okeigbo, and in the South by Igunshin. The town is situated in the West of Ondo State, Nigeria, lying between Longitude 4.83^0E and Latitude 7.1^0N. Ondo West has the second largest city which is Ondo town in Ondo State with 288,868 populations (NPC, 2006). It hosts Adeyemi College of Education, and Wesley University of Technology and other Educational institutions. Popular Health Facilities are the State Specialist Hospital, Wole Ayo Hospital, Emmanuel Clinic etc. National Union of Transport Workers is the popular union in charge of Transportation facility in the study area while for the Telecommunication facility, MTNNigeria, GLOng, Etisalat, Airtel and NIPOST are available.

LITERATURE REVIEW

Omuojine (1997) described infrastructure as "the stock of fixed capital assets in a country for example roads, railways, airports, waterways, hospitals and telecommunication network. All these with the attendant transportation network, electricity supply, Telephone services and wholesome water supply and medical services invariably constitute infrastructural facilities. Obateru (2003) elaborated on the meaning and scope of infrastructure, which according to him is "synonymous with public utilities, community facilities and services". Akubueze (2004) asserted "infrastructure refers to our national physical assets, which are the basic structures and facilities necessary for a country or organization to function efficiently, for example; building, transport, water, energy resources and administrative systems.

From all the definitions, one can see that infrastructures refer to the basic facilities and services essential to institution, economic and social development. They constitute the main fabric of what may be called institutional physical system linked to property development and use. Infrastructure management means the work necessary to preserve its finishes and fittings, in its near initial state so that it continues to provide the same facilities and amenities at it did when it was first created. In this sense, management implies the renewal of infrastructure components through repairs, servicing, replacement, decoration and cleaning (Akubueze,

2004). Infrastructure management is the practice of coordinating the physical workplace with the people and work of the organization. Aulua (1991) writing about poor management of public infrastructure, gave appointment of wrong managers by government to run affairs of her infrastructures as one of the problems associated with management of public infrastructures in Nigeria.

Public Infrastructure in Nigeria

Public infrastructures are mainly government owned facilities charged with responsibility of providing services that are public interest. In Nigeria, public infrastructures include; transportation facilities, electricity supply, water supply, healthcare, telecommunication, etc. each of these facilities is established by the government, hence the extent of their operation and ownership of property are subject to control by the government. According to William (1989), the major concern of public infrastructure is to provide vital services for people's welfare and progress and to accelerate development. The origin of public infrastructure in developing countries like Nigeria dates back to colonial period when many European nations utilized public corporations as an arm of their government for seizing foreign territories (Okpata 2004). The Infrastructural report of Nigeria just like any third world country is nothing to write home about. The infrastructure situation is in a sorry state both quantitatively and qualitatively (Oyedele, 2006). Most infrastructure are now decayed and need repair, rehabilitation or replacement. The management of the various infrastructure will ensure its efficacy as well as prolong its life-span, therefore, it is essential that appropriate mechanisms are put in place to ensure the efficient output of these infrastructure.

Types of Infrastructure

Infrastructure is a complex field with so many different components under it; but all of them can be categorized into two main types of infrastructure which are hard and soft infrastructure. The hard infrastructure includes; telecommunication and communication infrastructure which helps to convey information, ideas, decisions, messages from one place to another, from one individual or group to another individual or group of individuals or from one country to another. Transportation infrastructure aids movement and transportation which is limited to roads transportation in the study area. Linchfield (1974) asserted that roads are routes, which are primarily used for carrying traffic. Most intra-city, inter-city and inter-state roads are in need of repairs, while most village roads especially in the study area are almost impassable. Electricity infrastructure is one of the most important infrastructures, as its importance cannot be overemphasized; its presence is normally felt in all fields of human endeavor. Educational infrastructure is provided to aid learning and knowledge; it includes facilities for elementary schools (Nursery/Primary), Secondary Schools through Tertiary Institutions (Universities, Polytechnics and Colleges of Education) to support a good standard of education and training. Health facility is another crucial infrastructure of any economy, its primary mandate is to provide health care services to the people of the state through the management of secondary health facilities.

Soft infrastructures are the framework required to keep and maintain the different institutions which includes both the physical and the non-physical assets. Examples of physical assets are the buildings that house the network and the equipment used to maintain the institution. The non-physical assets are the software and programs, the governing rules and regulations, the financial system, and the organisational structure. In essence, the soft infrastructure embodies the system of delivery of services to the people.

Agencies Responsible for the Management of Public Infrastructure in Nigeria

Nigerian Communications Commission (NCC) is independent regulatory body for managing the Nigeria Telecommunications Industries. Other agencies are: Post Office, Nigerian

Television Authority (NTA), Federal Radio Corporation of Nigeria (FRCN), Nigerian Broadcasting Commission (NBC); MTN Nigeria, Glong; etc. The Nigerian Electricity Regulating Commission (NERC) is an independent regulatory body with authority for the regulation of the Electric Power Industry in Nigeria**.** The agency responsible for the management of Ondo State Electricity supply is Benin Electricity Distribution Company (BEDC). Also, responsible for the management of transportation infrastructure in Nigeria is the Federal Ministry of Transport, it coordinates road, rail, marine and air transport. The mandate, policies, program and budgets of the ministry are implemented through the various agencies at the ministry which include Nigeria Union of Road Transport workers NURTW. The ministry responsible for the management of health facilities in Nigeria is the Hospitals Management Board (HMB). Its primary mandate is to provide health care services to the people of the state through the management of secondary Health facilities. The agency responsible for the management of educational infrastructure is the Ministry of Education; it is the government body that directs education in Nigeria. It performs its functions through the State Universal Basic Education Board (SUBEB), Teaching Services Commission (TESCOM).

RESEARCH METHOD

The type of research design employed in this study is survey design. The study population in this research work includes the general public and agencies in the twelve (12) political wards of Ondo West Local Government Area, with population size of 283,672populations(NPC, 2006). As a result of the wide coverage of the study area, the field survey is limited to the five (5) most populated political wards that have touches of development by the state government and the public sector. These political wards include wards 3, 6, 7, 9 and 10, all with population of 160,979. Average family size in Nigeria has been estimated at 7 (Fasakin, 2006). This implies that, there are about 22,997 households in the five (5) sampled wards. In order to arrive at a manageable sample size in each ward, the below equation was used.

$$\frac{\text{Ward population}}{\text{Total Population}} \; x \; \frac{\text{Sample Size}}{1} \; \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Therefore, 230 households and 20 officers from the agencies were sampled, making a total of 250 questionnaires administered. Information on infrastructure provision and problem were sourced in the study area.

Essentially, the sources of data for this research were both primary and secondary data. The primary data were obtained by personal observation and the administration of multiple-choice questionnaires. Stratified sampling method was used to select the surveyed political wards among the identified political wards and the agencies in the study area, while random sampling was adopted to collect data and information from the households and from the officers of the agencies. 230 questionnaires were structured on the socio-economic characteristic of respondents at the five surveyed wards and agencies. A total of: 39, 45, 47, 45 and 54 households were randomly selected at wards3, 6, 7, 9 and 10, respectively. This was based on the level of their awareness and experience on infrastructure provision and problems. 20 copies of questionnaires were administered on the officers at the agencies in charge of infrastructure provision and management in the study area. This is to ensure that adequate information that pictured the level of development was collected. Therefore, in all, 250copies of questionnaires were administered, representing 1% of the sample size. The secondary data were obtained from textbooks, project dissertations, seminar papers, journals and research materials on infrastructure development in different part of the world. Useful information was obtained from internet and relevant agencies connected with management of Infrastructure in Ondo West Local Government Area.

Descriptive statistics was used to analyze the data collected in the course of the research. Tables and chart were employed to present the magnitude of occurrences of the variables that were obtained.

DISCUSSION OF FINDINGS

Socio-Economic Attributes of Respondents

Table 1 shows that age group 31-41years were the predominant respondents during the field survey. This is perhaps the most active age group of the population. Similarly, table 2 examines the educational background of the respondents and reveals that 42.4% of the respondents holds NCE/ND certificate, 34.4% holds Primary/ Secondary schools certificate and 21% holds B.SC/HND certificate. Table 3 shows that only 39.2% of the respondents are civil servants, 16% are students while others (44.8%) are self-employed. Table 4, shows the gender composition of respondents in the study area. According to this figure, 53% are males. The implication of this is that male dominates the sampled respondents.

Table 1: Age structure of Respondents

Age of Respondents (Years)	Frequency	Percentage
10-20	28	11.2
21-30	52	20.8
31-40	125	50.0
41and above	45	18.0
Total	250	100.0

Table 2: Education of Respondents

Education Status	Frequency	Percentage
BSC/HND	53	21.2
NCE/ND	106	42.4
Primary/Secondary	86	34.4
None of the above	5	2.0
Total	250	100.0

Table 3: Employment status of Respondents

Occupation of Respondents	Frequency	Percentage
Civil servant	98	39.2
Trader	58	23.2
Artisan	35	14.0
Student	40	16.0
Farmer	19	7.6
Total	250	100

Table 4: Sex composition of Respondents

Sex	Frequency	Percentage
Male	133	53.2
Female	117	46.8
Total	250	100

The Infrastructure Available in the Study Area

Figure 1 shows the respondents' rating of the available infrastructures in the study area. It revealed 37% of the respondents opined that education facilities have the highest frequency in the study area. The agency responsible for the management of Education facility is the ministry of Education performing its function through the Teaching service commission (TESCOM) in Ondo Town. Electricity facility has the 2nd highest frequency with 30% of the respondents with this opinion. The Nigerian Electricity Regulating commission (NERC) is

the regulatory body for Electric power supply in Nigeria, however, Benin Electricity Distribution company (BEDC) is the agency responsible for the management in Ondo town. 14% of the respondents were of the opinion that transportation facilities has 3rd highest frequency and the agency responsible for the management of transportation infrastructure in Nigeria is the Federal Ministry of Transport performing its functions through Nigerian Union of Road Transport Workers in Ondo town. Nigerian communications commission (NCC) is the regulatory body for managing the Nigerian Telecommunication industries, performing its duties through the postal Agency, Nigerian Television Authority (NTA), MTN Nigeria, Glo NG etc.10% opined that telecommunication facilities are available in the study area and finally 9% confirmed the availability of health facilities. The ministry responsible for the management of health facilities in Nigeria is the Hospital Management Board (HMB), providing health care services to the state through the management of secondary health facility. From the above analysis, it was revealed that education, electricity, transportation, telecommunication and health facilities are the available infrastructure in Ondo West Local Government. The implication of this is that, no nation can survive without necessary infrastructure, this is supported by Olaseni and Alade (2012) that, road, electricity, health, education, and communication infrastructures have profound effects on the economic development of a nation.

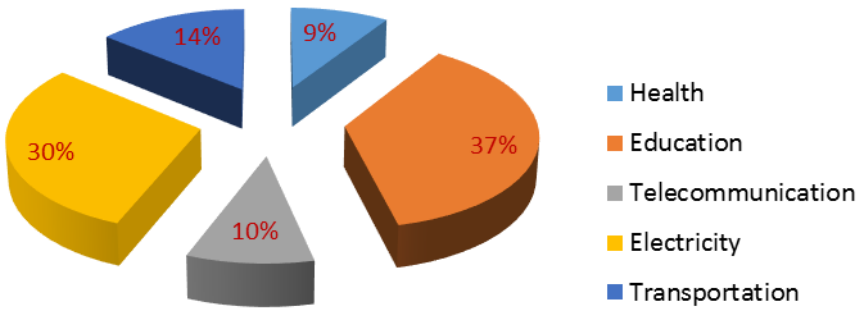

Figure 1: Available infrastructure in the study area

Problems Associated with the Management of Public Infrastructure

FERMA is charged with the responsibility of maintenance of Federal roads in Nigeria, the state and local government roads are not given the needed attention as its maintenance is left to the State and Local government accordingly. This is corroborated by the report of African Development Bank ADB (2010) that if the entire networks of the state and local government are in good condition, annual review and periodic maintenance would be about US200million and US550million respectively.

Another problem identified is that road design standards have not kept pace with increasing traffic volumes and vehicle weights and poor axle load control that is causing significant damage to the existing road network, lack of road markings, safety barriers, and signage that are contributing to the high accident and casualty rate on all roads (Oladele 2013). Administrative management of transport routes slow the movement of goods and people and raise transport costs. Many of the observed shortcomings in the urban transportation system in Nigeria stem from sector management weaknesses (Edema 2010). Nigeria is characterized by the absence of a planned and effectively integrated multi-modal transport system that incorporates rail and water transport, where applicable, to complement road transport on which there is over-dependence. There does not appear to be a well-articulated policy and strategic framework for the urban transport sector. Institutional responsibilities for urban

transport development and service provision among various agencies are fragmented at the three levels of government with no coordinating framework. (ADB, 2010)

The power sector has also been characterized by a high degree of operational inefficiency and under-pricing. As of 2005, only 64 percent of billed revenues were collected. Distribution losses were as high as 30 percent, compared to best practice levels of 10 percent. Tariffs covered about 28 percent of the costs of power supply. In 2005, Nigeria's residential power tariff was around US$0.03/kWh – among the lowest in Africa – and well below the average of US$0.16/kWh found in African countries predominantly reliant on thermal generation technologies. (ADB 2010)

Faced with the challenge of providing electricity and thus improving the economy with all its concomitant social and economic benefits, governments since 1999 have initiated a number of interventions, many of which have failed in implementation due to inadequate planning and the absence of crucial technical support. There is no doubt that there are sufficient domestic resources to meet the power needs of the nation. These resources include oil and gas, coal, substantial hydropower capacity and other forms of renewable resources. The exploitation and utilization of these resources have been hampered, like other aspects of national development, by the grossly inadequate indigenous technical capacity and poor governance in the sector and lack of long range planning. (ADB,2010)

Despite spectacular development over the last decade in terms of communication, a deep digital divide continues to separate Nigeria from more advanced economies in the world. Nigeria ranked a low 13th among the 29 Sub-Saharan Africa countries included in a recent survey. The divide is especially deep in terms of the quality of ICT-related infrastructure, affordability of ICT and the availability of ICT-related skills. With mobile telephony subscriptions of 55 per 100 persons, Nigeria ranks 122 among the 142 countries surveyed. Access to other technologies is limited: only 15 percent of households have a personal computer and only 9 percent of households have internet access (ADB, 2010).

Edeme 2010, opines that infrastructure development management in Nigeria suffer from capital flight, capital sink and capital stagnancy. A lot of materials and managerial services are procured outside the country, the contracts are full of loop-holes that allow leakages of funds. In some cases, there is over-design for the designers to earn more professional fees which are percentage of the contract sum. Capital stagnancy due to abandoned projects is also very rampant. The appropriate designs that will ensure value for money are not adopted. The finance not adequate is procured at high interest rates and financial management is lacked by most Nigerian contractors. The technology of construction is scarce and the management of infrastructure is lacking. The maintenance culture of Nigerians is poor thereby allowing most projects to decay (Oyedele, 2012).

Data sourced also revealed that major problems confronting infrastructure in the study area is not far- fetched from the foregoing discussions.

Table 5 shows the respondents opinion of problems confronting infrastructure, six majors problems were identified and they are lack of adequate funding (27.6%), poor maintenance culture (22.8%), lack of quality materials (17.2%) and wrong selection of contractors (15.2%) as problems confronting infrastructural development in the study area. Others problems are nonchalant attitude of people and lack of expertise. This is in tune with Oyedele(2012) that, poor maintenance, nonchalant attitude of the people, corruption and dearth of visionary leaders are the major challenges facing infrastructural development in Nigeria. Based on these, some policy recommendations were put forward to address these issues in order to

improve the provision and management of infrastructure in Ondo West Local Government Area.

Table 5: Problems Confronting Infrastructure in the Study Area

Problems	Frequency	Percentage
Poor Maintenance Culture	57	22.8
Nonchalant Attitude of People	33	13.2
Lack of Adequate Funding	69	27.6
Lack of Expertise	10	4.0
Wrong Selection of Contractor	38	15.2
Lack of Quality Materials	43	17.2
Total	250	100

RECOMMENDATIONS AND POLICY GUIDELINES

There is an increasingly clear understanding within Nigeria that sustainable improvements in urban mobility cannot take place without the implementation of proactive policies in favor of public transport development.

Many of the observed shortcomings in the urban transportation system in Nigeria stem from sector management weaknesses. Nigeria is characterized by the absence of a planned and effectively integrated multi-modal transport system that incorporates rail and water transport, where applicable, to complement road transport on which there is over-dependence. There does not appear to be a well-articulated policy and strategic framework for the urban transport sector.

Thus, the performance of government depends on the role assigned to the state, the competence of public agencies and the extent to which there is an enabling environment that facilitates and encourages growth promoting activities by private citizens and honest behavior by public officials (Anyanwu,1998).The federal government has appropriated more powers to itself than it can cope with. With about 52% allocations in a three-tier government structure of federal, state and local governments, the federal government is leaving the state with lesser fund for projects.

Therefore, four requirements of any physical infrastructure projects are: design, finance, technology and management. The appropriate designs that will ensure value for money should be adopted. The finance that is not adequate and procured at high interest rates should be reviewed. Nigerian contractors should not be lacking in financial management. The technology of construction should be updated and the management of infrastructure improved upon. Awareness on the importance of maintenance culture by Nigerians should be promoted thereby not allowing most projects to decay.

Stemming from the foregoing, the following recommendations are put forward based on findings on the management of infrastructure in the study area in order to keep the public infrastructure in good condition of functionality:

i. There should be proper maintenance of the available infrastructure, the beneficiaries of public infrastructures should not handle them carelessly but regard them as their own properties which should not be allowed to degenerate, vandalized or stolen. Adequate planning and maintenance scheduling should be done by managing agencies for the various facilities, this would prevent breakdown of facilities.
ii. A monitoring body or maintenance committee for the various infrastructure such as the Federal Roads Maintenance Agencies (FERMA) and its supporting agencies, The Nigerian Electricity Regulating Commission (NERC), Hospital Management Board (HMB), Ministry of Education through its various agencies and the Nigerian communication commission through the various communication agencies should be

adequately equipped financially and with experts to monitor and manage the infrastructure. The issue of inadequate man-power should be addressed by employing qualified and competent people in the agencies in charge of infrastructure management. This will enhance or promote proper inspection of the infrastructure and it will also reduce the burden on the present staff.

iii. Provision and maintenance of infrastructure should be funded adequately; this can be done by releasing adequate fund for the provision of standard and efficient infrastructure. There should be more provision of management instrument for efficiency and the available instrument should be put in good condition for effectiveness.

iv. Quality materials should be used during construction process and there should be proper monitoring of the contractors and others involved in infrastructure provision, this will ensure durability of provided infrastructure.

CONCLUSION

Different government policies in Nigeria have led to infrastructure decay, which has brought about poor erratic power supply, inefficient communication, poor road connectivity, inadequate output by health officials and a deteriorating education system resulting in stagnant economic performance (Bureau of Public Enterprises BPE 2003, Edame & Effiong 2013). Various action plans to improve the living standard of the populace through provision of infrastructure has been put forward: Transport, Electric power and access to energy (rural electrification), information and communication technologies etc (ADB,2010). However, these plans have failed to meet its objectives due to unstable budgetary allocation, underfunding of the projects by government, maintenance inefficiency, poor knowledge on appropriate technology for development, outdated design structure of projects, Finance, corruption etc (Olufemi, 2012) A cursory look at Ondo west local government area would reveal a spectacle of derelict public building and infrastructural facilities. It is therefore, essential for Nigeria (Ondo West LGA) to carry out administrative reforms and management of the infrastructure (Edame, 2013). In fact the ever-increasing population of urban migration has over stretched the available infrastructure beyond limit thereby. There is persistent inadequate supply of basic infrastructure. It is also imperative that a comprehensive planning and management strategy is adopted to ensure that the inadequacies in the areas of provision and maintenance of urban infrastructures are corrected.

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Indiscriminate Solid Waste Disposal in Okitipupa and Implications on Urban Aesthetics

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ABSTRACT

Efficient management of its refuse is one of the major indices for assessing the level of development of a developing-nation. Inefficient management of refuse poses great threats to public health and the environment. High solid waste generation is linked to economic development, unsustainable use of rapid industrialization, urbanization, and non-existing or poor waste management strategy. Open and indiscriminate dumps threaten environmental safeguards; they can pose major public health hazards and environmental pollution, especially the urban areas. This study investigates environmental impact of indiscriminate disposal of solid waste and its consequent effects on aesthetical value of Okitipupa in Ondo State, Nigeria. A total of 370 copies of a questionnaire schedule were administered in selected locations within Okitipupa metropolis based on systematic sampling technique. In-depth interviews (IDIs) of 70 selected residents/respondents were also conducted while tables and figures presented the findings of the study. It was observed that indiscriminate dumping of refuse causes environmental hazards including flooding (due to the blockage of main drains and sewers), and obnoxious odor (due to decay). It also destroys the aesthetical value of the entire environment. This study, therefore, recommends public enlightenment programs e.g. health education and the use of effective waste-management strategies in achieving an enduring aesthetics in the urban environment.

Keywords: Aesthetic Value, Solid Waste, Urban Environment, Waste-disposal Management

INTRODUCTION

The socio-economic development of any nation depends much on the sustainability of the environment. Akinbode (2002) opined that environment implies all external factors, living and non living materials with social and economic condition for sustainability. Therefore, indiscriminate refuse dump by anthropogenic practices is globally known to impact negatively on the environment. The disposal and management of solid waste is a globally challenging issue especially in developing countries due to its adverse environmental effects. Ayuba et al (2013) observed that mankind depends on the environment to sustain lives and that solid waste is one of the three major environmental problems, including flooding, and desertification, that are often considered life threatening.

Waste is rubbish or materials that are not needed and are economically unusable without further processing. It can also be described as any substance which constitutes scrap material or article, which requires to be disposed of as broken and worn out. It is an inefficient, or other unwanted, surplus substance arising from application of any process, or any substance. Olanipekun and Oyeniyi (2007) asserted that refuse are unwanted, discarded, non-liquid material emanating from various human activities at home and work-stations, such as paper, animal- droppings, carcasses, cellophane, bags and leaves, empty sachets, bottles, empty cartons in (market-places), abandoned automobiles (on public roads and industries), toxic industrial- waste, agricultural waste etc. Okecha (2000) described solid waste as comprising all waste arising from human and animal activities that are normally solid, mostly discarded as useless or unwanted. It is an unofficial index of prosperity. It can also be a major problem to human life especially where it is not well managed.

The problem of solid waste disposal in urban centres in developing countries is a major concern to government and this problem has become worrisome in Nigeria where municipal

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waste generation is always on the increase because of rapid population expansion growth and socioeconomic factors (Omole and Alakinde, 2013). Kenneth and Huie (1983) classified solid waste principally as garbage, ashes and rubbish. The garbage includes varying organic matters resulting from preparation and consumption of food. Ashes include remains of cooking and heating processes while rubbish may be papers, rags, wood, leaves and other non-biodegradable materials such as glass, metals and polythene materials. Sharma, (2009) classified solid waste as garbage which includes man-made waste from food; and rubbish comprising non-biodegradable or non-decomposable waste either combustible (such as papers, wood and cloths) or non-combustible (such as metals, glass, ceramics and polythene). Ashes comprise of the residues of combustible solid fuels, while large waste are made up of demolition and construction debris and trees, dead animals and, lastly, sewage treatment comprising of the materials retained on sewage-treatment screen, settled solid, and bio-mass. The current state of plastic-bag and polythene-waste pollution in Nigeria, and most especially in Okitipupa, is alarming. Several environmental impacts, including blockage of waterways and choking of animals, soils and mosaic litters of pure water sachet in the landscape requires urgent attention (Ogwo et al., 2013). Indiscriminate disposal of refuse is a situation where refuse is dumped in any environment or place whether at home, schools, streets, or market place and not minding the environmental risk-factors that are likely to follow. Ekpu and Archibong (2007) opined that the high rate of refuse generation by people, both in rural and urban areas is a direct reflection of the inefficient ways materials and energy resources are being used. Nearly every human activity creates refuse, which may be difficult to get rid of, especially with the careless attitude of some residents to sanitation. Lucas and Gilles (2006) asserted that the indiscriminate habit of refuse disposal has significantly affected environmental cleanliness and, in turn, bred environmental risk-factors affecting the health and well-being of the people.

In many developing countries, solid waste disposal sites attract, scavengers and small children which is the sources of contamination due to incubation and proliferation of flies, mosquitoes, and rodents. They, in-turn are disease transmitters that affect the population health, which has its organic defense in a formative and creative state. The said situation produces gastrointestinal, dermatological, respiratory, generic, and several other kind of infectious diseases (Salami, 2010). Open dumpsite in developing urban cities involved indiscriminate disposal of waste. They are uncontrolled and therefore pose major health threats which affect the landscape of urban cities (Sood, 2004). The UNEPA, (2006) stated that waste that are not managed properly, especially solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. The report further stated that unattended waste lying around attract flies, rats, and other creatures that, in-turn spread diseases such as Lassa fever.

The present situation in Okitipupa, as in other urban areas of Nigeria, portrays the situation analyzed above. However, empirical observation reveals that the Niger Delta Development Commission (NDDC) donated some Dino refuse disposal trucks to the Local Government Area and is being managed by both the Sanitation and the Local Government Environmental Protection Agency (LGEPA) Departments in the LGA where Environmental Officers are in control. This arrangement, however, failed and took a new turn due to the inefficiency of the officers, insufficient trucks, poor maintenance culture, inadequate funding, greed, indiscipline, illiteracy and unconcerned attitude of both the public and the officials that led to the ineffective waste management in the study area. Therefore, this paper, sort to present findings on the environmental and health impacts of indiscriminate solid waste disposal and its consequent effect on human and the environment in Okitipupa metropolis in Ondo State,

Nigeria, and, also make suggestions on appropriate waste disposal methods and management to avert further deterioration of the environment.

LITERATURE REVIEW

Sources of Refuse

The daily output of waste can be linked with the levels of urbanization/industrialization, living standards, dietary habits, and life styles of people living in an environment. Waste can be classified, based on its generation, its origin and sources. Oyediran (1997) asserted that waste is generated from domestic, agricultural, and industrial sources. The commercial sources of refuse generation include:

i. Domestic refuse; b) Refuse collected by the street cleaning services or scavenging,
ii. Stable litter-animal droppings and left-over animal feeds; d) Market refuse,
iii. Industrial refuse or inert materials, and, f) Sewage sludge.

Methods of Refuse Disposal

For a healthy environment, waste disposal method is very important depending on the types of wastes being generated, its volume, and the choice of disposal techniques. Professionalism is required in the selection of waste disposal sites as domestic waste could be highly polluting (Lucas and Gilles, 2006).

The main waste disposal methods are:

i. **Incineration:** Burning or incineration method is adopted where there is no adequate collection services and where refuse content is low and always at a localized level. Burning has a lot of disadvantages because of its close proximity to domestic dwelling. It could create fire risk in addition to producing atmospheric pollution. It could be very dangerous to asthma patients because of its obnoxious odor and choking effects.
ii. **Composting:** This method is adopted where waste product contains high organic matter. Composting is a method of combined disposal of refuse and “night soil” or sludge.
iii. **Indiscriminate Dumping:** Refuse is dumped in low lying areas as an easy method of disposal of dry refuse. This method entails exposing refuse unduly to flies and rodents; such that it becomes a nuisance from the smell and unsightly appearance. Another major problem arising from this method is that the loose refuse can be dispersed by winds and carried by rain as run-off; and dumped in the drainage system to contribute to the pollution of surface and ground-water. This method is considered the most unsanitary method that creates public-health hazards, a nuisance and severe pollution of the environment (Park, 2007).
iv. **Manure pits:** This method of refuse-disposal is quite effective and simple though adopted mostly in the rural areas. It is by digging ‘manure-pits' by individual householders. The garbage, cattle-dung, straw and leaves could be dumped into the manure-pits and covered with earth after each day's dumping.
v. **Burial:** Nwankwo (2004) discovered that burial of refuse is a method suitable for small camps.

A trench 1.5m wide and 2.0m deep is excavated and after each day, the refuse is covered with 20cm to 30cm laterite and compacted. However, both burial and manure-pits are not good methods of waste-disposal for inorganic or non-bio-degradable waste such as plastic waste.

Impact of Indiscriminate Refuse Disposal

The blockage of drainages by debris moved from refuse dumps by runoff during storm is the major cause of flood in most cities. Toyobo et al., (2013) observed that empty sachet water disposed in gutter caused blockage of drainages which constitute to the level of flood during heavy downpour, and this is the characteristics feature of Broad Street especially Ebute area. Apart from the physical damage caused by roadside disposal of solid waste to the environment, studies have shown that most of the synthetic or non-biodegradable materials which are disposed in these open roadside dumps contained some harmful chemical elements which have their origin in the decomposing high refuse dumps that dot the entire landscape. Iguisi et al (2001) also observed that several chemical elements have their origin from the decomposing high refuse dumps in the urban area.

Olokor (2001) asserted that the impact of indiscriminate disposal of refuse has been a worrisome health issue for quite some time now. One aspect of the problem is the fact that the cause-effect relationship takes a long time to establish. In some cases, the effects are spontaneous and are seen immediately while in many other cases it is not as direct. The environmental risk-factors attached to indiscriminate refuse disposal can cause mild to moderate illness, and at times, severe illness that can lead to death. There can also be the outbreak of epidemics like cholera, typhoid fever, and other diseases, in severe forms, causing death, especially in children aged 0-15 years, whose immunity is not as strong as that of the adult population. Some risk-factors of indiscriminate refuse disposal include:

i. Breeding of arthropod-borne-diseases which carriers can transmit diseases as malaria, viral encephalitis, typhoid, paratyphoid fever, diarrhea, dysentery, cholera, gastro-enteritis, amoebiasis, conjunctivitis, sleeping sickness, relapsing fever, scabies, filariasis, enteric pathogens, etc. (Park, 2007)
ii. Breeding of flies: As the organic portion of solid waste ferments, it gives rise to the breeding of flies which can deposit polluted materials on the skin or on food or other objects thereby contaminating it. Huge piles of refuse can constitute nuisance and an unsightly scene especially when dumped in strategic places like motor parks, market places or on the streets causing offensive odour and health hazards. (Alakija, 2002).
iii. Refuse dumps give rise to smog and air pollution when burnt openly. Discharge of carbon monoxide by industries, domestic combustion of coal, wood or oil, open burning of refuse, incinerators, pesticide spraying, wind borne dust, fungi, moulds, bacteria and nuclear energy all contribute to air pollution (Ayodele, 2007).
iv. Fire Disaster: Unguarded burning of refuse or indiscriminate throwing of cigarette stubs into refuse dumps may cause fire disasters which can lead to serious devastating effects on human life. Also fire may break out from the methane gas from the organic matter in refuse piles destroying lives and properties. (Lucas and Gilles, 2006).

Achalu and Achalu (2004) found that blockages in drainages caused flooding and hinder the free-flow of erosion, while Moronkola (2003) claimed that indiscriminate dumping of refuse gives rise to offensive odour. On environmental accidents, Ajayi (2004) asserted that if an environment is polluted with filthy items such as broken bottles and heaps of hazardous objects, children and adults can be injured from the materials and, if not quickly attended to, can lead to tetanus infection, which, in turn, can kill the host. Poor environmental sanitation according to Nwankwo (2004) is the indiscriminate disposal of refuse that often constitutes serious threats to human health and the achievement of healthy environmental sanitation. According to Bassis (2004) serious and devastating outbreaks of diseases and epidemics have been regularly associated with the indiscriminate dumping of refuse.

RESEARCH METHOD

The Study Area

Okitipupa metropolis is situated in the southern senatorial district of Ondo State, Nigeria. It is located between Longitudes 4035' and 5050'E and Latitudes 6025" and 6025' N within the tropical rainforest zone of Nigeria (Figure 1). It has a population of about 233,565 (NPC, 2006) with a current estimate of about 400, 00, and, it covers a land area of about 636sq km.

Okitipupa, the erstwhile headquarters of Okitipupa Division but now comprising of Okitipupa, Irele, Ilaje, and Ese-Odo Local Government Areas (LGAs), is now the headquarters of Okitipupa LGA in Ondo State. It is bounded in the North by Odigbo LGA and on the East by Irele LGA, South by Ilaje/Ese Odo LGA and in the West by Ogun State. The inhabitants of the LGA are mainly Yoruba of the Ikale ethnic group. The Local Government Area can boast of many big towns and villages like Okitiupa, Ilututu, Ode-Aye, and Igbotako. The people are mainly urban dwellers and no matter where they go to farm, they still come back to base. Okitipupa is the headquarters of the LGA, while other towns include Aye, Ikoya, Ilutitun, Iju-Odo, Igbotako, Erinje, Igbodigo, Ayeka, Erekiti, Iju-Oke, Igodan, Okunmo, Omotoso, Ayetoro, Wakajaiye and Mile 49 along Lagos–Benin Express way. Aside from the agrarian occupation of the inhabitants of the LGA, other economic activities involve agricultural production and trading-wholesale and retail as well as providing services in, financial institutions, hotels and restaurants.

Methods of Data Collection

The data used for this study were derived from both primary and secondary sources. The primary data were collected from direct interviews, personal observation, and responses to a Questionnaire schedule administered on the respondents/residents. The secondary data were drawn from previous studies done on the research topic and collated, from books, journals, library-search/archives and the Internet.

The sample for the study were residents randomly selected from four areas; namely Broad Street, Ikoya Road, Erinje Road, and Sabo. The respondents from the sampled households in all the areas were selected using a systematic sampling technique based on interval of five. The Questionnaire Schedule designed for the study contained questions for probing into the method of waste disposal used, general aesthetics of the area, and effects of indiscriminate dumping of refuse in the area.

In each of the areas sampled, 100 copies of the Questionnaire schedule were distributed randomly in each of the four sampled areas, making a total of 400. 370 were duly completed and retrieved while 20 were not returned and 10 others were invalid. The response Rate of 92.5% is good enough for the data to be reliable. Site-visits were also undertaken in order to identify indiscriminate waste dumps and access the general aesthetic quality of the areas. Data obtained, were presented in tabular form for clarity and easy understanding and analyzed by descriptive statistics. 70 in-depth interviews (IDIs) were also conducted on some residents in the area; to complement the quantitative data from the Questionnaire Schedule. The qualitative data generated through the IDIs were transcribed and reported verbatim.

RESULTS AND DISCURSIONS

Socioeconomic Characteristics of Respondents

Table 1, in the appendix, shows that majority 29.73% of the respondents attained the primary-school level of education and 23.24% had vocational education while 21.62% attained the level of higher education. Whereas 17.30% attained the secondary school level of education and 8.11% had no education. The table also shows that, majority of the respondents 37.30% were not employed and 32.43% engaged in civil service jobs while 10.81% were

self-employed, others, being 12.97% and 6.49%% respectively, embarked on small scale faming and trading. The implication of this is that most of the respondents engage in all sorts of street trading and small scale enterprise such as hawking, and pure water production/sales as a source of income and livelihood. Some of the residents living close the dumpsites became scavengers collecting solid wastes such as cans, metallic objects, plastics, in order to make a living. Direct handling of solid waste, especially Health Care waste mixed with domestic waste can lead to increasing risk of infection most especially the scavengers. The activities of street traders and market women cause littering of solid waste on the streets and drains thereby destroying the aesthetical values of the environment. The degenerating influence of flooding due to blockage of drains and water ways also leads to overland pollution that drains into the streams or river bodies, which led to infrastructure degeneration.

Types of Waste Generated by Respondents

Table II, revealed that paper and water nylon 27.56% are the commonest generated wastes in the four areas of study, followed closely by food remnant and vegetables 22.70%; clotting materials/foot ware 14.05%; metal scraps/bottles/plastic 12.97% while wood/saw dust, electronic gadgets and other wastes represents 11.89%, 6.48% and 4.32% respectively. The mixed biodegradable and non-biodegradable waste dumped by the road side has negative impacts on the general environment. Some of these solid wastes are been washed by rainstorm into drainages/gutters that were made for free flow of water and end up blocking them preventing easy flow of water and subsequently lead to flooding of River Oluwa/Yewa banks and even people's home along the bank.

Sources of Waste

Sources of solid waste generated by the respondents as indicated in Table III, shows household waste as the highest with 59.4%, while educational establishments and commercial waste takes 15.13% and 13.0% respectively. Industrial waste accounts for 4.90%, agricultural 5.40% and others 2.17%. The biodegradable solid waste in Okitipupa are mostly consumable materials such as kitchen remains, discarded food items, yard wastes, pieces of cloths and discarded cartons that were used for packaging. There are several heaps along the roads with no special organized system of solid waste collection. The residents confirmed that the wastes are either incarcerated at the site or left to rotten and sometimes evacuated during the monthly environmental exercise.

Disposal Methods used by respondents

The Disposal methods of solid waste adopted by residents in the study area are unsatisfactory. The preference of educated people to adopt better methods of waste disposal could be higher than illiterates. It is obvious from the table that people who throw refuse on open land and drains are uneducated. Table IV, shows that 24.32% of the residents prefer to dispose their refuse in any thereby bush and 17.18% in any open spaces thereby constituting nuisance to their immediate environment. Waste Management Authority Dino-bin type of waste disposal method 13.51%. This method has constituted a serious nuisance in the environment because of the nonchalant attitude of the Waste Management Workers. The study also confirmed that, waste evacuation is not regularly done because it takes more than a period of one month to evacuate waste deposited in Dino-bin by the Waste Management Authority. This automatically leads to overflow of waste in the bin which results into spreading of waste along the streets in most cases. It is also a source of transmissible diseases because majority of the respondents either throw their waste on land around the bin, drains or the streets thereby constituting health hazard to the immediate environment. Only a small proportion 3.95% of the respondents deposits their waste in bins and bags from private refuse disposal companies where they can be transferred to dumpsites outside the living environment.

Furthermore, from the total of 70 in-depth interviews (IDIs) conducted, responses on the types of solid waste generation and disposal, revealed household waste to be the major waste generated in the study area, followed by industrial waste, and some biomedical waste. The reason given for high generation of household was the rapid urbanization and industrialization of the study area. This is in line with the findings of Oyediran, (1997) who linked waste with the levels of urbanization and industrialization in living environments. To buttress this, one the respondents Mrs. 'Akin'60 year old trader stated that;

> "I*t was not like this when l was growing up, Okitipupa was not as busy as this and people did not use to throwing dirty anyhow as at then"*

Moreover, on the question of solid waste disposal in the study area the in-depth interview conducted shows that respondents disposes their waste in nearby bushes, open-spaces and only few people employ the skeletal services provided by the Waste Management Authority, while others burn their solid waste and dumps theirs in the drainages, gutter/river. This environment according to the household residents especially those who are living very close to the dump sites complained about the smelly and filthy nature of their environment that also constitutes nuisance to the aesthetical value of the environment. When they were asked for the reasons for indiscriminate solid waste disposal, many of them claimed they do not have a standard or approved refuse disposal. Among those who claimed to dispose their refuse in bushes and rivers were further asked on why they refuse to make use of the Okitipupa Waste Management facilities. All respondents interviewed complained that there are no standard waste management techniques in place in Okitipupa. Mrs 'Ago', aged 40, a teacher, said;

> *"Even around the premises of the local-government Secretariat where one of the Waste Management Authority Dino-bin type of waste disposal method is placed is full of refuse waste littered on the ground, where then is the waste management/facilities?If the local government claims they have waste management they should start with their environment"*

General overview of the environment

From Table V, household residents, especially those living close to the dump site are the most hit of the impact of refuse dumpsite, they complained that the dumpsite near their home is the major cause of sicknesses within that environment. As indicated in the table, 37.30% argued that their surrounding are dirty, 42.70% of the respondents claimed their surrounding are smelly, while 20% said their surrounding are filthy.

Similarly, the result of the complementary in-depth interview conducted revealed that the respondents, argued that their surrounding are smelly, filthy and dirty and that some of the wastes from the dumpsite overlap their houses causing environmental discomfort in the environment. Apart from the fact that waste disposal bins were not provided by the Local Government Authority to willing homes, it was further reported that they are no waste disposals facilities even in market places. The market is littered with waste and the marketers either dump their waste in the gutters/drainages or drop the waste on open spaces (the multi-billion naira ultra-modern market is now a ghost of itself). Another respondent 'Mrs. Ige' aged 35 trader in the market claimed that;

"Since we do not have any standard disposal, we dump our waste in the gutters/drainages so that when rain falls it will help us flush them inside the river especially river Yewa and Oluwa".

When they were further asked on what to do about indiscriminate waste disposal, many of the respondents admitted that they are aware of the implications of indiscriminate dumping of waste, like drainage blockage, flooding, underground stream or water pollution and infrastructural degradation with its attendant health hazards. And they agreed that they are ready to pay a little token if there are standard waste management facilities. They also suggested that isolated waste dumpsite should be provided or marked out by the Local government administrators as a 'drop off location', to enable individuals deposit their waste.

Impacts of Indiscriminate Refuse- dump

The impacts of inappropriate disposal of solid waste are quite numerous to be mentioned. Table VI, shows that, 26.49% of the respondents agreed that indiscriminate refuse dump causes flooding, 27.57% said it causes pollution while 22.16% and 23.78% agreed that it causes erosion and infrastructural degradation respectively. The implication of this is that indiscriminate refuse dump could cause health deterioration, accidents, destruction to the landscape, and other environmental pressures. UNEPA, (2006), further confirmed that waste that are not managed properly, especially solid wastes from households and commonly, are a serious health hazard and lead to the spread of infectious diseases. The report further stated that unattended waste lying around attract flies, rodents and other creatures that, in turn spread diseases. The mountains of refuse dump which decorate the major roadsides in Okitipupa serve as good hideout for rodents and snakes. These rodents are known to be vectors of the deadly "Lassa fever" and the snakes are also known to be poisonous reptiles. Also the biodegradable wastes serve as good breeding grounds for mosquitoes. These spread various diseases like cholera, typhoid fever, malaria and yellow fever. It therefore impacts negatively on the health the residents and also destroys the beauty of the environment.

Respondents' view of Indiscriminate Refuse Dump

As reported in Table VII, majority of the respondents 38.90%, were not satisfied with the indiscriminate waste disposal. About 30.30% had no idea of the consequences of the effects of dumpsites. Only a few of the respondents 11.40% whose refuse are being evacuated by private waste management companies seem to be satisfied with the system. On the environmental aesthetic and quality, majority of the respondents confirmed it as being filthy and dirty.

CONCLUSION

The study examined the consequences of indiscriminate solid-waste disposal by households in Okitipupa and environment. Results from the analysis of the data reveal that both far-away and nearby respondents suffered from related-diseases due to the location of dumpsites closer to their houses. This study further reveals that the indiscriminate dumping of refuse on road-sides and in any open space in Okitipupa often result in drainage blockages, flooding, underground stream or water-pollution, and infrastructural degradation with its attendant health hazards. It was also noted that the extent of air and water pollution is worst in the raining season as a result of offensive and disease-carrying odor, as well environmental decay during the dry season. The smoke from the burning of refuse in the dumpsite is a major source of air-pollution that causes asthma and chest pain.

The study therefore concludes that dumpsites should be properly located away from houses and properly managed to minimize its effects on the environment. People need to be educated by health motivators about the effects of dumpsites on their health, therefore, for a sustainable management of waste the study emphasizes the need for a frequent and adequate publicity and environmental health enlightenment to ensure healthy environment. The study further suggests the need for the introduction of an environmental management strategy (by

means of legislation) with clearly defined objectives such as the introduction of waste disposal bin, regular environmental sanitation period, more Dino-bin, adequate funding of waste disposal equipment, introduction of permanent dumpsites outside the residential area, that can be articulated into one holistic approach to achieve a cleaner and healthier environment with good aesthetics value.

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APPENDIX

Table I: Distribution of Socioeconomic Characteristics of the Respondents

Educational Level	**Frequency**	**Percentage**
No Formal Education	30	8.11
Primary Education	110	29.73
Secondary Education	64	17.30
Vocational Education	86	23.24
Higher	80	21.62
Employment Status		
Self Employed	40	10.81
Farming	24	6.49
Civil Service	120	32.43
Trading	48	12.97
Unemployed	138	37.30
Total	370	100.0

Table II: Distribution of Types of Waste Generated by Respondents

Type of Waste	Frequency	Percentage
Paper/Water Nylon	102	27.56
Wood/Sawdust	44	11.89
Clothing Materials/foot wares	52	14.05
Metal Scraps/bottles/plastics	48	12.97
Electronic gadgets	24	6.48
Food remnant/vegetable	84	22.70
Others	16	4.32
Total	370	100.00

Table III: Distribution of Sources of Waste Generated by Respondents

Sources of Waste	Frequency	Percentage
Commercial	48	13.0
Industrial	18	4.90
Household	220	59.40
Agricultural	20	5.40
Educational establishments	56	15.13
Others	8	2.17
Total	370	100.00

Table IV: Distribution of Disposal Methods used by Respondents

Types	Frequency	Percentage
Nearby Bush	90	24.32
Dunghill	54	14.60
Gutter/Drainage Channel	30	8.10
Waste Management Authority-Dino-bin	50	13.51
Streets/Rivers	32	8.64
Burning	36	9.72
Open Spaces	66	17.18
Others	12	3.24
Total	370	100

Table V: Distribution of Respondents Views about Indiscriminate Refuse- dump

View	Frequency	Percentage
Dirty	138	37.30
Smelly	158	42.70
Filthy	74	20.0
Total	370	100

Table VI: Distribution of Respondents Views about Impacts of Indiscriminate Refuse- dump

Impact	Frequency	Percentage
Flooding	98	26.49
Pollution	102	27.57
Erosion	82	22.16
Infrastructural Degradation	88	23.78
Total	370	100

Table VII: Distribution of Respondents view of Indiscriminate Refuse Dump

View	Frequency	Percentage
Very satisfied	50	13.51
Dissatisfied	144	38.90
Undecided	112	30.30
Satisfied	42	11.40
Very Dissatisfied	22	5.90
Total	370	100

Effect of Infrastructure Provision on Residential Property Values in Ijaiye Housing Estate, Lagos, Nigeria

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ABSTRACT

The study examines the effect of infrastructure provision on residential property values in Ijaiye Housing Estate. It assesses the level of satisfaction of occupiers with the maintenance of the infrastructure and the effect of the services on the residential property values in Ijaiye Housing Estate, Lagos, Nigeria. Structured questionnaire were administered on one hundred and twenty five (125) respondents for the study. Data collected were analyzed using descriptive (frequency distribution tables and weighted mean score) and inferential (multiple regression analysis) statistics. Findings revealed that parking space is the most adequate of all the infrastructures in the estate, while security and water supply were somewhat adequate. Also, the occupants are satisfied with the maintenance of water supply above other infrastructures, while electricity is the least maintained. Furthermore, the results of the regression analysis shows that all the infrastructural facilities, except type of security outfit and parking garage, have significant effects on the values placed on residential properties in the estate. The R^2 Statistics is 0.553, which is significant at 0.000 levels. It is therefore recommended that the available infrastructures in the estate should be adequately maintained in order to keep the functionality and further enhance the value of the residential properties in the estate.

Keywords: Infrastructure, Provision, Residential, Property, Value

INTRODUCTION

Over the years, infrastructural provisions have been played down by all levels of government (Federal, State and Local) perhaps because they are largely ignorant of the fact that a major determinant of property values is the availability of infrastructures (Odudu, 2003). The provision of infrastructural facilities is of high importance in every country because of its contribution to the economic development of a nation. The efficiency of any form of human activity system, including urban area, largely depends on the provision of efficient infrastructure and services (Babarinde, 1998). The quality and coverage of infrastructure services have a major impact on living standards and economic growth, yet it is estimated that two billion of the world's poor lack access to adequate sanitation, two billion lack access to electricity, and one billion lack access to clean water (United Nations, 2002).

According to Oyenuga (2006), housing comprises of the immediate accommodation, environment and facilities like roads, water, electricity and a host of other facilities that make living comfortable to the dwellers. The World Health Organization defined housing not only in terms of the dwelling units but also in terms of the facilities and services in them. Therefore, urban infrastructure plays an important and indispensable role in the economic, social and environmental aspects of life of any urban setting. The competition for locations with good urban infrastructure usually results in an increase in land and housing values, either sales or rentals (Harvey, 1993). The availability of these basic facilities, public utilities and services in any residential area enable the properties to function properly, efficiently, satisfactorily, and become more marketable. Okoh (2010) discovered that the rental values of residential properties were directly dependent on the level of adequacy and functionality of the facilities available. Ibrahim (2011) is of the opinion that the presence of facilities generates high preference, keen competition for properties and thus high rental values, while

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absence of facilities results in low patronage, disincentive to people, attraction of poor tenants and consequently low rental values.

However, it is painful to note that the Infrastructural report of Nigeria, just like any other third world country, is nothing to write home about. Research has shown that the housing situation is in a regretful state both quantitatively and qualitatively (Agbola, 1998; Nubi, 2000; Ajanlekoko, 2001; and Oyedele, 2006). Therefore, the government ought to put in place all measures deemed fit to make the environment beneficial for living for everybody. Therefore this paper tends to examine the effect of infrastructural provision on residential property values in Ijaiye Housing Estate, Lagos,

LITERATURE REVIEW

According to Ajibola, Awodiran and Salu-Kosoko (2013), infrastructure network is the very socio-economic climate created by the institutions (public or private) that serve as conduits of trade and investment. Infrastructure does not only affect production and consumption directly, it also creates many direct and indirect externalities. It involves large flows of expenditure, thereby creating additional employment (Oyedele, 2012). Equally, infrastructure can have a significant impact on output, income, employment, international trade, and quality of life. Kumar (2005) observed that the provision of infrastructural facilities in any socio-economic unit whether a nation, region or community could have either a positive or negative impact on property value. For instance, while the provision of infrastructural facilities like good roads network, water and electricity supply, drainage system, good refuse collection treatment and disposal system etc enhances values to unprecedented level, the inadequacy or lack of these facilities will adversely affect value as a paradox.

No matter the level of provision or adequacy of infrastructural facilities in any neighbourhood, maintenance will determine the durability of such. However, maintenance has been a neglected field of technology in Nigeria. Maintenance as a service covers every aspect of the building environment particularly the building assets and infrastructural facilities. Amobi (2006) opined that every infrastructure or equipment requires being maintained to remain in functionality and in up-to-date standard. Buildings and infrastructures are the nation's most valuable assets, providing people with shelter and facilities for work and leisure. Therefore, maintenance starts the day the contractor leaves the site, having completed the project. For instance, Olujimi (2010) observed that the level of deficiencies and the degree of deterioration of infrastructure in Nigerian urban centres is becoming more alarming and worrisome due to the inability of the public sector to meet up its social responsibilities to the people. This problem is pronounced in the old, indigenous core areas of the cities and low income areas. However, maintenance aims at retaining components, equipment as well as the entire structure at specified level of performance.

Residential property is considered a basic necessity of life – the third after food and clothing. The fact remains that unlike food and clothing, real property is difficult to acquire. Its importance can be seen in the vital roles it plays in socio-economic and psychological development of individuals, states and nations. Most often, when people talk of the factors affecting rental values of residential properties, the most commonly discussed factors are location, quality of building, demand and supply rate as little or no regard is given to public facilities. Ajibola et al. (2013) observed that whereas location is important in relation to proximity to the target market and sources of supplies; conditions and facilities (infrastructure) are important in relation to attracting optimal rentals. According to Johnson, Davies and Shapiro (2005), infrastructure is one of the determinants of property value, the presence of which leads to appreciation in property values and vice versa. Whereas Hammer,

Booth, and Love (2000) are of the opinion that good and adequate infrastructure is central to property values. This shows that a neighbourhood may have infrastructure that are not adequate to serve the residents. However, when there is adequate and functional infrastructural facility such as accessibility, water and electricity, a residential user may be prepared to pay a high value for a property depending on his consideration for such basic facilities (Harvey, 1993).

THE STUDY AREA

Ijaiye Medium Housing Estate Phase 4 is the fourth phase of the Lagos State Development and Property Corporation (LSPDC) plan that was executed over 20 years ago. The phase of the LSDPC housing project is aimed at providing premium housing qualities and facilities for the medium income earners in Lagos state. It was built between the years 1986 and 1987 as a result of the housing problems in Lagos State. The estate is well laid out with a peaceful and beautiful serenity. LSDPC Medium phase 4 has just one major road, which serves as the entrance and exit point to and from the estate. Most of the links within the estate are parks, one can hardly find streets. Examples are Cactus Park, Lilly Park, peacock road, Eagle Park, Robin Park and so on. The type of houses and structures found inside LSDPC medium phase are flats of a storey building and bungalows. Also, the estate is provided with various infrastructural facilities which make the estate functional such as electricity and water supply, Drainage channel and Recreational facilities, Street lights and community hall, health facilities, Security and Transportation.

Table 1: Operationalization of Variables

Variable code	Definition of variable	Measurement scale
Independent Variables		
PWS	Power Supply	1, if stable and 0, if erratic
WRTS	Mode of Water Supply	1, if Water running 0, if otherwise
SECTY	Type of Security Outfit	3, if Independent Security 2, if Local Vigilante group 1, if No security Operation
WSDP	Waste Disposal System	3, if Disposal by Gov't Agency 2, if Individual disposal at dump site 1, if by Burning
DSTH	Distance from Health Facilities	Actual (Km)
DSCHL	Distance from Schools	Actual (Km)
RDNET	Type of Road Network	3, if tarred 2, if Graded but not tarred 1, if Ungraded
PRKG	Type of Parking Garage	3, if In-built 2, if Open garage 1, if No garage
Dependent Variable		
RENTV	Rental values	Actual Amount (₦)

Source: Compiled by the Author

METHODOLOGY

The study was carried out in Ijaiye Housing Estate, Lagos having eighty three (83) blocks of housing units in the estate comprising of eighty (80) blocks of 4 no. 3 bedroom flats in each block and 3 no. bungalows. Thus, the sample frame for the entire residential properties in the estate is three hundred and twenty three (323). Therefore, 2 units of the 4 no. 3 bedrooms flat in each block were assessed for the study giving a sample size of 160 no. 3bedroom flat and 3no.Bungalow in the estate. This represents approximately 50% of the total flats in the estate.

One hundred and sixty three (163) structured questionnaires were administered on the occupants of the housing estate, out of which 125 (representing 77%) were retrieved and used for analysis. Descriptive and inferential statistical methods were adopted for the analysis of the data obtained from the field survey. The descriptive statistics involves the use of frequency tables, weighted mean score and standard deviation. The weighted mean score on a 5 point likert scale was used to assess the level of satisfaction of the occupiers with the maintenance of the residential properties in the study area.

The regression analysis was used to measure the effect of the infrastructural facilities on the residential property values in Ijaiye housing estate.

$RV = a + b_1X_1 + b_2X_2$ ----------$+ b_nX_n$

Where, RV = Rental Values

a = constant

b_1-b_n= coefficient of the independent variables

x_1-x_n= the infrastructural facilities

FINDINGS AND DISCUSSIONS

This section deals with the presentation of the data obtained from the field survey. It discusses the objectives of research and employed the methodology put forward in the previous section in attaining the goal of the research.

Table 2 revealed that most of the respondents have been in occupation of the property for more than 5 years. This implies that most of the respondents have resided in the estate for a considerable period of time. This could be as a result of the infrastructural facilities in the estate, the rent paid for accommodations in the estate and/or the fact that some of the properties are owner occupied. Agbola (1997) and Megbolugbe (2007) opined that infrastructural facilities in a neighbourhood help in boosting the healthy life of the residents. These often cause residents to desire for and/or retain accommodations in the neighbourhood notwithstanding the rent they pay. Also, most of the residents, by virtue of the years they have spent in the estate, have adequate knowledge of the state of developments in the estate.

Table 2: Period of Occupancy

Period(Years)	Frequency	Percentage
1 – 2	5	4.00
3 – 4	11	8.80
5 – 6	52	41.60
7 – 8	12	9.60
9 – 10	17	13.60
Above 10	28	22.40
Total	**125**	**100.00**

In order to examine the adequacy of infrastructural facilities in Ijaiye Housing Estate, the respondents were asked to rate level of adequacy of a list of possible infrastructural facilities as reported in Table 3. On a 5-point rating scale, '5' is used to denote very adequate, while '1' is used to denote the not adequate.

Table 3 showed the adequacy of the available facilities provision in the estate. From the table, Parking space with the mean score of 4.14 was ranked as being adequate in the estate. Security and water supply with mean scores of 3.93 and 3.70 respectively ranked 2nd and 3rd indicating that they are adequate. However, other infrastructures like, recreational facilities, electricity etc are not adequate as their mean response was less than 3.50. The mean response of between 2.50 and 3.49 indicates that the respondents are undecided or indifferent in their response. These services are available in the estate, but they are not adequate enough to meet

the demand and desires on the residents. The implication of this is that things other than infrastructural facilities such as low rent and owner occupation etc might have kept the residents in the estate, because facility provision is an essential part of any housing provision within a neighbourhood.

Table 3: Adequacy of Infrastructural Facilities Provision

Facilities	VA (5)	A (4)	U (3)	LA (2)	NA (1)	WMS	Rank
Parking Space	83	17	0	15	10	4.14	1st
Security	7	111	0	5	2	3.93	2nd
Water Supply	33	62	0	20	10	3.70	3rd
Road Network	30	55	5	15	20	3.48	4th
Waste Disposal	21	28	0	57	19	3.26	5th
Recreational Facilities	17	30	2	63	13	2.80	6th
Electricity	16	31	1	52	25	2.69	7th
Drainage System	10	27	4	59	25	2.50	8th
School	10	40	5	28	12	2.34	9th
Estate Hall	10	11	4	38	71	1.53	10th
Health Facilities	0	9	0	15	101	1.34	11th

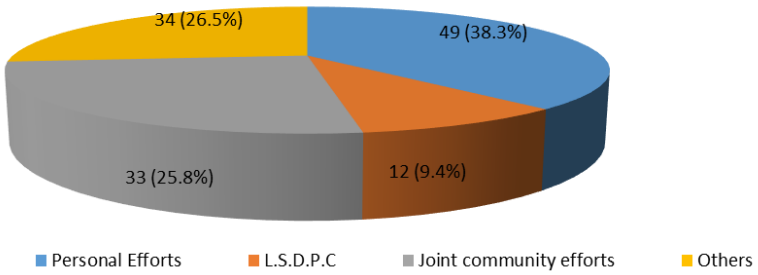

Fig 1: Mode of Maintenance of the Infrastructural Facilities

Fig 1 shows the mode of maintenance of the infrastructural facilities in the estate. It can be observed that that funds employed for the maintenance and sustenance of infrastructures within the estate are those realized majorly through personal and joint community efforts. This reveals the fact that the public sector, as noted by Olujimi (2010), has left their responsibility to the individual community and residents. Ijaiye estate, if care is not taking, might degenerate into slum in the nearest future unless there is a conscious effort by the government to revamp its maintenance level.

In order to examine the level of satisfaction of respondents with the maintenance of infrastructural facilities in Ijaiye Housing Estate, the respondents were asked to rate their satisfaction on a 5-point rating scale, where '5' is used to denote 'highly satisfied', while '1' is used to denote the highly 'dissatisfied'.

Table 4: Level of Satisfaction with the Maintenance of the Infrastructure

Facilities	HS (5)	S (4)	LS (3)	D (2)	HD (1)	WMS	Rank
Water supply	70	10	10	25	15	3.80	1st
Recreational Services	33	55	17	15	5	3.77	2nd
Parking space	49	25	19	12	20	3.57	3rd
Security	38	4	70	5	11	3.50	4th
Drainage	18	53	25	19	10	3.40	5th
Waste disposal	25	19	50	21	10	3.22	6th
Road network	31	16	28	30	20	3.06	7th
Estate Hall	15	32	19	40	19	2.87	8th
Communication	10	27	4	59	25	2.50	9th
School	17	11	23	24	50	2.37	10th
Health facilities	15	35	7	23	12	2.32	11th
Electricity	5	5	4	101	10	2.15	12th

Table 4 shows the level of satisfaction of the respondents with the maintenance of the infrastructural facilities provision in the estate. The result shows that the respondents are satisfied with water supply, recreational services, packing space and security in the estate as these ranked 1st, 2nd, 3rd and 4th with mean scores of 3.80, 3.77, 3.57 and 3.50 respectively. They are less satisfied with maintenance of the drainage system, waste disposal, road network and estate hall with mean scores of 3.40, 3.22, 3.06 and 2.87 respectively, while they are dissatisfied with communication system, school, health facility and electricity supply. The finding shows that the intervention of government is highly needed in the estate to save it from deterioration. These facilities are basic to human function and health, thus they ought to be working very efficiently.

Table 5: Model Summary of Effects of Infrastructural Facilities on Residential Property Values

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.743[a]	.553	.507	61236.65590

Table 6: Analysis of Variance of Effects of Infrastructural Facilities on Residential Property Values

	Sum of Squares	Df	Mean Square	F	Sig
Regression	361298717412.058	8	45162339676.507	12.044	.000[b]
Residual	292494386036.218	78	3749928026.105		
Total	653793103448.275	86			

In Table 5, the value of R (0.743) shows that there is a strong relationship between the dependent variable and the predictor variables, while the coefficient of determination i.e. the R^2 statistics is 0.553 indicating that 55.3% of the variation in the dependent variable (Rental Value) can be attributed to the independent sampled variables (infrastructural facilities). Also, the computed F statistics (F = 12.044) in Table 6falls in the rejection region. The data provides that at least one of the model coefficients is non-zero and this is significant at 0.000 levels. This shows that the model can be used to predict the rental values in Ijaiye residential estate, Lagos.

Table 7: Regression Coefficients on the Effects of Infrastructural Facilities on Residential Property Values

Impacts	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	464174.036	70666.908		6.568	.000
PWS	56790.259	19415.610	.289	2.925	.005*
WRTS	107144.379	27411.217	.336	3.909	.000*
SECTY	37783.137	21564.308	.217	1.752	.084**
WSDP	59453.947	20707.228	.401	2.871	.005*
DSTH	-32931.650	8832.707	-.372	-3.728	.000*
DSCHL	32972.368	9095.536	.344	3.625	.001*
RDNET	-57486.121	20841.482	-.381	-2.758	.007*
PRKG	-9765.969	13125.906	-.074	-.744	.459

*Significant at 0.05
**Significant at 0.1

Table 7 shows that six (6) of the variables were absolutely significant at .05 levels and these variables are power supply (PWS), Mode of water supply (WRTS), waste disposal system (WSDP), health facilities (DSTH), distance from children school (DSCHL) and type of road network (RDNET) and thus have effect on the rental values of the residential properties in Ijaiye housing estate. Whereas type of security outfit (SECTY) can be said to be significant at 0.1 levels, type of parking garage (PRKG) is not significant in predicting changes in the dependent variable the model. From the findings, a unit change in power supply from stable to erratic will result in approximately ₦56,790.00 change in the rental

value of the property. Since majority of the infrastructural facilities under study are significant to the model, the finding supports the works of Hammer, Booth, and Love (2000) and Johnson, Davies and Shapiro (2005) that infrastructure is a major determinant of and central to property values. McNeil and Dollery (1999) is of the view that as infrastructure works, productivity and labor increase; when it does not work, economic renewal can be postponed or even halted. Also, the provision of infrastructure in residential property would continue to attract prospective tenants and therefore increase property values. Thus, serious attention should be paid to these infrastructures as the value of both lives and properties depend on it.

Thus, the model; $Y = \alpha + \beta_0 + \beta_1X_1 + \beta_2X_2 + \ldots + \beta_nX_n + e$; can thus be re-written as

RENTV = 464174.036 + 56790.259PWS + 107144.379WTRS + 37783.137SECTY + 59453.947WSDP - 32931.650DSTH + 32972.368DSCHL - 57486.121RDNET - 9765.969 PRKG.

CONCLUSION

Infrastructure is an important element of a good living environment hence, this study examined the effect of such infrastructural provision on residential property values in Ijaiye Housing Estate, Lagos State. The findings suggest that various infrastructural facilities are available in the estate. The various infrastructures available in the study area include water supply, electricity, road networks, waste disposal, drainage system, health facilities, security, parking space, school, estate hall and recreational facilities. It could be concluded therefore that the required infrastructure for good living environment is available within the estate but not in good state of repair, which was the reason why the residents are not satisfied with the level of maintenance of the infrastructures. However, the study revealed that not all the facilities are significant in influencing property's rental value in the area. Facilities such as power supply, mode of water supply, waste disposal system, distance from health facilities, distance from children's school and type of road network are significant, while type of security outfit and type of parking garage are not. Therefore, it is recommended that facilities within the estate need serious upgrading to further enhance the living conditions of the residents and the rental values of the properties. Provision of infrastructures is capital intensive, and funds realized for infrastructural service maintenance may not be adequate, hence the need for Public-Private participation.

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Appraisal of the Geographical Influence of the Cocoa Products Limited, Ile-Oluji as a Regional Agro-Pole in Ondo State, Nigeria

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ABSTRACT

The Cocoa Products Limited, Ile-Oluji (CPL) as a firm, buys raw cocoa beans and processes it into value-added forms such as cocoa powder, cake, butter and liquor which sell locally and internationally. The CPL requires large quantity of raw cocoa beans for production hence buys cocoa beans from across the cocoa producing areas within the state. These are largely from Ondo, Idanre and Ile-Oluji. This study explores the geographical influence of the CPL as a regional agro-pole in Ondo state. Two management staff were interviewed at the CPL using purposive sampling, seventy farmers, sixty Sub-buying Agents (SBAs) and six Licensed Buying Agents (LBAs) were interviewed across the three towns which constitute the region of study using the simple random sampling with Tipett's table of random numbers as a guide for selecting the sample. Using the Statistical Package for Social Sciences (SPSS) for analysis, the study discovered that the demand of the CPL for raw cocoa beans has a large impact on the quantity of raw cocoa beans produced by the farmers as well as that bought and sold by the SBAs and LBAs in the region of study thereby creating job security and enhanced opportunities. The study therefore recommends that the CPL be seen as a regional agro-pole whose influence cuts across several towns and villages.

Keywords: Agro-pole, Cocoa beans, Cocoa Products Limited, Region, Value chain

INTRODUCTION

Industrialization refers to the presence of industries in an environment, according to Basorun (2003), it is a government development policy rooted in both national and regional plans and is in most cases tailored towards effective use of both human and natural resources available within a community, state or a nation. Industrialisation has been seen as a veritable channel of attaining the lofty and desirable conception and goals of improved quality life for the populace; this is because industrial development involves extensive technology-based development of the productive (manufacturing) system of the economy. It could be seen as a deliberate and sustained application and combination of suitable technology, management techniques and other resources to move the economy from the traditional low level of production to a more automated and efficient system of mass production of goods and services (Ayodele and Falokun, 2003). Against this background, however, industrialisation seems to be central to economic growth and development.

In many developing countries, industrialization has become an increasingly valuable tool towards achieving rapid and sustainable economic growth as well as a more balanced regional development; this is as a result of the high potential which manufacturing activities have in generating externalities that would have a widespread effect across sectors of the economy through production linkages. The main objective of regional development is to have a strong economic flavour through the achievement of high growth rates and the efficient utilization of resources (Glasson, 1978 in Basorun, 2008). Basorun, (2008), citing Hall (1992) opines that other possible objectives of regional economic policy includes: improving the efficiency of industry, raising the level of gross regional product per work or per head of total population, improving the distribution of regional income and many other variants.

Economic activities are characterized by their pronounced tendency to cluster in space, the presence of factors such as raw material sources, cheap labour availability, market potentials,

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nodal points on transport networks and the like usually tend to attract different industrial activities thus aiding the clustering of activities in an area and this in turn is a factor that brings about regional development.

From the planning view, cocoa production in Ile-Oluji is a development indicator that can generate the driving force for the economic growth of Ile-Oluji and the interdependencies among cocoa firms in the cocoa industry (and other sectors of the economy). It is a vital feature of the industrialization process in the town and this is a tool for regional development in Ondo state with the cocoa industry as the significant attribute and the Cocoa Products (Ile Oluji) Limited (CPL) the reference point to which other Cocoa based firms are linked. This study explores the geographical influence of the CPL as a regional agro-pole in Ondo state with a view to promoting regional development by examining if there are any viable trade links between the CPL and the farmers in the region as well as if the existence of the CPL in the region has any effect on the quantity of raw cocoa beans produced by the farmers in the region.

STUDY AREA

The Cocoa Products (Ile-Oluji) Limited located in Ile-Oluji, Ile-Oluji/Oke-Igbo local government of Ondo state, Nigeria is the most prominent industrial outfit in the Local Government Area.

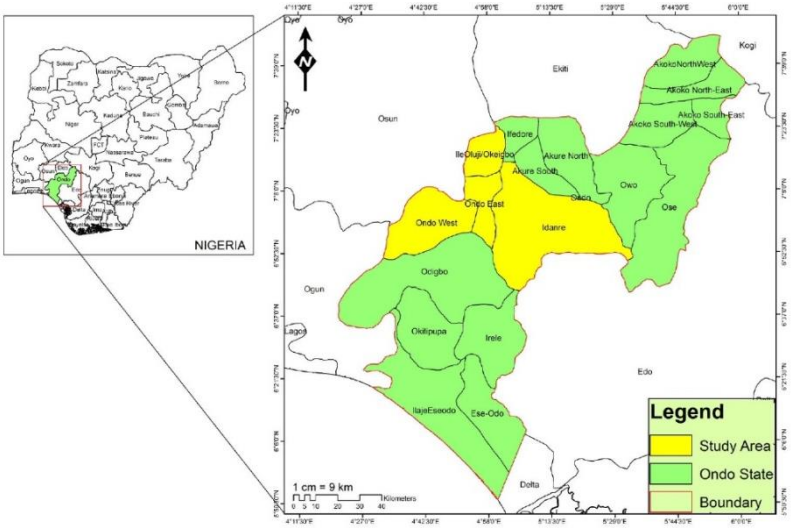


Fig. 1: Map of Nigeria showing Ondo State and Map of Ondo showing the region of study
Source: Akure south Local Government secretariat (Updated, 2009)

The CPL is one of the three first generation Cocoa Processing companies in the country established in Nigeria between 1964 and 1991; it was incorporated as Ile-Oluji Cocoa mills on 1st of April 1980 and was commissioned on May 31st, 1984. The company was designed to process raw cocoa beans into semi-finished edible products of cocoa butter, cocoa liquor, cocoa cake and cocoa powder with an initial installed capacity of 30,000 tonnes of raw beans per annum based on a projected 100 tonnes of cocoa beans per 24 hour day of 300 – day year to produce (a) 8,000 tonnes of cocoa butter (b) 7,000 tonnes of cocoa liquor (c) 7,200 tonnes cocoa powder (d) 2,000 tonnes of cocoa cake hence buys cocoa beans from across the cocoa producing areas within the state; largely from Ondo, Idanre and Ile-Oluji as shown in figure 1 above.

The influence of the CPL extends beyond Ile-Oluji its host community to farmlands in Idanre and Ondo town, the scope of this study is therefore limited to the CPL and the cocoa based firms who supply raw cocoa beans to the CPL within the three towns.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Literature Review

Regions are not arbitrarily defined or demarcated areas but are defined on the basis of some significant attribute(s). The Microsoft Encarta Dictionary (2009) defines it as a large area of land that has geographical, political or cultural characteristics which distinguishes it from other areas. According to Langdon in Basorun, 2008, regions are artificial constructs used by planners to divide the world into sections which can be compared with other units. Okafor (2004) opines that regions have common attributes and in the regional planning context, these attributes could be unemployment, agricultural output, industrial output, school enrolment, infant mortality and so on. Three types of region are recognised in literature, these are: homogeneous region, functional region and programming regions. The region of study in this research is a functional region and it is defined by interactions and flows between the CPL which is located in Ile-Oluji and the surrounding cocoa based firms (LBAs, SBAs and farmers) located in Ile-Oluji, Ondo and Idanre with which linkages exist. The common attribute that defines this region is the production of raw cocoa beans.

Adeoye, (2005) in a study on the industrial development and trade in Nigeria reports that theoretical and empirical studies on industrialisation and globalisation in Nigeria have focused mainly on sources of industrial growth and the linkage effects of different sectors of the economy. Among these studies include that of Ohiorhenuan (1978) who attempts at clarifying the concept of industrial linkages *vis-a-vis* the developing economies as against the developed economies; in line also with this is the study conducted by Olofin and Iyaniwura (1983) which was to attempt at ascertaining the degree and nature of the inter-sectoral relationship existing in the Nigerian economy before the emergence of the oil as a dominant sector using the measures of direct and indirect dependence. Falokun (1996) in a similar study discusses ten key sectors of the economy that the government can stimulate through its export diversification and expansion programme in order to bring about rapid industrial transformation of the economy were identified. The study findings however show that the economy is still largely dependent on the external sector for the supply of intermediate input.

For the case of South Korea, Park in Bing Zhang and Junhai (2003) argued that polarized regional economies with a diversity of industries, information, and technical workers generate innovative firms and spin-offs, which, in turn, encourage further growth. He further noted that vertical disintegration and the clustering of small plants increase the productivity of labour-intensive industries and that subcontracting is an important organizational strategy for lowering wages and deflecting industrial disputes. Similar arguments have been made for the case of Taiwan, where subcontracting networks and cluster-based manufacturing were found to be important strategies for increasing the competitiveness of firms, Bing Zhang and Junhai (2003).

In a study of the semiconductor industry in Southeast Asia, Scott, 1987 in Bing Zhang and Junhai (2003) showed that production units in Manila's semiconductor complex in the mid-1980s were clustered close to one another and were intricately linked to minimize transactions costs. Similarly, in 1994, he demonstrated as stated in Bing Zhang and Junhai (2003) that the gem and jewellery industry of Bangkok has been able to thrive on the basis of its vibrant transactional networks, its low wages, and the skilful political manoeuvring of its representatives.

Conceptual Framework

One of the basic concepts adopted for this study is the "agro-pole" which was developed to offer explanations for the significance of a centre in a region. The concept according to

Basorun (2010) is coined from the term "growth pole," and it implies that there is the presence of a center with some indicators of growth (Perroux 1950), a geographical agglomeration of activities according to Boudeville (1966) as well as a center of an activity whose output influences the performance of many other activities in a particular economy (Ivarah 2003).

"Regional agro-pole" in this study refers to a main agricultural core that reflects some features of a central place in a geographical context. In this case, the focus is on a particular activity which is dominant and growth-inducing in a place and the agro-pole is seen in terms of location and influence, which in turn has some spread effect on the whole of a regional economy.

Francois Perroux who propounded the growth pole theory in 1950 was concerned about the phenomenon of economic process of structural change that accompanied the rise and fall of industries on others within the economy. He was of the belief that spatial as well as industrial development which are indicators of growth do not appear everywhere and all at once but in points or development poles with variable intensities spreading along diverse channels and both with varying degree of terminal effects to the whole economy. These points are referred to as growth poles. Viewing the growth poles as centres of activity interrelationship within any region, Perroux was of the opinion that such focal points attract centripetal forces and emit centrifugal forces as development in terms of business or commercial ventures and sub-sectors of the economy appear functional.

According to Ugwu, 1992 in Basorun, 2003, of importance in the analysis of growth pole are two terms, these are: linkage and innovation. Perroux's concept of propulsive industry (as well as the related idea of a key industry) invokes inter industry linkages – when an industry defined as a propulsive industry expands its outputs, it induces major expansion in the outputs of other industries in the industrial system.

The Cocoa Products (Ile-Oluji) Limited is seen as the propulsive industry in the region which invokes inter industry linkages in the region, an increase in the output of the CPL will bring about an increase in the output of the firms that are linked to it and this is a tool for the development of the region.

RESEARCH METHODOLOGY

Three sets of questionnaires and one interview guide was used to obtain data from the population audiences of the research; at the CPL, two management staff were interviewed; one set of the questionnaires was administered to the six (6) Licensed Buying Agents (LBAs) across the three towns in the region of study; the remaining two sets of questionnaires were administered to the farmers and Sub-Buying Agents (SBAs) who sell raw cocoa beans to the LBAs respectively taking a sample of 10% out of the total number. Table 1 below shows the breakdown of the sample frame and size of the SBAs and farmers respectively.

Table 1: Table showing the breakdown of the sample size of sub-agents and Farmers

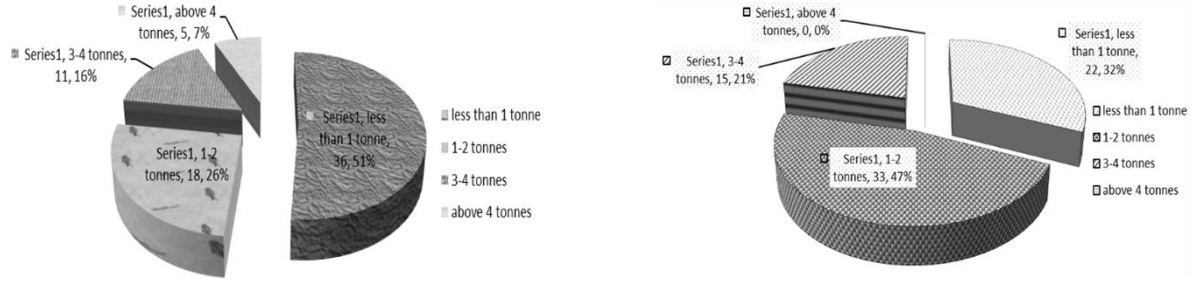
LOCATION OF LBA	LBAs SAMPLED	NO. OF AGENTS	10% OF AGENTS	NO. OF FARMERS	10% OF FARMERS
Ile-Oluji	LBA 1	200	20	100	10
Ile-Oluji	LBA 2	150	15	100	10
Ondo	LBA 3	20	2	200	20
Ondo	LBA 4	120	12	100	10
Ondo	LBA 5	60	6	100	10
Idanre	LBA 6	50	5	100	10
TOTAL		600	60	700	70

The sampling techniques used for the interview and administration of questionnaire is; purposive sampling at the CPL; total census for the LBAs and; the simple random sampling technique for the farmers and SBAs with the Tipett's table of random numbers as a guide for selecting the sample. Analysis and presentation of data was done using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel.

FINDINGS AND DICUSSION

Quantity of Raw Cocoa beans produced by the Farmers yearly

Analysis of the research revealed as shown in figure 2a below that 51% of the farmers produced less than 1 tonne before the existence of the CPL in Ile-Oluji, 26% produced between 1 and 2 tonnes, 16% produced between 3 and 4 tonnes while the remaining 7% produced above 4 tonnes.



a: Before the Existence of CPL b: After the Existence of CPL

Fig. 2: Quantity of raw cocoa beans produced by farmers yearly before and after the existence of the CPL in Ile-Oluji

Findings reveal as shown in figure 2b above that 47% of the farmers sampled produce 1-2 tonnes of raw cocoa beans yearly, 32% produce less than 1 tonne and 21% produce 3-4 tonnes. It may be seen from the analysis when comparing figure 2a and b that the farmers produced more raw cocoa beans after the establishment of the Cocoa Products Limited in Ile-Oluji than before it was established, It may therefore be inferred that the existence of the CPL in the region has a positive effect on the quantity of cocoa produced by the farmers.

The set of people that the farmers sell their raw Cocoa beans to

It was discovered during the course of the research that before the existence of the CPL, farmers sold their cocoa through the cocoa board which was in operation at the time as the cocoa board served as the sole buyer and exporter of all cocoa beans and products. This posed as a major problem to the cocoa farmers because the prices of beans and products were fixed at the beginning of a trading season and farmers only received small fractions of the terminal market price and in most cases they were delayed but shortly after the existence of the CPL, the cocoa board was dissolved and transaction of cocoa beans and products became easier and this enabled LBAs to be able to function better and also brought about the introduction of SBAs.

The farmers sampled sell the cocoa they produce either to SBAs or LBAs and few of them sell to other farmers. It was discovered that 54.3% of the farmers sell to SBAs, 34.3% of them to LBAs while the remaining 11.4% sell to other farmers who may need more to meet up with the requirement from the agents that buy from them. It can be seen from the analysis above that the existence of the CPL in Ile-Oluji makes cocoa trade easier and more profitable for the farmers.

Quantity of raw cocoa beans supplied by the SBAs to the LBAs

Before the existence of the CPL in Ile-Oluji, the SBAs were not in operation, the LBAs at this time buy cocoa directly from the cocoa board but when CPL was established and the

board was dissolved, there was a need for an intermediary between the LBAs and the farmers who would be able to gather raw cocoa beans for the LBAs in order for them to be able to meet up with the requirements of the CPL. Figure 3 below shows that 33% of the Sub agents supply above 100 tonnes of raw cocoa beans to LBAs yearly, another 33% supply 26-50 tonnes, 17% supply76-100 tonnes and the remaining 17% supply less than 26 tonnes. It may be inferred from this that there is a viable trade link of cocoa from the farm gate to the CPL through various intermediaries such as SBAs and LBAs.

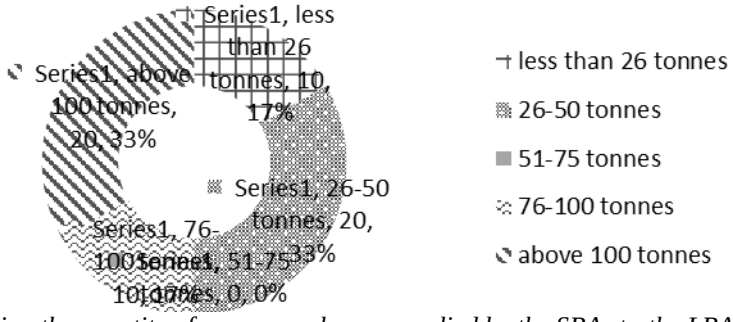


Fig. 3: Chart showing the quantity of raw cocoa beans supplied by the SBAs to the LBAs yearly

Total quantity of raw cocoa beans that the LBAs supply to the open market yearly

It was discovered during the course of the research that all the LBAs that supply raw cocoa beans to the CPL entered into the business after the existence of the CPL in the region, none of them was involved in cocoa business before the existence of CPL. Analysis of findings on the total quantity of raw cocoa beans that the LBAs supply to the open market on a yearly basis and revealed that 33.3% of the LBAs supply between 1000 and 1999 tonnes of raw cocoa beans to the open market yearly, another 33.3% supply between 2000 and 2999 tonnes, 16.7% supply between 3000 to 3999 tonnes and the remaining 16.7% of the LBA's supply 4000 tonnes and above.

Percentage supplied by the LBAs to the CPL out of the total quantity supplied to the open market yearly

Figure 4 below shows the percentage of the raw cocoa beans that the LBAs supply to the CPL out of their yearly supply to the open market and it reveals that 33.3% of the LBAs supply between 21 and 40% of the total quantity of cocoa they supply yearly to the CPL while 16.7% supply each between 1-20%, 41-60%, 61-80% and 81-100% respectively. It may be inferred from this analysis that the CPL takes most of the cocoa beans that the LBAs supply and this means that they supply more to the CPL than other cocoa firms.

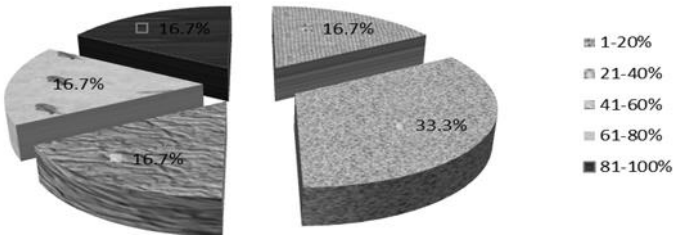


Fig. 4: Chart showing the percentage of raw cocoa beans supplied by the LBAs to the CPL out of the total quantity they supply yearly

Quantity of raw cocoa beans required by the CPL monthly

From the interview that the researcher conducted with the management staff of the CPL, it was discovered that the Cocoa Products (Ile-Oluji) Limited requires a lot of raw cocoa beans for their production and sometimes buy as much as 80 tonnes of raw cocoa beans at once, on a monthly basis the company purchases about 800 to 1000 tonnes of raw cocoa beans, this

translate to about 9600 to 12000 tonnes of raw cocoa beans yearly. The result of the findings however reveals that the quantity of raw cocoa beans supplied by each of the LBAs yearly is not sufficient for the CPL

SUMMARY OF FINDINGS

i. None of the LBAs can singly handle supply the CPL with the cocoa they require yearly so the CPL has to buy from as many of them as possible, it may be inferred from this therefore that the rate at which the CPL patronizes the LBAs is high and can lead to other LBAs joining the business in order to meet the required quantity of cocoa need by the CPL which will make job opportunities available for people in the region.
ii. The quantity of raw cocoa beans supplied by each SBA to the LBAs is also not sufficient to meet the requirement of each of the LBAs which is as a result of the need of the CPL.
iii. The raw cocoa beans produced by individual farmer is not sufficient enough to meet the needs of the CPL, this may be the reason why the sub agents have to buy from a lot of farmers in order to be able to gather a considerable amount of raw cocoa beans. This may serve as a form of encouragement to the farmers to produce more raw cocoa beans. It may therefore be said that the existence of the CPL in Ile-Oluji has an effect on the quantity of raw cocoa beans produced by the farmers in the region.

CONCLUSION AND RECOMMENDATION

The purpose of industrial development of any region is to provide opportunities of better living and employment to the people. The agglomeration of various firms within a region is bound to affect the economy of the region positively. The study revealed that there is a positive difference between production of raw cocoa beans before the inception of the CPL and after its inception and that the existence of the CPL in the region also led to the establishment of various cocoa firms which are linked to each other thereby making job opportunities available to individuals; (LBAs and those working in their firms as well as SBAs and farmers), the following recommendations are therefore made:

i. Government should provide incentives such as timely procurement of adequate supply of necessary cocoa production inputs and introduction of improved mechanized farming systems to attract youths into cocoa farming and provide subsidies such as access to loans, chemicals and fertilizers to farmers.
ii. Stakeholders such as the CPL to develop initiative programs to assist the farmers so that they can increase productivity. This may be done by encouraging the farmers to produce more with the assurance that they would buy all the cocoa, there should be a form of interaction with farmers, provision of things like fertilizers, store houses among other initiative programs.
iii. The CPL should also seek to employ more LBAs to supply them with raw cocoa beans, as this will give the CPL better opportunity to have access to raw cocoa beans for processing and also increase competition amongst LBAs thereby making them strive for excellence and better quality of cocoa.
iv. In furtherance to the problem of insufficient supply of cocoa beans as discovered in the research, this study is recommending that the CPL embark on extensive plantation agriculture solely funded or in public-private partnership schemes.

There is therefore a need to see the CPL as a tool for regional development and government as well as other stakeholders should invest in the CPL to give it a face lift and also bring it up

to begin to produce at its initially installed capacity of 30,000 tonnes of raw cocoa beans yearly as against its present production capacity of 12,000 tonnes of raw cocoa beans yearly

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Challenges of Inadequate Infrastructural Facilities on City's Vista in Developing Countries: The Case of Akure, Nigeria

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ABSTRACT

Infrastructure facilities refer to those basic services without which primary, secondary and tertiary productive activities cannot function. Infrastructure plays an important role in effective service delivery and enhances quality of life. Most developing countries are faced with the challenge of inadequate infrastructure. The aim of this study is to investigate the challenges posed by inadequate infrastructure facilities in Akure with a view to recommending sustainable solutions. The scope of this study is limited to road network, street fabrics and street trading, it also accesses how they affect the city vista. Qualitative and quantitative research methods is adopted for the study, data were collected through 160 questionnaire interviews, facilities survey as well as physical observation were carried out for the study. Challenges of Inadequate infrastructure, such as lack of streetlights on major roads, feeder roads and congestion of vehicular movement especially at peak periods of the day were noticed in the study area. This has resulted into inconveniences for the inhabitant. This paper gives an overview of the status of infrastructure in Akure and its effect on city vistas and recommends the provision of adequate infrastructure and improvement of the existing ones.

Keywords: challenges, city vista, infrastructure, services, service delivery

INTRODUCTION

The escalating rate of population growth with inadequate infrastructure poses great challenges on the city outlook. Cities all over the world attract large number of people primarily for economic growth. The desire to work and live in the cities is enormous while the needed infrastructure for a healthy and satisfying which are not usually met, or inadequate. Sanni and Hashim (2014) conclude that adequate infrastructure enhances social and economic development of any nation.

Most cities in developing worlds are faced with inadequate infrastructure facilities as a result of population increase, which posed a lot of challenges on the inhabitants of such cities. Olotuah, (2005) observed that the rate of urbanization bringing about massive movement of people from rural to urban area in Nigeria has led to environmental problems characterized by inadequate supply of water, lack of drainage facilities, problems of refuse disposal, poor road conditions, erratic power supply and unbalanced economy .

Infrastructures facilities such as road networks are constructed in the city centre but in most cases they are inadequate to meet the volume of traffic, they are not well constructed and they lack regular maintenance Alabi and Ocholi (2009), noted that in Nigeria there are inadequate infrastructural facilities in terms of quality and quantity as compared to other developed countries. Also collaborating this assertion, United Nations (2012) said that cities continue to be challenged by shortages of affordable housing and basic services, traffic congestion, and declining infrastructure.

Infrastructures are the physical facilities that enhance society functionality, they are facilities put in place by the Governments and managed by them. Nubi (2003) opined that the three tiers of government federal, state and local are to make provision of these services in the urban centres and constitutionally, local government councils are responsible for the

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construction and maintenance of some categories of roads, street drains, installation of street lighting and waste disposal.

Fawehnimi (2003) describes infrastructure as a social services derived from public works and for public use. Osaisoje and Aidelunuoghene (2012) in Mabogunje (1976) refers to infrastructure as basic services without which primary, secondary and tertiary productive activities cannot function. Infrastructures include all public services from law and order through education and public health to transportation, communications and water supply.

Infrastructure is said to enhance not only decent living in cities centre of developing countries but also for city beautification and economic gains Arun and Owolabi (2014) opined infrastructure as facilities needed for economic activity these include power, water supply, roads network and sewage. Ojiefo and Urhoghide (2011) highlight the key role play by infrastructure in economic development and growth. The challenges posed by inadequate infrastructure has affected how the city vista is been view. Ibrahim and Bello (2015) observed how inadequate infrastructure has rendered the city unattractive. Gbadegesin, Oladokun and Ayorinde (2011) noted that expansion of cities has resulted in traffic congestion, where resident use lengthy time to travel to work, and time wasted and this have made urban centres to be unsafe for people and less attractive.

Infrastructure have shifted from physical facilities such as roads, water supply, power, sewage system which are called public utilities but now includes infrastructure such as telecommunication and information.. Infrastructure is broadly refer to all basic inputs and requirement needed for functioning of the economy and can be categorised into social and economic infrastructure. United Nation (2011). Economic infrastructure include utilities (power, gas, water, sewage and sanitation), public work (road and drainage) and transport (railways, waterways, airports and urban transport system) while social infrastructure include services such as education, health and recreation.

The study is investigating three variables as it affect city vista

i. Road network
ii. Street lighting and
iii. Street trading

City can be characterised into demographic or functional definition Massey, Allen and Pile (1999) said the city constitute the physical features, human experience and urban image. City life is distinct as a result of its luxury, poverty, amenity and pollution, tradition and innovation, drudgery and novelty, order and disorder, thrill and spills. City features are the physical features such as house, housing estate, streets, shops, hotels, hospital, museums, traffic, libraries, cathedral, restaurants and so on. City experience differ from person to person, it varies depending on the part of that city in which the person or group is located. City life is distinctive because it is bigger and with more activities. City could be for pleasure, for home, for work, for administration and government. The vista of the city are very different as seen by a holiday makers, city dwellers all have different view of how the city looks like.

The rapid growth of urban centres has been attributed to traffic congestion within the city cities experience traffic congestion at peak periods constantly with long queues of vehicles. Most road network in cities can no longer cope with the volume of traffic plying the road daily Ogunsanya (2002). Population increase and inadequate infrastructures in cities leads to traffic congestion Varaiya (2005) noted that traffic congestion in most urban centres is as a result of limited infrastructure. Osaba (2012) revealed that the traffic congestion leads to time delay as a result of inadequate parking space, traffic signs/signals and indiscipline.

Congestion on roads can be caused by non adherence to road traffic regulation by motorist, Asiyanbola, Osaba and Adewale (2012) attribute lack of discipline and recklessness among motorist as a factor responsible for traffic congestion on roads. Osaba (2012) revealed that the traffic congestion leads to time delay as a result of inadequate parking space, traffic signs/signals and indiscipline.

The rate of high number of motorist plying the roads and has subsequently increase the volume of traffic in urban/cities is cause by increase in urban population, a lot of problem are associated with traffic congestion as asserted by UNCHS (1993) that travel speeds in cities are decreasing and the travel environment for pedestrians and people-powered vehicles are deteriorating in developing countries, due to the inefficiency of the entire road transport system, also Ibrahim et 2015 noted that traffic congestion are as a result of on-street parking, street hawking and narrowness of the road. .Fadairo 2013 also noted that poor driving habits, weather condition, absence of traffic light and/ warden, work zones, road side parking, are some of the causes of traffic congestion.

Street defines the circulation pattern within the city, trading is the activity of buying and selling, Adepeju and Oluwole (2012) described street as an element of the built environment. Omosegun (2015) described street as any commercial activity undertaken beyond confined premises or secluded working environment such as sidewalks, street pavement, major transport hubs and other public area.

Street trading is an informal employment basically for economic gains, people desire to make a living engages in street trading, street trading are common at road intersections, traffic light points and traffic holdup. Street trading or hawking constitutes a nuisance to the city vista and it leads to traffic congestion on our road, road accident, and waste travelling time.

The aim of this study is to investigate the challenges posed by inadequate infrastructure facilities on city vistas in Akure with a view to recommend a sustainable solution. The objectives are to access the existing condition of infrastructure in the study area and access the impact infrastructure plays on city vista.

RESEARCH LOCATION

The study is located in Akure. Akure is a city in the South Western region of Nigeria; it is the capital of Ondo State located on the intersections of Latitude 7^{o} 17^{1} North of the equator and Longitude 5^{o} 14^{1} East. Akure is a medium-sized urban centre and became provincial headquarter of Ondo province in 1939. Akure being the state capital with its inhabitants engages in different activities. Akure is located within the tropical rain forest vegetation where rainfall is common for 8 months of the year. Akure is an agricultural trade centre popular for yam, cassava, corn and palm oil. The study is limited to road network at Oda junction along Igbatoro road, street lights along Ilesa road and street trading at North gate of Federal University of Technology, Akure all in Akure, Ondo State, Nigeria.

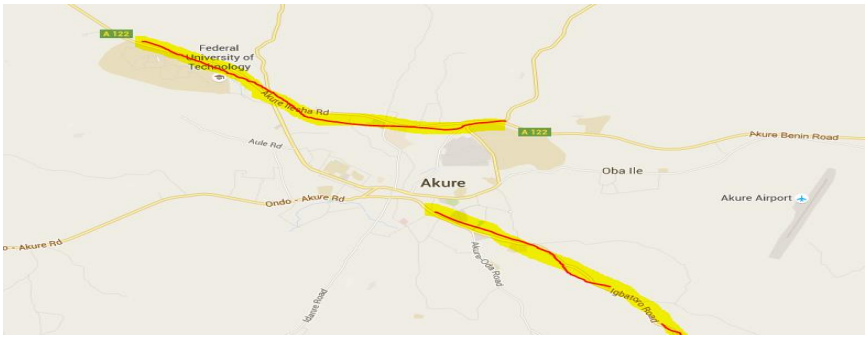

Figure 1: Map of Akure showing the study area
Source: *www.googleearth.com*

METHOD OF STUDY

The research method employs descriptive findings obtained from questionnaires which were administered to residents of Oda and Igbatoro road, Oyemekun and Ilesa Garage road and federal University of Technology, Akure all within Akure. The sample population were selected by simple random sampling in such a way that every individual in the study has an equal chance of being included in the survey. Questionnaires for this study were designed to obtain data on the state of physical infrastructural facilities; while a reconnaissance survey purposely meant to familiarize the researcher with the study area and their physical environment.

The sample populations were professionals in built environment, residents, road users and traders in the study area. The questionnaire probed into the availability of infrastructural facilities, condition of the infrastructure, and their management. The general variables associated with this study are: Electricity, Drainage System, Roads Network, travel hour and commercial or shopping complex

In each of the three area visited, about 55 questionnaires were distributed to randomly selected residents and average of 45 were retrieved in each of the area and a total of 135 questionnaires were validly completed and returned and were used for the analysis. Site visits were also undertaken in order to assess availability and quality of infrastructural amenities within the study areas. For the purpose of this study, the infrastructures such as Road, Drainage, shopping centre and road width were classified into good, fair and bad based on the users' perception of their functionality.

The research design objectives are to:

i. identify the condition of physical infrastructure,
ii. investigate how infrastructure affect the city vista,
iii. the present state of the city

The data sources that was used for this study was derived from both primary and secondary sources. The primary data was collected from direct interviews, personal observations and responses to structured questionnaires administered to the residents. The secondary data was collated from previous work done on the subject matter, including books, journals and visits to libraries and the internet. The empirical research in this paper focuses on existing situation in the study area, the road network at Oda junction along Igbatoro road, the street lights along Ilesa road and street trading at North gate of Federal University of Technology.

RESULTS, FINDINGS AND DISCUSSIONS

The socio- economic characteristic of the respondents in Table 1 revealed that 61% were males while 39% were females. in terms of age distribution about 7.4% of respondents were aged 25 and above, while those who were aged 26 to 50, and those who were 50 years and above were more of adult dependent respondents. The marital status revealed that about 68.8% of the respondents were married, 8.9% were single and about 8.9% were divorced/ separated and widowed. The result shows that more than half of the respondents are male, adult and married.

Occupation analysis in Table 2 shows that 45.1% of the respondents were Civil servants, 46.67% are businessmen and business women, while about 8.89% are in other Jobs. Most of the respondents are both civil servants and business men and women and are on the road daily for work and to improve their economic activities.

Table 1: Socio-economic Analysis of respondents'

Socio-economic characteristics		Frequency	Percentage
	Male	82	60.74
Sex	Female	53	39.25
	Total	**135**	**100.00**
Age	Under 25yrs	10	7.41
	25yrs-35yrs	37	27.4
	36yrs-45yrs	56	42.0
	46yrs-50yrs	22	16.29
	50yr+	10	7.40
	Total	**135**	**100**
Marital status	Single	12	8.9
	Married	93	68.8
	Divorced/separated	12	8.9
	Widowed	18	13,3
	Total	**135**	**100**

Table 2: Distribution of Respondents by Occupation

Occupation	Respondent	Percentage
Civil servant	61	45.1
Businessmen/women	63	46.67
Others	12	8.89
Total	135	100

Analysis of Monthly Income

table 3 shows the level of monthly income of respondents, 11.85% of the respondents earns N10,000 or below, 40% of the respondents earns N10, 001-N50,000.39.25% earns N50,001-N100,000 and 8.89% earns N100,000 and above. The result shows that majority of the respondents earns between N50,001-N100,000 which mean they are middle income earners.

Table 3: Level of monthly income

Rate	Respondent	Percentage
N10,000 or below	16	11.85
N10,001-N50,000	54	40.0
N50,001-N100,000	53	39.25
N100,001 & Above	12	8.89
Total	135	100

Analysis of Means of Transportation

Table 4 revealed that 9.52% use private vehicle, 19.04% of the respondents disposes uses public means of transportation, while 14.07% uses motorcycle popularly call Okada and 2.2% use other means of transportation. The result therefore shows that many of the respondents have private vehicle and this will subsequently increase the number of vehicles plying the road daily especially at peak period of time.

Table 4: Means of transportation

Types	Respondent	Percentage
Private vehicle	76	56.2
Public transport	37	27.4
Motorcycle(Okada)	19	14.07
Others	3	22
Total	135	100

Analysis of Travel Time

Table 5 shows 41 respondents that is 30.37% use between 5minutes and 3omintyes to travel or get to their destination, 54.07% travels for between 31minutes and 1 hour and 11,11% and 4.4% travel between 1 hour and 2hrs and 2hours and above respectively as travel time. The

result shows that many of the respondents spend between 30mins-1 hour to get to their destination as a result of the traffic congestion they experience daily.

Table 5: travel time/ hour(s) to work place

Time(Mins/ hour)	Respondent	Percentage
5mins-30mins	41	30.37
31mins-1hour	73	54.07
1hr-2hrs	15	11.11
Above 2hrs	6	4.4
Total	135	100

Analysis of Business Venue

Table 6 shows categories of business venue of the respondents. 11.11% that represent 15 respondents have their business located in s shopping complex, another 11.11% respondents engages in an in-house business, about 24.44% have their business location inside the container/ on street Kiosk. 18.5% of the respondents engage in street hawking and selling in traffic and 17.17% has no business. the result revealed that many of the respondents sells on street, in traffic or hawking and they constitutes to the poor view of the environment by taken advantage of the traffic for their trading activities.

Table 6: Business venue

Categories	**Respondent**	**Percentage**
In shopping complex	15	11.11
In house	15	11.11
On-Street Kiosk/Container	33	24.44
Mobile trading	8	5.92
Street hawking/selling in-traffic	25	18.5
No business activities	34	17.17
Others	5	3.70
Total	**135**	**100**

Analysis of Road Condition

Table 7 analysed the condition on the road into categories to find out from the respondents if there are drainage on the roads, if the width (wideness) of the road is adequate and if there is pedestrian walkway by the road. 46% said the drainage is bad, 40%aid fair and14.07% said good, 60.74% said the width of the road is inadequate, 30.37% said it is fair and 8.88% said good and lastly 46% said the road has no pedestrian walkway, 41.48% said fair and 13% said good. the result therefore shows that major roads lack proper drainage, they are not wide enough, and as a result of this both pedestrians and vehicular movements are in a chaotic state most especially at peak period of time.

Table 7: Condition of road Infrastructures

Categories	**Good**		**Fair**		**Bad**	
	No	%	No	%	No	%
Drainage on roads	19	14.07	54	40.0	62	46.0
Road width	12	8.88	41	30.37	82	60.74
Pedestrian walkway	17	13.0	56	41.48	62	46.0

Analysis of Street Light Condition

Table 8 revealed the analysis of street light in the study area, 15.55% of the respondents affirms that the street light are working, about 43.70 said they are available but are not working and 40.74 said there are no street light in their area. Many of the respondents pointed out the availability of street light but they are not functioning.

Table 8: Condition of street light

Categories	Respondent	Percentage
Available and working	21	15.55
Available but not working	59	43.70
Not available	55	40.74
Total	**135**	**100**

Assessment of City and Infrastructure

Table 9 shows the analysis assessing the city vistas of the surrounding visa vice infrastructure, 26.66% of the respondents affirms that the view of the city is very poor, 37.77% and 26.66% said the city vistas is poor and fair respectively, while only 7.40% said good and only 1.48% said very good. The analysis revealed the condition of the environment and how the city is been view by the respondents, where many of them affirm that the city vista is poor.

Table 9: city vistas / infrastructure

Categories	Respondent	Percentage
Very poor	36	26.66
Poor	51	37.77
Fair	36	26.66
good	10	7.40
very good	2	1.48
Total	**135**	**100**

Plate 1: shows hawking on major road, a constant view at FUTA North gate, depicting a ugly environment at the entrance of the University

Plate 2: Shows Street trading

Plate 3: shows road side trading

Plate 4: shows trading in traffic

CONCLUSION

The city vista has changed as a result of inadequate infrastructure leading to traffic congestion as shown in the study. Economic activities on major roads in form of hawking and street trading in traffic have affected the view of the city and its aesthetic value. Street trading activities also contribute to the litter of the surroundings and can also result into accident. Lack of street light on major roads was It is important that the three tiers of Government implement the recommendations in this paper for a sustainable and attractive city.

RECOMMENDATIONS

The paper investigates the challenges posed by inadequate infrastructure and how it affects City vistas. The paper recommends the followings, expansion of road network into more than 2 or 3 lanes to accommodate the population increase so as to reduce traffic congestion, the construction of an alternative road to reduce the pressure on Oda-Igbatoro road junction. The use of traffic control devices and road signs to provide necessary information to warn road users and regular maintenance of street light along Oyemekun-Ilesa Garage road.

Lastly, the paper recommends the deployment of law enforcement agencies on major roads to curb motorist excesses and adequate provision of pedestrian walkway where necessary to deal with these challenges.

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Residents' Participation in Infrastructure Provision and Maintenance in Residential Neighbourhoods in Akure, Nigeria

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ABSTRACT

Residents' participation has become a topical issue in housing development research. Thus, residents' willingness to participate in the provision and maintenance of infrastructure in their neighbourhoods especially in developing countries like Nigeria is essential because it creates an avenue for accountability and also enables them to develop a strong sense of attachment of community with their neighbourhood. This study examines the level of residents' participation in the provision and maintenance of infrastructure in two selected estates; Alagbaka and Ijapo housing estates in Akure, Nigeria. Primary data were collected through the use of structured questionnaires and direct observations of infrastructure within the residential neighbourhoods. The data were analysed using descriptive statistical tools and categorical regression was used to predict participation in the study area. The paper identifies education, income, tenure status, length of residence and household size as predictors of participation in infrastructure in the study area. The paper concludes by providing implications to improving neighbourhood revitalization through residents' participation in infrastructure provision and maintenance.

Keywords: Infrastructure maintenance, Infrastructure provision, Residential neighbourhoods, Residents' participation

INTRODUCTION

The existence of infrastructural facilities in a residential neighbourhood is essential because in conjunction with the house itself, they make living in housing environments possible for residents. It would be absurd if a house is designed and constructed without its concomitant infrastructure and services such as roads, water supply, electricity supply, drainage, etc. Housing, as defined by Federal Ministry of Works and Housing (2002) refers to the process of providing a large number of residential buildings on a permanent basis, with adequate physical infrastructure and social amenities, in planned, descent, safe and sanitary neighborhoods to meet the basic and special needs of the population. Housing is a residential environment which man uses for shelter and the environs of the structure required or designed for his physical and mental health as well as his social wellbeing (Omole, 2001). As averred by Adegun (2011) housing embraces all infrastructure, services and utilities that go to make a neighbourhood environment to become livable. From the above definitions, it is palpable that housing comprises of the house and its concomitant infrastructure. Housing infrastructure is an important aspect of housing development due to the fact that the house cannot stand alone; it requires basic services and infrastructure to be able to perform its functions.

Mallo and Anigbogu (2009) defined neighbourhood as residential area in a particular location of a city. Thus it is an area in a city where people live and a community can be formed amongst themselves. According to Local Government Commission (2015) community change processes affect residents, first and foremost; therefore they should be allowed to help shape such changes. This is one of the main reasons behind the notion of resident participation in housing development. Therefore, it is necessary that residents of housing

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neighbourhoods participate in the planning, provision and maintenance of such infrastructure. Resident participation as claimed by Leung (2005) is an aspect of community development intended at increasing involvement of residents in housing development, management and community building. Janine (2006) stated that the lack of appropriate residents' participation in housing infrastructure development will result in failure to establish an authentic and empowering people centred development. This is predicated on the fact that people should be at the centre of developments in order to ensure that such development meet their identified needs. Thus, such identification of needs should not be done through abstraction because only the people that have such needs and who the developments are meant for can state them actually.

Okoye (2014) observed that despite the fact that public housing estates in Nigeria which are government initiated and managed should be a model of housing provision especially in basic infrastructure facilities, this is not so due mainly to problems of low quality facilities and lack of maintenance culture. This according to the study results in high level of dissatisfaction by the public housing residents. The strategies implemented to produce what can be considered a successful resident's participation is an aspect not thoroughly considered in the development process (Janine, 2006). This is evident in situation where development authorities attempt to provide and maintain infrastructure in neighbourhoods without trying to identify from the resident what actually are their needs. In such cases, what will be provided is assumed and might not necessarily meet the needs of the resident users in such neighbourhoods.

Thus, this study therefore focuses on discovering the sources of provision and maintenance of neighbourhood infrastructure in Alagbaka and Oba-Ile housing estates in Akure, Nigeria. Both of these estates are government owned public housing estates located in the city and it is necessary to discover whether the government authorities involve the residents of these estates in infrastructure planning, provision and maintenance. The aim of this study is to therefore highlight the significance of the participation of residents in these residential neighbourhoods in Akure, Nigeria. The main objectives of this study include: assessment of the residents' willingness to participate in infrastructure provision and maintenance; appraisal of the existing levels and modes of participation; evaluation of outcomes of existing participation and identify if the socioeconomic characteristics of the respondents influences their participation.

LITERATURE REVIEW

Nature of Resident Participation in Infrastructure Provision and Maintenance

Who decides what, for whom, is a central issue in housing and human settlement (Sanoff, 2000). Bovaird (2007) asserted that traditional conceptions of service planning and management are outdated and require revision to account for coproduction (resident participation) as an integrating mechanism and an incentive for resource mobilization; a potential that has been greatly underestimated. Olotuah and Aiyetan (2006) believed that, for housing provision to be sustainable in Nigeria, cognizance must be taken of the bottom-up participatory approach involving genuine local participation by people at the grass root level. Resident participation in housing infrastructure requires that the development authorities carry the local residents along from the planning stage through to the implementation stage. It takes the notion that one size does not fit all and therefore that every neighbourhood have their unique requirements that can be different from others.

Housing should be a planned environment with the provision for critical condition for the physical, psychological, social and economic well-being of human beings (Taiwo and Arayela, 2010). Participation in infrastructure management is a process whereby people – as

consumers and producers of infrastructure services, and as citizens influence the flow and quality of infrastructure services available to them (Schubeler, 1996). As such Arnstein (1969) ladder of citizen participation helps to explain the levels of participation of residents in housing development. Thus, on the ladder, the degree of participation of residents should be based on the peculiar situation of the particular project. However, there is need for transparency and trust in the whole process if success is to be expected of the project. According to Harris (2000), a socially sustainable system must achieve distributional equity, adequate provision of social services including health and education, gender equity, and political accountability and participation. Therefore if resident participation in infrastructure is properly carried out, it should lead to certain benefits that can be derived from the process.

Benefits of Resident Participation in Infrastructure Provision and Maintenance

One of the most important objectives of economic development is the improvement of production capacity and welfare through the availability of sustainable and reliable infrastructural facilities (Obiegbu, 2008). In other words, the benefits of having adequate and satisfactory neighbourhood infrastructure cannot be overemphasized. Therefore, resident participation due to its potential to improve this should be integrated into housing policy and monitored during execution of housing projects. Several researchers have highlighted the benefits of resident participation in housing development.

LGC (2015b) stated the benefits of public participation in community planning to include: enhancement of the quality of planning; avoidance of contentions between interested parties; ensuring swift and efficient project implementation; ensuring that good plans remain intact over time; foster a sense of community and trust in the government. Social equity, the fulfillment of basic health and educational needs, and participatory democracy are crucial elements of development, and are interrelated with environmental sustainability (Harris, 2000). LGC (2015b) affirmed that in the long run, programs and projects that develop from an informed public, guided by professionals, are likely to be more creative and locally appropriate than those where the public is excluded from the planning process. Therefore, public participation is vital to the processes of community design, planning, and development (LGC, 2015a). This collective approach to development will also create a sense of belonging among the residents and this is beneficial to the government due to the trust they have from the residents.

Therefore, to ensure that both government and resident communities grow closer to each other, the aspect of decentralization of power must be considered especially for infrastructural service provision (Nhlakanipho, 2010). This aspect is very vital because such approach empowers the residents and ensures that the government schemes are successful in achieving their set goal. Hence, it is expedient that residents be involved in the planning, provision and maintenance of neighbourhood infrastructure. Also, if the people are allowed to participate, it can help strengthen the community and ensure such infrastructures are protected; thus enhancing its durability.

As asserted by LGC (2015a) Community involvement and resident participation in infrastructure planning may be more time- and resource-intensive than entirely “top-down” planning, but they present the following important benefits:

a. Ensuring the retention of good plans and policies over time, through the development of a long-lasting and stable constituency.
b. Reducing the likelihood of contentious battles over density and land use, which have eclipsed the equally important considerations of context and fit. Proactive planning that incorporates meaningful public involvement increases the likelihood of a project’s success.

c. Speeding the development process and helping prevent costs associated with public opposition.
d. Increasing the quality of planning, by combining the insights of an informed citizenry with the guidance of professionals.
e. Enhancing the relationship between citizens and government. Local and regional governments become more open, responsive and effective, eliciting increased trust and sense of ownership on the part of citizens.

Improvements in infrastructural services can have the positive effect of increasing household's real income and quality of life (Okoye, 2014). Similarly, Omole & Rotowa (2010) averred that human health, security, educational and employment opportunities coupled with quality and efficient housing system are essential for economic growth and prosperity. Hence, the proposed projects have the potential to employ some of the residents of the neighbourhood; and this creates a win-win situation for both the residents and the development authority. Thus, there are several benefits to resident participation in infrastructure development, and especially in developing countries like Nigeria, this approach needs to be widely practiced.

METHODOLOGY

The study employed the survey method. A structured questionnaire was designed to elicit information on the level of participation of residents of two public estate, Ijapo and Alagbaka housing estates in Akure, Ondo State. The questionnaire consists of two parts. Part A deals with the socio-economic characteristics of the respondents while Part B deals with the residents' perception of participation in infrastructure provision and maintenance. In administering the questionnaire in each estate, the systematic sampling technique was used. On the main street in each estate, the first house was randomly chosen, with subsequent units at an interval of every third building. Due to the nature of the research one adult household head was administered questionnaire in each household visited. A total number of five hundred and forty-five (545) household head collected the questionnaire. Four hundred and fifty five (455) questionnaires were returned and analysed with descriptive analysis and categorical regression analysis.

RESULT AND DISCUSSIONS

Residents' perception of importance of participation

The study investigated the importance respondents attached to participation in the provision and maintenance of infrastructure within their estate. The result of findings (Table 1) shows that the highest percentage (69.9%) of the respondents ranked participation important, (9.5%) also ranked participation as fairly important. A few of the respondents (20.7%) rated participation to be of no importance. The result indicates that citizens are aware of the importance of participation in neighbourhood development.

Table 1: Level of importance of participation

Importance of participation	Frequency	Percent
Very Unimportant	49	10.8
Not Important	45	9.9
Fairly Important	43	9.5
Important	105	23.1
Very Important	213	46.8
Total	455	100.0

Willingness to participate

Willingness to participate is an essential tool in measuring how well citizens want to be part of what goes on within their neighbourhood. Resident's willingness to participate (Table 2)

shows that the majority (77.1%) of the respondents are willing to participate in the provision and maintenance of estate infrastructure while a few of the respondents (9%) are not willing to participate. The remaining (13.8%) of the respondents are fairly willing to participate. The result indicates that not only do the residents consider participation important; they are also willing to participate in the physical development of their estate.

Table 2: Willingness to participate

Willingness to participate	Frequency	Percent
Very unwilling	12	2.6
Not willing	29	6.4
Fairly Willing	63	13.8
Willing	230	50.5
Very willing	121	26.6
Total	455	100.0

Willingness to pay for infrastructure

Peoples' willingness to pay can be used to measure how valuable a commodity is to them. The result of finding (Table 3) shows that an over whelming majority (80%) of the respondents are willing to pay for infrastructure while (9.4%) are not willing to pay for infrastructure development in their estate. The result indicates that estate infrastructure provision and maintenance is indeed important to the residents. This result further confirms Whittington, Lauria and Mu (1988) opinion that if people are willing to pay a certain cost of a particular service, then it is a clear indication that the service is valued and therefore will most likely be used and maintained.

Table 3: Willingness to pay

	Willingness to pay	Frequency	Percent
Valid	Very unwilling	12	2.6
	Not willing	31	6.8
	Fairly Willing	48	10.5
	Willing	242	53.2
	Very willing	122	26.8
	Total	455	100.0

Evaluation of residents' participation in the provision of infrastructure and maintenance

The result of findings (Table 4) to investigate how well residents have participated in the provision of infrastructure in their estate shows that only a few of the respondents (23.1%) ranked participation high in their estate while (39.8%) rated participation to be low or no residents participation in the provision of neighbourhood infrastructure. However a sizeable percentage of the respondents (37.1%) rated participation to be moderate in the estate. The result shows that there is a reasonable level of residents' participation though not strong in the provision and maintenance of the existing infrastructure in the estates.

Table 4: Participation in infrastructure

	Participation	Frequency	Percent
Valid	No participation	104	22.9
	Low participation	77	16.9
	Moderate participation	169	37.1
	High participation	105	23.1
	Total	455	100.0

Residents' participation in neighbourhood infrastructure

The respondents were asked which of the neighbourhood infrastructure they have participated in. The result of findings (Table 5) shows that residents participated more on neighbourhood

security (54.7%) and power supply (33.1%) within their estate. There is however a very low level of participation in the provision and maintenance of other infrastructure in the estate. The reason for this could be because they are more capital intensive and they may need support from the government.

Table 5: Neighbourhood infrastructure residents participated in

Neighbourhood infrastructure	Frequency	Percent
Security	249	54.7
Waste management	23	5.1
Roads	13	2.9
Electricity Supply	151	33.1
Water supply	8	1.8
Drainage	3	.7
All of the above	4	.9
No Idea	4	.9
Total	455	100.0

Levels of participation

Respondent's level of participation was investigated in the study. The result of findings (Table 6) indicates that participation was higher (43.3%) at the street level than the neighbourhood or individual (house) level. Participation at the neighbourhood level (36%) was also considered to be higher than that of the house level (20.7%). The result of findings shows that respondents preferred to contribute to the provision and maintenance of infrastructure close to where they live than in the whole estate. The implication of the result is that people are more willing to contribute to infrastructure in which they have direct access to and are more likely to benefit from.

Table 6: Levels of participation

Level of participation	Frequency	Percent
Individual (house)level	94	20.7
Street level	197	43.3
Estate community level	164	36.0
Total	455	100.0

Means of Participation in the provision of infrastructure

The result on residents' participation in estate infrastructure development (Table 7) indicates that majority of the respondents (63.1%) participated through payment of estate levies and voluntary donations to the estate, while (7%) of the respondent participated in provision of labour and man power and (4.4%) participated by educating other residents of the estate. Only 12.6% of respondents participated in decision making, planning and execution.

Table 7: Means of participation

Means of participation	Frequency	Percent
Financial participation (donations and levies)	287	63.1
Intellectual /decision making	23	5.1
Project planning & execution	34	7.5
Provision of labour /man power	32	7.0
Education of estate residents	20	4.4
All of the above	3	.7
No Participation	46	10.1
Total	455	100.0

Stages of participation

The preferred stage of participation (Table 8) shows that the highest percentage (27%) of the respondents wants residents to participate in the project planning while (25.3%) want to be involved in project execution. Also (20.2%) of the respondents preferred residents participate

by given regular feedback and (9.2%) residents should participate by collaborative funding of infrastructure in the estate. A few of the respondents (9.2%) also believes respondents should take part in policy making. The result implies that at all levels of infrastructural provision; the residents will like to be carried along.

]*Table 8: Stages of residents' participation*

Stages of Participation	Frequency	Percent
Project planning	123	27.0
Project execution	115	25.3
Regular feedback from residents	92	20.2
Financial participation only	28	6.2
Policy making	43	9.5
All of the above	54	11.8
Total	455	100.0

Predictors of Participation

In search for explanation for the level of participation in the estates, categorical regression was done. The result as shown in (Table 9) yields R2 = .160. This result indicates that there is a relationship between the dependent variable (level of participation in the estates) and the independent variables (residents' social economic characteristics). The analysis of variance (sum of square = 72.628; df = 17; p≤ 0.005) confirms the significance of the relationship.

Table 9 : Predictors of participation

	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error			
Gender	-.056	.046	2	1.521	.220
Age	.084	.054	2	2.458	.087
Highest level of education	.132	.047	2	7.835	***.000
Monthly income	-.149	.050	2	9.012	***.000
Tenure status	.274	.055	1	24.562	***.000
Length of residence in the estate	-.202	.051	2	15.809	***.000
How long will you stay in the estate	.078	.051	1	2.299	.130
Household size	.129	.047	3	7.684	***.000
Marital status	.057	.051	2	1.242	.290

***** significant predictor variables**

The results indicates that five variables of residents' socioeconomic characteristics namely, education (p≤0.005), income (p≤0.005), tenure status (p≤0.005), length of residence in the estate (p≤0.005) and household size (p≤0.005) were significant predictors of participation. As indicated in the (Table 3), gender, age marital status and how long respondents will stay in the estates are not significant predictor of participation. Out of all the variables that are significant predictors of participation, length of residence in the estate is the strongest predictor of level of participation (Beta = -.202).This is followed by monthly income (-.149), Tenure status (.274), education (Beta = .132) and household size (.129) as the least significant predictor.

The result implies that socioeconomic status of the respondents contributed to their level of participation in the provision and maintenance of estate infrastructure.

CONCLUSION AND IMPLICATIONS OF THE RESULT

Participation in neighbourhood infrastructure was found very important (69.9%) among the residents of the estates and a very high percentage (77.1%) of the respondents showed willingness to participate in the provision and maintenance of public infrastructure. Willingness to pay for infrastructure was also investigated to know the value residents attached to infrastructure in their estates, majority of the respondents (80%) are willing to pay for the estate infrastructure. This indicates they value the infrastructure and will maintain it.

Despite their willingness to participate, only a few of the respondents (23.1%) rated participation high in the provision of estate infrastructure. The residents and estate residents association participated majorly in contributing fund regularly for security in the estate and maintenance of power supply equipments in the estate. The paper has revealed respondents' attitudes towards participating in infrastructure projects in the estate, 63.1% of the respondents participated by paying levies and donations towards infrastructure while the others contributed in the planning and execution of projects. The respondents however preferred to be involved in both decision-making process and the financing of the estate infrastructure. The study also suggested that some socioeconomic variables like education, income, tenure status, length of residence in the estate and household size were significant predictors of participation.

The study therefore concludes that government should ensure that residents are part of the entire process of neighbourhood development right from the inception to the project execution and completion. They should also allow for feedback on projects implemented towards the physical development of neighbourhoods. Participation enhances trust and sense of belonging to a neighbourhood which also translate into residents' attachment to their neighbourhood and therefore wanting to contribute to the total development of their neighbourhood.

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Neighbourhood Physical Characteristics and Sense of Community in Poor Residential Neighbourhoods in Akure, Ondo State, Nigeria

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ABSTRACT

This study looked at the influence of neighbourhood physical characteristics on sense of community in poor residential neighbourhoods in Akure, Nigeria. Previous researches on sense of community have suggested a number of interrelated components, which were integrated into this research: the social characteristics of the neighbourhood, the physical infrastructure and the socio-economic characteristics of the residents. Four specific residential neighbourhoods in the core of Akure were selected for the study, 532 questionnaires were successfully administered and analysed with frequency distribution and categorical regression analysis. The regression analysis confirms a significant relationship between neighbourhood physical characteristics and sense of community (Adjusted R2= .136, sum of square = 63.444; df = 24; p 0.000). The results indicates that nine variables of neighbourhood physical characteristics namely, physical condition of the residential units, neighbourhood environmental quality, health facilities, recreational facilities, shopping centre, educational facilities, power supply, street roads and house type were significant predictors of residents' perception of sense of community. Sense of community was also found to be influenced by the socio-economic status of the residents. The second regression analysis model produced a significant relationship between neighbourhood sense of community and resident socio-economic characteristics (sum of square = 33.068; Adjusted R2= .042, df = 11; p 0.000). Socio-economic variables like age, income, sex and education were the strongest predictors of sense of community. The paper concludes that sense of community if well utilised can result into neighbourhood improvement while neighbourhood physical characteristics on the other hand is an essential tool in building strong sense of community particularly in poor residential neighbourhoods.

Keywords: Neighbourhood, poverty, sense of community, social capital, social network

INTRODUCTION

Poor neighbourhoods are places of resources based on the strong social capital and social network embedded in it (Ayoola, 2015). Neighbourhood sense of community is premised on the notion that social networks have value. Social capital is the collective value of all social networks (who people know) and the benefits that arise from these networks to do things for each other (norms of reciprocity). Social networks also reflect the degree of social interaction within communities. When social networks are related to participation, they are often found to be helpful in facilitating participation by bundling individual needs and capacities; in other words, networks allow communal action to take place (Kearns & Forrest, 2000).

The notice of social capital and network has been significant for neighbourhood studies. It has helped to re-focus attention and efforts on the positive aspects of neighbourhoods especially neighbourhoods with high levels of poverty. Social capital is influential and widely accepted as useful, because it is seen as important to economic development (Forrest and Kearns, 2001). The dimensions of social capital can include: empowerment (people feeling listened to); participation (people taking part); associational activity and common purpose (people cooperating with each other); collective norms and values (people sharing common values and norms of behaviour); and trust (people feeling that they can trust their neighbours and organizations in their community) (Forrest & Kearns, 2001). The US Asset-Based Community Development Institute, recommends re-building communities 'from the inside out', maintaining that low-income neighbourhoods are rich in social capital. They argued that

Ayoola, H. A. & Amole, D. (2016). Neighbourhood Physical Characteristics and Sense of Community in Poor Residential Neighbourhoods in Akure, Ondo State, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1413-1421

"everything you need is inside" because low-income neighbourhoods have many more local associations than in some more affluent areas and newer sub-divisions (Benns, 2003).

Research on social capital has shown that people with rich social connections are more likely to have housing, jobs, good health and life satisfaction. However, the benefit derived from social capital depends on the type of social capital and the socio-economic position of people. "For the poor, social capital is not just about how many people you know and how close you feel to them, but where they are located socio-economically" (Warren, Thompson, & Saegert,1999).

This paper examines the relationship between neighbourhood physical characteristics and the sense of community with a view to a better understanding of how the neighbourhoods physical structure has contributed to strong sense of neighbourhood particularly in poor residential neighbourhoods. Galster, (2001), defined neighbourhood as both physical and social unit. It is thus important to view places (especially neighbourhoods) as composites of both the physical and social environment. It is their interaction that creates neighbourhood characteristics; therefore neighbourhood cannot be seen in isolation with any of its attributes missing. The neighbourhood is a context in which socially supportive relationship can be established and maintained (Schwirian & Schwirian, 1993). La Gory, Ward, & Sherman, (1985 quoted in Young, Russel & Powers, 2004) defined sense of community or sense of belonging to a neighbourhood as a complex process involving the objective qualities of the neighbourhood, the physiological state of the person and his subjective definition of neighbouring and neighbourhood. This qualities or factors according to Bolan, (1997) are the environment, emotional attachment to the community and formal participation or involvement in community organisation. Sense of community is an essential tool in measuring the general quality of life among all social classes (O'Brien & Ayidiya, 1991).

The ongoing debate on sense of community and neighbourhood physical characteristics is important for neighbourhood revitalization and improvement. It has helped to re-focus attention and efforts on the positive aspects of neighbourhoods especially in neighbourhoods with high level of poverty. The physical characteristics of the neighbourhood, such as the condition and adequacy of the dwellings and surroundings, may influence the establishment of social ties (Schwirian & Schwirian, 1993). If the physical characteristics of the neighbourhoods are not conducive to establishing contact, then obtaining support may be more difficult (Thompson & Krause, 1998). The physical barriers as well as psychological barriers such as poverty and socio economic deprivation, can further contribute to fewer social networks and norms of reciprocity. The quality of the physical environment could also be a consequence of different levels of social capital experienced in poor neighbourhoods (Araya, Dunstan, Playle, & Thomas, 2006). The high level of physical poverty evident in poor residential neighbourhoods could probably be as a result of low levels of social capital experienced in that area. Poor neighbourhoods with obsolete buildings and poor neighbourhood infrastructure are likely going to affect the sense of community in the neighbourhoods while it is also likely that poor sense of community will lead to poor physical characteristics of the neighbourhoods as residents might have little or no interest in their neighbourhood development. It is could therefore be agreed that the physical and social characteristics of the neighbourhood can both affect each other and effect changes which has impact on the neighbourhood quality.

This study will therefore investigate sense of community in poor residential neighbourhoods with a view to contributing to a better understanding of how the neighbourhood physical environment has helped in creating a feeling of sense of community.

LITERATURE REVIEW

Sense of community

Sense of community can be described as a feeling of belonging and shared interests among members of a community (Farahani & Lozanovska, 2014, Rogers & Sukolratanametee, 2009). McMillan and Chavis (1986) discuss four key elements: (1) membership, which involves the sense of belonging and the emotional safety it provides; (2) influence, reflecting the ability to affect change in each other; (3) reinforcement and needs fulfilment, which refers to the feeling or perception that needs are met through the cooperative behaviours of the group; and (4) shared emotional connection, which individual member's commitment and belief the members of the group share (or will share) life experiences, or history of time and place. Sense of community has been identified as a key determinant of well being and a sense of been part of a readily available social network which one can benefit from (Sengupta, Luyten Greaves, Osborne, Robertson, Armstrong & Sibley, 2013).

Long & Perkins (2007) have argued that social capital is intricately linked to sense of community and that it is often an outcome of social participation. Sense of community operates differently at individual (among neighbours) and community levels to predict informal neighbouring behaviour and citizen participation.

Most researches on sense of community in neighbourhoods have concentrated mostly on neighbourhood social outcomes while relatively few studies have examined the relationship between neighbourhood physical characteristics and sense of community (Farahani & Lozanovska, 2014). It is however observed that the contribution of the neighbourhood physical characteristics in creating sense of community have not been adequately emphasised in most researches in the social science discipline. (Moustafa, 2009; Rogers & Sukolratanametee, 2009; Farahani & Lozanovska, 2014).The physical characteristics of the neighbourhood environment can influence the residents perception of sense of community (Farahani & Lozanovska, 2014).The physical attractiveness of the neighbourhood has also been discovered to strengthen social cohesion (Buckner, 1988). Lockton, (2011), also opined that designed environments influenced people's behaviour in various ways and have also been used in crime prevention or for political reasons.

Sense of community in a neighbourhood is spatially defined, and a well-defined boundary contributes to the connection to a particular place and the sense of community. The use of shared public outdoor space (in the form of natural and semi-developed areas) has a stronger positive impact on sense of community (Kearney, 2006).

There are a lot of other factors that have been documented in the literature which plays significant important roles in sense of community. For example, length of residency (Skjaeveland et al., 1996), homeownership (McMillan and Chavis, 1986) and membership or sense of belonging (Bradsky and Marx, 2001) have all been found to influence sense of community. Neighbourhood sense of community has been found to be beneficial to the general well being of individuals, families and the society at large. It is also assumed in the literature on sense of community that cohesive neighbourhoods are useful in the implementation of social and economic development programs (Moustafa, 2009). This particular study investigates how neighbourhood physical infrastructure and residents socioeconomic characteristics enhance sense of community in poor neighbourhoods.

METHODOLOGY

This study is part of a larger study which evaluated urban poverty in the core residential neighbourhoods of Akure, Nigeria. For the purpose of the study, four poor residential neighbourhoods identified by Olanrewaju, (1990) in the study of spatial distribution of urban

poverty in Akure were purposively selected for this study. The four selected neighbourhoods are Zone 3 of the inner core area (which comprises Araromi, Oja Oshodi, Odo-Ikoyi, Isolo and Ijomu via Oke-Ijebu streets), Zone 1 covers Erekefa/Erekesan market, Town Hall, General Post Office, and Deji's Palace areas, Zone 2 includes Idiagba, Ijemikin, Irowo, Odopetu, Ajagunle areas while zone 4 comprises the other side of Araromi, Odo–Ijoka and Old stadium areas.

The sample size was based on the number of existing buildings in the area since questionnaire administration will be done on one person per household and a household per building. The unit of analysis was the household head in the housing units. Stratified systematic sampling technique was used. Out of a total population of about 2228 housing units a sample of about 25% was selected, and questionnaires were distributed to the household heads of these units. Five hundred and thirty-two (532) questionnaires were returned, and these were subsequently analyzed. The questionnaire was used as the instrument for collecting data. Three types of data were collected. The first was the residents' sense of community. This was done using thirteen variables measured on a 5 points Likert scale. These variables measured social capital, reciprocated exchange, collective efficacy and trust within the housing unit and the whole neighbourhood. The second was the residents' perception of their neighbourhood quality. This was measured also on a Likert scale with fourteen variables. These variables measured the availability of neighbourhood infrastructure and their level of performance. The socio-economic characteristics of residents were also collected and are presented in this paper to further emphasise the level of economic deprivation experienced in the study area. The data collected were analysed using categorical regression model. In line with the aim of the study, two models were examined; the socio-economic characteristics model and the neighbourhood physical characteristics model. In the first analysis, the variables of social-economic characteristics (independent variables) were regressed with neighbourhood sense of community (dependent variable). Similarly, the variables of neighbourhood physical characteristics (independent variable) were also regressed with sense of community (dependent variable)

RESULTS AND DISCUSSIONS

Socio-economic characteristics of respondents

Out of the 532 respondents interviewed (Table 1), half (50%) were males while the other (50%) were females. Also, each active age bracket was well represented. More than half of the respondents belong to the very active age bracket 26-55, this group accounted for the adult and most economically active group. It is however surprising that about a third of the respondents had tertiary education, this shows that poor urban neighbourhoods are not predominantly inhabited by people with low level of education. The employment situation of the urban poor in Akure indicated that majority of the respondents are petty traders or working informal sector of the economy. The income situation of most of the respondents is however embarrassing as about a third of household heads earned below ₦ 10,000 per month (far below the national minimum wage of ₦18,000 per month approved by the federal government of Nigeria for the least paid civil servant), there were also the presence of a few wealthy individuals in the neighbourhood. The neighbourhoods are dominated by rentals (51.5%) and people living freely in family houses (21.5%). The socio-economic status of the respondents is an evidence of a concentration of poverty in the neighbourhoods.

Neighbourhood physical characteristics

In order to evaluate the physical characteristics of poor urban neighbourhoods in Akure, the overall quality of all the neighbourhood housing and infrastructure were examined together, taking into consideration the resident's perception of their housing condition, neighbourhood

infrastructure and amenities. Respondents were asked to rank the quality of their neighbourhood, out of the 532 respondents only 131(26.5%) ranked the condition of the street good while (10%) ranked the residential units good. Percentage of neighbourhood Infrastructure ranked good; health facilities (19.2%), recreational facilities (16%), educational facilities (16%). A low percentage of respondents agreed that neighbourhood amenities are good; electricity (30.4%), pipe-borne water (12.4%), street roads (29.1%), drainage (29.9%) refuse disposal (36.8%) and sanitary condition (24.9%). A closer look at (Table 2), reveals that majority of the neighbourhood infrastructure are poor particularly water supply, recreational facilities, health facilities and the residential units.

Table 1. Socio -economic characteristics of the respondents

Variable	Characteristics	Frequency	%	Total
Gender	Male	266	50.0	
	Female	264	49.6	532
Age	<25	101	19.0	
	26-40	169	31.8	
	41-55	153	28.8	
	56-70	91	17.1	
	71- Above	18	3.4	532
Education	Tertiary (Univ/ Hnd/Nce,Ond,Grade II)	183	34.4	
	Secondary school	202	38.0	
	Primary school	84	15.8	
	Vocational training only	31	5.8	
	No education at all	30	5.6	530
Income	Below #10 000	171	32.1	
	#10 001-#20 000	200	37.6	
	#20 001- #30 000	67	12.6	
	#30 001-#40 000	44	8.3	
	#40 001-#50 000	26	4.9	
	Above #50 000	17	3.2	532
Occupation	Petty trading	284	53.4	
	Civil /formal employment	136	25.5	
	No job	35	6.5	
	Artisan	49	9.2	
	Unskilled job/informal employment	28	5.2	532
Tenure status	Self Owned	115	21.6	
	Rented	274	51.5	
	Rent free	4	.8	
	Family Houser	137	25.8	532
Length of residency	0-10 years	118	22.1	
	11-20 years	140	26.3	
	21-30 years	125	23.4	
	31-40 years	79	14.8	
	41-50 years	38	7.14	
	Above 50 years	29	5.45	532

Perception of sense of community

Respondents were asked how much they agreed or disagreed with a series of statements about sense of community in their neighbourhood (Table 3). On average, respondents were more likely to agree that neighbours get together to deal with problems in their neighbourhood (72.3%) and that it is a close- knit neighbourhood (68.2%). The neighbourhood has adult that children can look up to (63.6%) and people are willing to help their neighbours (65.4%). In relation to trust and safety, over half of the respondents (54.1%) feels their neighbourhood is safe, (44.9%) agreed that they trust people in their neighbourhood, (42.8%) feel safe in open spaces during the day and (34%) at night. Sense of being part neighbourhood was also positive as (71.6%) of parents relate with each other and (62.2%) feel at home in their

neighbourhood while just under half (43.3%) grew up in the neighbourhood and (48.5%) of the respondent agreed to been proud of living in the neighbourhood.

Influence of neighbourhood physical characteristics on sense of community

The result as shown in (Table 4) yields R2 = .136. This indicates that there is a relationship between the dependent variable and the independent variables. The analysis of variance (sum of square = 63.444; df = 24; p 0.000) confirms the significance of the relationship, although the relationship is weak.

Table 2. Perception of neighbourhood physical characteristics

Neighbourhood infrastructure	Poor N (%)	Fair N (%)	Good N (%)	Missn N (%)	Mean
Condition of street	159(29.9%)	219(41.2%)	131(26.5%)	6(1.1%)	2.08
Condition of the residential units	194(36.5%)	261(49.1%)	64(12%)	10(1.9%)	1.91
Overall environmental quality	163(30.6%)	245(46.1%)	111(20.9%)	13(2.5%)	2.04
Health Facilities (Dispensary, Health Centre, Hospital, etc.)	292(54.9%)	134(25.2%)	102(19.2%)	4(.8%)	1.75
Recreational facilities	335(63%)	106(19.9%)	85(16%)	6(1.1%)	1.67
Shopping Centre	173(32.5%)	176(33.1%)	177(33.2%)	6(1.1)	2.21
Educational facilities	167(31.4%)	197(37.0%)	153(28.8%)	15(2.8%)	2.27
Electricity	140(26.3%)	221(41.5%)	162(30.4%)	8(1.5%)	2.20
Pipe-borne water/ borehole	368(69.2%)	88(16.5%)	66(12.4%)	10(1.9%)	1.62
Street roads	169(31.8%)	189(35.5%)	155(29.1%)	6(1.1%)	2.08
Religious/ Worship centres	62(11.7%)	181(34.0%)	233(43.8%)	6(1.1%)	2.38
Drainage	137(25.8%)	194(36.5%)	159(29.9%)	10(1.9%)	2.21
Refuse disposal	159(29.9%)	170(32%)	196(36.8%)	7(1.3%)	2.36
Sanitary conditions	184(36.4%)	200(37.6%)	133(24.9%)	5(.9%)	2.00

Table 3. Perception of sense of community

Perception of sense of community	Agree (4, 5)	Neutral (3)	Disagree (1, 2)	% misn	Mean (SD)
If there is a problem around here, the neighbours get together to deal with it	385(72.3%)	67(12.6%)	78(14.7%)	2(.4)	3.81
This is a close-knit neighbourhood.	363(68.2%)	99(18.6)	64(1.2%)	6(1.1%)	3.81
There are adults in this neighbourhood that children can look up to	338(63.6%)	105(19.7%)	83(15.6%)	6(1.1%)	3.68
People around here are willing to help their neighbours	348(65.4%)	101(19%)	127(13.9%)	9(1.7%)	3.76
People in this neighbourhood can be trusted.	289(44.9%)	195(36.7%)	84(15.8%)	14(2.6%)	3.47
Children around here have no place to play but the street	245(46.1%)	147(27.6%)	125(13.4%)	15(2.8%)	3.46
The park or open space closest to where I live is safe during the day.	228(42.8%)	200(37.6%)	100(18.8%)	4(.8%)	3.36
The park or open spaces closest to where I live is at night.	181(34%)	151(28.4%)	192(36.1%)	8(1.5%)	3.08
Parents in this neighbourhood generally know each other and relate	381(71.6%)	97(18.2%)	47(8.8%)	7(1.3%)	3.92
I feel at home in the neighbourhood.	331(62.2%)	123(23.1%)	72(13.6%)	6(1.1%)	3.71
I am proud of living in the neighbourhood.	258(48.5%)	140(26.3%)	132(24.8)	2(.4%)	3.33
I have grown up in the neighbourhood.	233(43.8%)	89(16.7%)	204(38.3%)	6(1.1%)	3.09
The neighbourhood is safe	288(54.1%)	145(27.3%)	87(16.3%)	12(2.3%)	3.63

The results indicates that nine variables of neighbourhood physical characteristics namely, physical condition of the residential units, neighbourhood environmental quality, health facilities, recreational facilities, shopping centre, educational facilities, electricity, street roads and house type were significant predictors of residents' perception of sense of community. As indicated in the (Table 4), waters supply, refuse disposal and drainage is not a significant

predictor of sense of community. This may be due to the fact that they are not communal facilities or shared facilities among a large number of people. Out of all the variables that are significant predictors of sense of community, power supply is the strongest (Beta = -.409).This is followed by physical condition of the residential units (-.126) and then by house type (Beta = -.123) and Educational facilities (-.109). The next one is shopping centre (Beta = .169) followed by street roads (.139), health facilities (.099) and lastly, by the presence of recreational facilities or open space in the neighbourhood (Beta = .081) as the least significant predictor.

Table 4: Categorical regression analysis of neighbourhood physical characteristics on sense of community

	Standardized coefficients		Df	F	Sig.
	Beta	Std. Error			
Physical condition of the residential units	-.126	.053	2	5.660	.004*
Overall Neighbourhood environmental quality	.102	.047	2	4.646	.010*
Health facilities,	.099	.050	2	3.897	.021*
Recreation facilities	.081	.054	3	2.268	.005*
Shopping centre	.169	.065	3	6.858	.000*
Educational facilities	-.109	.053	3	4.193	.006*
Electricity	-.409	.060	2	46.836	.000*
Water supply	.052	.051	2	1.032	.357
Street roads	.139	.071	1	3.858	.050*
Refuse disposal	.040	.062	1	.422	.516
Drainage	-.034	.047	2	.512	.600
House type	-.123	.045	1	7.456	.007*

Dependent variable: sense of community
*$\rho \leq 0.05$

This result implies that neighbourhood infrastructure and amenities would encourage informal contacts which would in turn enable residents to socialise with one another and protect each others interest. This may enhance social trust and reciprocal exchanges that may lead to neighbourhood revitalization. Also, neighbourhood physical infrastructure may encourage residents to develop relationship with their neighbours which may influence attachment with the environment which that may have positive and direct effect on the strength of local social bonds that may also enhance neighbourhood revitalization. Public social infrastructure that is shared was also found to encourage social interaction that may reinforce neighbouring behaviour. The result of findings further supports previous findings that neighbourhood physical characteristics influence residents' perception of sense of community which in turn has the potential to enhance quality of life.

Residents socio-economic characteristics and sense of community

The result as shown in (Table 5) yields R^2 = .062. This indicates that there is a relationship (though weak) between the dependent variable (sense of community) and the independent variables (socio-economic characteristics). The analysis of variance (sum of square = 33.068; df = 11; p 0.000) shows that it is a significant relationship.

The result (Table 5) suggests that four variables of resident's socio-economic characteristics are linked with perception of sense of community. The predictors of sense of community in this model are, sex (.002), age (.004), education (.001) and income (.003). it is however worthy of note that tenure status and marital status does not influence sense of community in this study. A closer look at the result shows that the strongest predictors of sense of community in the model (Table 5) are age and sex followed by income while education seem

to be the least significant. The result however shows that the neighbourhoods can be described to possess a very high sense of community.

In all, the two models supports previous findings about the positive influence of sense of community on the perception of neighbourhood characteristics which in turn can enhance residents' quality of life as well as neighbourhood quality.

Table 5: Categorical regression analysis of socio-economic characteristics and sense of community

	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error			
Sex	-.097	.043	3	5.081	.002
Age	-.133	.056	2	5.519	.004
Marital status	-.083	.056	1	2.209	.138
Education	.156	.045	1	11.870	.001
Income	.104	.043	2	5.854	.003
Tenure status	-.041	.044	2	.856	.425

Dependent variable: sense of community

*$\rho \leq 0.05$

CONCLUSIONS

This study highlights the physical and social characteristics of poor urban neighbourhoods in Akure with a view to understanding the impact of the neighbourhood physical characteristics on sense of community and also to further substantiate the fact that sense of community can also be strengthened by the socioeconomic characteristics of the residents. The result of findings shows that the selected four neighbourhoods in the core of Akure are not only inhabited by poor people who earn far below the poverty line, a few wealthy individuals live within the core neighbourhoods. The neighbourhood can also be described physically to be characterised with poor residential units, poor infrastructure and social amenities but also with a positive social capital and sense of community.

This study supports further previous studies (Farahani & Lozanovska, 2014, Wood, Frank &Giles-Corti , 2010, Schwirian & Schwirian, 1993, Araya, Dunstan, Playle, & Thomas, 2006) that sense of community and neighbourhood physical characteristics both affects each other significantly. The findings further shows that shared public facilities are more likely to encourage sense of community while sense of community variables like trust and social cohesion may encourage residents to collectively develop their neighbourhood which may in turn translate to better quality of life for the residents. Strong sense of community could also be part of the reason people stay in poor environments despite the fact that poor neighbourhoods are linked to poor health and crime threats that renders the place unsafe. Nevertheless, given the reality that many residents of poor neighbourhoods will not accept or cannot afford a move, it may be sensible from the standpoint of government and policy makers to focus on programs that can translate residents' positive bonds of sense of belonging to a neighbourhood into place improvements. Future research may therefore consider how neighbourhood sense of community can better be used to combat poverty and also facilitate neighbourhood development.

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Issues in Adequate and Quality Housing Provision for Nigeria Urban Residents

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ABSTRACT

The need for Nigeria to comply with the Istanbul declaration and Habitat II conference resolutions of 1990 on ensuring adequate shelter for all and making human settlements safer, healthier, livable and sustainable for all citizens particularly the urban residents is advocated in this paper. Housing as a basic need is lacking for a sizeable number of Nigerians. The medium and the low income groups of the population, most of who live in urban areas, suffer severe housing crisis. In cities like Akure, Lagos, Abuja and P/Harcourt, few houses are available for workers in both formal and informal sectors. In highlighting the roles of housing in the totality of man's life, the paper review the past and present efforts by government and private individuals at providing housing in Nigeria, as well as identifying aggregate factors militating against the provision of quality housing for urban dwellers. While enumerating attributes of standard homes, the authors emphasized the need for identifying all technical, Socio-economic, cultural, political and environmental issues relating to good housing provision.

Keywords: Development, Housing, Infrastructure, Quality, Urbanization

INTRODUCTION

In recent times regional environmental phenomena such as rapid population growth rate, industrialization and urbanization occur mostly in developing countries where 75% of the world population lives Hyuwa (2000). Though these processes are welcome development, but inherent in the processes are socio-economic and environmental problems which include inadequate housing supply to match demand, rapid urban decay characterized by dilapidated buildings, emergence of urban poor, rising crime rates, pollution, poor infrastructures, poor Sanitation system, high traffic congestion among others.

This paper therefore dwells on the issues of inadequate housing provision and a number of social maladies associated with the tripartite processes of high population growth rate, industrialization and urbanization.

Definition of Housing

Housing connotes different things to different people at different times. Housing is an inevitable requirement for the survival of man. Globally, the central thing in housing is the "dwelling unit". Broadly speaking, dwelling unit, which may be in the form of a cave, cabin, canopy, house or palace, offers a bundle of services. Housing is a collective term for human shelter. Strictly speaking the dwelling structure, which is legitimately constructed or erected in accordance with approved plan, qualifies for a house or home. Shelter, which is housing is next to food as far as man's hierarchy of need is concerned. The environmental perception of housing is reflected in the view of the Kick lighters (1986) when they describe housing as being more than just a dwelling. Provision of housing is the creation of a special environment in which people live, grow and conduct their day- to-day businesses.

Housing affects the way people feel and act, just as values and personality affects people's choice of housing. People's life and housing are inseparable; hence the term "life space" is sometimes used to describe housing. For the very poor, a house is just a sleeping place. For others, the house may be a place for intense routine activities in which case the house becomes a home.

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Functions of Housing

The fundamental functions of housing may be itemized as:

i. Protection from vagaries of weather
ii. Security from intruder
iii. Indoor cooking
iv. Sanitary and storage facilities
v. Serving as area for rest and privacy
vi. Provides space for recreation
vii. Prestige and as a means of self actualization/fulfillment

If housing must be described as adequate; it must be good enough in quality as well as being easily accessible to place of work.

Need for Adequate Housing

Nigeria is one of the fastest urbanizing countries in the world (Raji, 2008). The greatest challenge posed by this urbanization is inadequate housing needs due to the high rate of rural urban migration resulting to social, economic, environmental and political challenges.

A recent study on housing situation in Nigeria put existing stock at 23 per 1000 residents, while the housing deficit is put at between 16million and 17million houses, and N65 trillion will be required to finance the deficit at the average of N3.5 million per unit (dailyindependentonline 2015). This amount is about 10 times the 2016 Nigeria proposed budget expenditure.

LITERATURE REVIEW

Past Efforts in Housing Provision in Nigeria

The issue of housing is of paramount concern to government across the globe. Since man went through a transition from primitivism to modernism, the problem of providing adequate shelter for him has been of prime importance. In Nigeria for instance, concerted efforts have been made by the past governments, organized private sectors and individuals towards solving the lingering issue of housing provision.

Pre-colonial Era

Prior to the coming of the colonial masters at the end of 20th century, a communal system of housing provision was in existence in most part of Nigeria. The process involves age grades, friends, and or community members coming together en-mass to carry out the task of building house to the benefiting member, who in-turn provides sumptuous meal to the participants. The process revolves round till every member benefits. This system continues till 1928, and indeed may still be in practice by some communities today.

The Colonial Era

This period spans through 1928 – 1960. Here, the colonial masters began to intervene in the provision of housing in Nigeria particularly during the Bubanic plague in 1928 (NHR 1991). They needed good housing to curtail the incidence of plague that was killing them. This action brought into existence bye-law termed Lagos Executive Development Board (LEDB) which was charged with the responsibility of planning and developing the capital city of Lagos. The scheme was meant for the civil servants who eventually bought the houses through a payroll deduction system.

Post-independence

Several housing provision schemes were introduced after independence to carter for the Nigeria workers. For instance the building society was established and tasked with the responsibility of providing housing opportunities to more Nigerians including those outside

the public sector. The impact of NBS was felt significantly in Lagos, with few people benefiting from outside Lagos. The society could not last for long as it depends wholly on government for its operation.

Other Housing Interventions

Public

According to Fedahunsi (1985), Bodija in Ibadan, Trans Amadi in Port Harcourt and Stander and Taylor Woodrow Estates in Lagos constitute the early efforts made at providing housing for civil servants through the activities of the Regional Town Planning Authorities, Housing Corporation and Federal Mortgage Bank (FMB) which were established to engage in direct housing provision and financing.

From about that same period, involvement of employers in housing their workers was made mandatory by law to reduce national housing problems. Regrettably, in spite of all the efforts made to increase the national housing stock it was discovered that housing problem in terms of quality and quantity kept increasing in the urban communities rather than decreasing.

Considering the prevailing situation, it was obvious that management and strategies for the implementation of housing policy were fundamentally faulty. For instance, in the Third National Development plan, the military government proposed to construct 200,000 units of housing across the nation but by the end of 1980 only about 12 % of the figure was achieved Onibokun (1984). The rate of construction in urban areas hardly exceeded 2 dwelling units per year per 1000 population.

Private

The roles of individuals and corporate entities have been major sustaining factors to housing provision from the onset both in the rural areas as well as in the urban centers. Indeed private sector participatory role has reached such a dimension that it is becoming the most popular source of proving urban housing in Nigeria. Examples of private sector involvement include, Still Water Garden in Lagos, Prince and Princess Estate in Abuja, Brick City Estate Minna, Ijapo estate in Akure to mention a few. Government must find a way of encouraging private developers to boost housing stock for the Nigeria Urbanites. Usman (2000) asserted that if given proper leadership and incentives, the private sector can act as a veritable tool in the socio-economic progress and development of Africa.

Required Standards for Quality Housing Design

Wahab (1985) in reviewing standards for a good home design in Nigeria summarized functional requirements of any building as:

i. Strength and stability to ensure occupants safety;
ii. Structures must be dimensionally stable;
iii. Protection against hazardous weather conditions;
iv. Durability;
v. Thermal insulation;
vi. Sound insulation
vii. Provision of adequate ventilation (cross ventilation design).

While the management requirements must address issues such as.

i. Owner's need/requirement;
ii. Suitable site location;
iii. Good layout;
iv. Maintainability.

The design of a house must provide for the following basic functional areas:

i. The living area;
ii. The bedrooms;

iii. The bathroom;
iv. The toilet room;
v. The kitchen.

Attributes of a Standard House

In addition to the above, the standard homes can be described as those, which satisfy occupancy ratio of 2 or less and fulfills/ or are served with functional infrastructural facilities such as:

i. Access roads and free flowing side drainages:
ii. Portable water supply;
iii. Steady supply of electricity through a well installed and appropriately rated transformer;
iv. Adequate sewage and solid waste disposal systems:
v. Open space for play and recreation;
vi. Safety factor such as adherence to prescribed set back to roads, rail, rivers, or beaches in case of coastal towns;
vii. Education and Health services located in appropriate proximity.

METHODOLOGY

In order to examine the challenges associated to adequate quality housing provision, the study included secondary data. The secondary data involved available housing census data, official documents and other relevant secondary data were obtained from existing literature, books, internet and journals.

RESULTS, ANALYSIS AND INTERPRETATION

The abysmal performance of the National Housing Policy in meeting its set goals and objectives led to a comprehensive review, which culminated in the Housing and Urban Development Policy of 2002. Under the revised National Housing policy during Olusegun Obasanjo regime in 2002, and upon the recommendation of the Presidential Committee on Housing and Urban Development, the Federal Government of Nigeria accepted to adopt a primary goal which was to ensure that all Nigerians own or have access to decent, safe, and quality housing accommodation at affordable cost with secured tenure. As proposed by the Presidential Technical Committee on Urban Development and Housing, the framework for its operation involved restructuring of existing structures and the creation of new ones. These include: National Urban Development Policy of 1997; Land Use Act 1978; Mortgage Institutions Act, 1989(Cap 231); Employees Housing Scheme (Special Provision) Act (Cap 107); and Federal Housing Authority Act, 1990(Cap 136), among others. The housing reforms policy also involved the establishment of the Federal Ministry of Housing and Urban Development in July, 2003 which was saddled with the responsibility of adequately addressing the complex problems of the urban housing sector. It also accepted to vigorously pursue the implementation of a private sector led programme of constructing forty thousand (40,000) housing units per annum nation-wide under the following distribution:

i. 1,000 units in each state of the Federation except Lagos, Kano and River State;
ii. 1,500 units in Kano and River States;
iii. 2,000 unit in Lagos State
iv. 3,000 units in Abuja in addition to restructuring and adequately funding key agencies such as Federal mortgage Bank of Nigeria (FMBN), Federal Mortgage Finance Limited (FMFL) and Federal Housing authority (FHA) with a view to ensuring sustainable provision of the needed housing stock.

Recently, on Tuesday 8th December 2015, the Honorable Minister of Power Works and Housing, Mr. Babatunde Fashola announced that Buhari led government would in 2016 spend N10 billion naira in each of the state of the federation including the federal capital territory to build 40 low income housing estate (Vanguardonline, 2015).

The move was in agreement with the Istanbul declaration (1996) and Habitat II conference where the Global National plans of Action deals with provision of adequate shelter and sustainable human settlements in urbanized world for the next two decades.

Today, the efforts made towards meeting the national housing need has not yielded the desired result as the sector continuously receives low funding. For instance, the 2016 budgetary provision to the housing subsector is ridiculously low compared to the allocation made to other sectors. This is shown on the table below:

Table1: showing budgetary allocation to some selected sectors in Nigeria for 2015 and 2016.

S/N	Sectors	Years	
		2015	**2016**
1	Transport	11.98billion	202billion
2	Interior	143billion	531billion
3	**Works, Housing and Power billion**	**6.2b (housing)**	**433.4**
4	Education	450billion	369.6billion
5	Defence	289billion	294.5billion
6	Health	232billion	221.7billion
7	Ministry of Interior	157.5billion	145.5billion
8	Labour and productivity	8.7billion	500billion

Source: *Budget office of the federation, budget research, 2016*

From the table above, it is observed that N6.2billion was allocated to housing sector in 2015 national budget and N433.4billion was proposed for 2016 budget for works, power and housing sectors. This amount is ridiculously low and will in-avertedly hamper the idea of providing quality housing to Nigerians.

Table 2: Distribution of Housing Units Under the National Housing Programme (1994/95)

S/N	State	Targeted unit	Unit completed s/n	S/N	States	Targeted unit	Unit completed
1	Abuja	10,000	1,114	17	Kebbi	5,000	None
2	Abia	5,000	None	18	Kogi	3,000	None
3	Adamawa	3,000	None	19	Kwara	3,000	None
4	Akwa Ibom	2,000	None	20	Lagos	10,000	None
5	Anambra	5,000	None	21	Niger	1,000	None
6	Bauchi	3,000	None	22	Ogun	3,000	None
7	Benue	1,000	None	23	Ondo	3,000	None
8	Bornu	3,000	None	24	Osun	5,000	None
9	Cross River	1,000	None	25	Oyo	5,000	None
10	Delta	5,000	None	26	Plateau	3,000	None
11	Edo	2,000	None	27	Rivers	3,000	None
12	Enugu	3,000	None	28	Sokoto	3,000	None
13	Imo	3,000	None	29	Taraba	5,000	None
14	Jigawa	5,000	None	30	Katsina	3,000	None
15	Kaduna	3,000	None	31	Yobe	500	None
16	Kano	3,000	None	TOTAL		121,000	1,114

Source: Housing Policy Council Report No 3, 1995 and Agbola, 1998 in Shittu and Akande (2010)

Table 2 above revealed that government could only provide less than 1% (1,114 units) of the targeted units of housing (121,000 units) for the year 1994/95. This is grossly inadequate compared to the number of people that are in need of housing.

Poor Environmental and Housing Conditions In Nigeria

Waste generation is a natural by-product of population but absence of effective disposal system results to serious health and environmental problems.

It is estimated that Solid waste generated per home per annum in Nigeria is 20kg, and for an estimated population of 110 million homes, it means that a total volume of 2.2 Million tones of solid waste is generated annually in Nigeria. Out of this figure, only about one-fifth is properly and hygienically disposed. Table 3 below shows estimated volumes of solid wastes produced in states across Nigeria.

Table 3: Distribution of Households by Method of Solid Waste Disposal – National

State	Total	Collected	Buried	Approved	Unapproved	Burnt	Other
Abia	605,987	54,769	66,989	208,644	187,366	77,736	10,483
Adamawa	576,348	81,298	49,289	122,133	169,928	140,935	12,765
Akwa Ibom	857,436	57,200	187,729	101,837	325,715	167,649	17,306
Anambra	882,875	167,434	122,650	173,678	167,918	211,842	39,353
Bauchi	847,731	162,994	119,698	164,907	141,319	238,700	20,113
Bayelsa	352,025	14,305	14,774	122,360	161,414	23,159	16,013
Benue	801,833	79,398	82,926	86,486	311,312	214,243	27,468
Borno	787,274	121,026	103,383	190,881	167,561	189,523	14,900
Cross River	645,251	33,015	64,007	197,795	273,823	69,219	7,392
Delta	890,312	113,292	67,650	142,369	370,427	143,337	53,237
Ebonyi	449,709	62,367	39,329	87,159	165,995	77,574	17,285
Edo	701,073	126,164	69,600	87,309	227,107	179,040	11,853
Ekiti	493,739	31,881	26,488	96,455	198,887	131,918	8,110
Enugu	725,767	124,113	78,701	104,560	231,276	155,471	31,646
Gombe	419,226	83,985	54,886	83,667	92,161	98,000	6,527
Imo	837,195	128,820	117,594	120,588	223,085	211,772	35,336
Jigawa	810,310	208,347	106,899	162,136	119,888	181,493	31,547
Kaduna	1,115,974	202,661	121,514	269,213	214,555	295,774	12,287
Kano	1,603,335	433,151	193,333	346,022	222,133	359,746	48,950
Katsina	1,066,316	368,735	137,840	236,210	151,150	139,415	32,966
Kebbi	562,827	195,506	66,974	99,967	110,568	70,463	19,349
Kogi	641,556	45,296	51,354	124,313	293,881	119,782	6,930
Kwara	468,780	35,578	23,623	118,782	203,083	76,855	10,859
Lagos	2,195,842	1,171,872	60,633	484,777	77,426	176,239	24,895
Nassarawa	342,711	39,511	34,380	81,819	119,629	63,653	3,719
Niger	729,964	73,196	50,561	200,078	283,374	112,580	10,175
Ogun	880,970	153,986	42,452	147,077	255,096	272,369	9,990
Ondo	763,020	72,036	42,904	106,578	334,776	194,547	12,179
Osun	730,313	51,988	42,960	122,459	280,247	219,714	12,945
Oyo	1,248,105	126,955	46,883	169,926	538,871	335,739	29,731
Plateau	604,491	64,674	54,915	89,239	186,077	201,692	7,894
Rivers	1,123,998	111,219	101,179	447,341	343,072	99,018	22,169
Sokoto	688,710	235,492	91,643	127,561	130,937	78,044	25,033
Taraba	431,385	51,012	41,604	70,474	160,210	94,639	13,446
Yobe	418,899	78,145	49,662	96,849	95,414	87,278	11,651
Zamfara	592,106	203,330	78,377	115,050	100,675	70,711	23,963
FCT Abuja	303,592	74,523	10,654	52,501	129,171	35,434	1,309
Nigeria	**28,197,085**	**5,439,274**	**2,716,037**	**5,759,200**	**7,965,527**	**5,615,273**	**701,774**

Source: Population and Housing Census of Federal Republic of Nigeria (2006)

From the table above, it is observed that the quantity of solid waste deposited at the government approved dump sites was only 20.4%. This shows that 70.6% of solid wastes generated by Nigerians, particularly the urban residents are disposed in a manner other than the approved system.

As long as these generated solid wastes outweighs the rate at which they are properly evacuated and disposed, the quest for the attainment of livable and quality housing environment will remain a mirage for the urban dwellers.

In Nigeria, it is common to find road ways in urban streets either completely or half-way blocked with heaps of solid wastes. In several of these urban centers Agbonoga (2000) noted that the rate at which solid wastes are generated overwhelmed urban administrators' capacity to plan for their evacuation. The negative practice of Nigeria urban residents - dumping refuse into drains with the expectation that rain water will wash them off often results to the blockage of the free flow of storm water thereby causing flooding and in some cases cause liquid wastes to stagnate forming mosquito breeding ground with its attendant outbreak of diseases such cholera, malaria etc. It is also a common thing to note that many urban houses do not have toilet and bathing facilities, this often result to urban dwellers defecating in an open place.

Table 4: Distribution of Regular Households by Main Source of Water Supply for Domestic Use - National

State	Total	Pipe-borne Inside	Pipe-Borne outside	Tanker	Well	Bore-Hole	Rain Water	River Spring	Dug-Out Pond	Others
Abia	605,987	13,975	52,723	19,304	13,458	242,248	21,295	234,992	2,632	5,360
Adamawa	576,348	14,079	13,688	44,826	189,942	72,069	37,339	165,877	10,766	27,762
Akwa Ibom	857,436	29,010	44,670	12,207	37,100	235,099	37,280	415,453	9,551	37,066
Anambra	882,875	31,494	53,485	76,925	95,351	171,424	91,687	247,533	31,119	83,857
Bauchi	847,731	31,478	23,467	21,589	499,302	60,233	105,009	78,552	6,947	21,154
Bayelsa	352,025	11,698	32,979	15,532	45,758	24,645	12,437	187,083	14,780	7,113
Benue	801,833	10,639	9,505	23,061	278,237	24,783	86,363	297,073	12,035	60,137
Borno	787,274	36,057	44,882	101,248	358,490	128,233	53,254	45,415	11,627	8,068
Cross River	645,251	12,841	26,165	6,749	43,051	117,046	11,538	394,609	9,153	24,099
Delta	890,312	30,293	49,364	32,849	315,371	107,525	141,455	148,409	15,928	49,748
Ebonyi	449,709	9,727	10,954	6,409	70,867	75,460	32,695	147,058	46,911	49,628
Edo	701,073	35,910	60,093	69,158	132,039	149,594	56,584	168,581	10,252	18,862
Ekiti	493,739	35,957	49,145	8,423	214,152	23,040	28,985	115,362	4,435	14,240
Enugu	725,767	31,123	53,773	92,970	107,163	42,439	90,745	202,834	22,765	81,955
Gombe	419,226	13,862	17,520	30,441	200,105	40,832	29,486	68,268	7,314	11,398
Imo	837,195	32,697	52,795	42,944	87,220	169,289	114,734	249,026	32,283	56,207
Jigawa	810,310	48,416	43,147	27,404	239,483	234,888	130,264	80,047	3,952	2,709
Kaduna	1,115,974	124,264	43,254	25,503	672,201	31,322	63,289	132,167	4,290	19,684
Kano	1,603,335	89,249	58,766	114,276	771,420	162,506	301,460	80,374	14,332	10,952
Katsina	1,066,316	58,676	36,687	41,390	544,357	61,372	218,707	67,083	16,257	21,787
Kebbi	562,827	19,609	12,449	11,540	343,362	28,135	92,414	41,460	3,124	10,734
Kogi	641,556	20,637	24,564	94,089	175,551	47,841	26,305	225,954	6,342	20,273
Kwara	468,780	33,564	38,472	9,963	168,969	73,423	33,470	90,225	3,591	17,103
Lagos	2,195,842	214,505	336,505	326,618	743,017	479,896	35,666	34,999	3,262	21,374
Nassarawa	342,711	15,668	15,249	16,353	115,770	22,208	16,032	125,247	3,558	12,626
Niger	729,964	55,819	38,353	24,914	268,240	80,726	31,075	199,036	6,743	25,058
Ogun	880,970	49,394	137,254	77,142	229,497	206,351	18,651	147,963	3,797	10,921
Ondo	763,020	13,908	24,210	12,675	338,579	76,116	42,220	230,095	8,095	17,122
Osun	730,313	52,098	66,482	9,299	340,368	36,807	48,873	153,542	4,555	18,289
Oyo	1,248,105	34,348	50,912	28,833	695,720	85,895	103,800	204,801	10,063	33,733
Plateau	604,491	28,928	19,456	16,245	265,087	17,577	30,203	184,477	16,999	25,519
Rivers	1,123,998	69,253	136,430	43,974	402,165	302,096	30,876	124,209	7,850	7,145
Sokoto	688,710	48,300	30,868	21,645	453,676	24,074	85,454	18,757	2,667	3,269
Taraba	431,385	4,469	4,524	20,984	118,462	25,836	31,530	173,585	7,747	44,248
Yobe	418,999	14,995	21,787	25,876	233,098	52,308	45,638	17,040	5,456	2,801
Zamfara	592,106	18,319	12,578	21,533	226,541	60,753	97,499	114,036	8,446	32,401
FCT Abuja	303,592	47,871	15,819	82,045	54,307	44,943	4,563	49,224	890	3,930
Nigeria	**28,197,085**	**1,443,130**	**1,762,974**	**1,656,936**	**10,087,476**	**3,839,032**	**2,438,875**	**5,660,446**	**389,884**	**918,332**

Source: Population and Housing Census of Federal Republic of Nigeria (2006)

From table 4 above, it is revealed that only 11.4% of urban houses built in Nigeria have public water supplied into the houses either inside or outside the houses, thereby leaving

about 89.6% of the houses getting their supply from other sources. This has equally resulted to the outbreak of cholera and other killer diseases.

PROBLEMS MILITATING AGAINST EFFECTIVE HOUSING PROVISION IN NIGERIA

Most of the National Development Plans, NDPI (1962-68) NDPIII (1970-74) NDPIII (1975-80) NDPIV (1981-85) and subsequent rolling plans are well intended to boost housing provision but unfortunately the efforts did not yield much dividend because of numerous obstacles in the way of implementation. The problems of lack of realistic housing standards, overconcentration of policy at the federal level with its attendant bureaucratic impediments, lack of proper maintenance culture have all combined to make the lofty ideals expressed in the plans unrealizable. In addition, the following factors greatly contributed to the failure of the various programmes:

i. Change of governments caused by political instability as witnessed during the military rule often lead to change or abrupt termination of policies and priorities.
ii. Variation in political ideologies among the ruling political parties.
iii. Insincerity of those entrusted with governance, which resulted in the implementation of selfish and hidden agenda;
iv. Financial mismanagement and corruption resulting in overpricing and high cost of housing delivery.
v. Favouritism which sustains wrong hands in jobs as well as propping up mediocrity and production of substandard public infrastructural facilities.
vi. Ethnic-balancing and geographic character at the expense of merit and professionalism;
vii. Cultural factors such as giving chieftaincy titles to people in government thereby promoting undue loyalty and loss of focus;
viii. Absence of appropriate technology and researches in sourcing local building material to bring down costs of construction.
ix. Ignorance and dirty habits resulting in poor sanitation and poor housing conditions:
x. Poor urban infrastructures: such as, faulty transformers, damaged water pipes, sewage and drainage, poor refuse disposal systems;
xi. Over-crowding resulting in rapid deterioration of urban infrastructures apart from promoting immorality among the residents;
xii. Sizeable housing stocks are lost to fire when parts of towns and cities are set ablaze during political, ethnic or religious riot as presently witnessed in the North East region of Nigeria.
xiii. Non –involvement of all relevant stakeholders in the conception, design and implementation of housing projects and
xiv. Paucity of fund due to global recession and drop in the oil revenue among others.

PROPOSED STRATEGIC PLANS FOR ADEQUATE AND QUALITY HOUSING PROVISION IN NIGERIA'S URBAN CITIES

The followings constitute a recipe for effective and efficient housing of Nigeria's teaming urban population:

i. Sustenance of political stability to provide to attract foreign investment. This could be achieved by conceding electoral defeats thereby creating a measure of confidence to the prospective property investors.
ii. Involving all stake holders' such as the Architects, Engineers, Surveyors, Builders and others right from the conception, planning and design stages up to the implementation of housing projects.

iii. Planning and implementation of Rural Integrated Development Programme to sustain rural economy and food production in order to reduce the current influx of rural youths and able-bodied men to urban centers there by reducing undue pressure on urban housing and infrastructures.
iv. Embarking on enlightenment campaign on good health habits and proper method of refuse disposals such recycling;
v. Adoption of pragmatic mode of housing such as provision of site and services schemes, and direct provision of affordable housing by states;
vi. Introduction of clean policy on integrated waste management strategy, which should spell out the responsibilities of institutions and all stakeholders involved in waste generation/management and must be supported by appropriate legislation based on principle of farness and in agreement with Malungu (2000) who remarked that those who generates waste should also have the responsibility for its safe disposal.
vii. Conducting periodic census exercise to determine housing needs of the urban centers, towns and cities:
viii. Encouraging private sector developers in housing delivery, through tax relief, site and services scheme to enable them put greater emphasis on production of affordable houses for the urban poor;
ix. Reversal to the status quo of having a Minister solely in charge of Lands, Housing and Urban Development;
x. Establishment of Research Centers in Nigeria Universities on local building materials aimed at lowering the cost of building construction.

CONCLUSION

Nigeria is endowed with both human and abundant natural resources such as solid minerals, gas, and petroleum, extensive regional setting with high agricultural and tourism potentials. They must all be properly developed to build our economy and provide much-needed fund for provision of adequate and suitable housing for all on sustainable basis. Apart from the central role housing plays in the life of an individual, it constitutes a singular biggest sector next to agriculture that generates the greatest number of jobs for the greater number of people. The newly planned 40,000 housing units per annum by Buhari lead administration should not go down in the way of past plans and projections. They should be materially and financially provided for in the national budget and constructed for physical occupation of the targeted workers and population. If this is done on a sustainable basis, the issue of housing provision in terms of quality and quantity will be achieved in not too distant future.

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Inner City Decay and Rehabilitation in Ile-Ife, Nigeria

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ABSTRACT

Most often, cities suffer decay for lack of values and maintenance of its immediate infrastructure. The real cause of this decay lies in re-establishing the value that gave the city or a section of the city its life. This study aimed at identifying Ile-Ife inner city problems with the aim of providing information that could inform policy towards the rehabilitation of the study area. A total of 477 household heads were selected for questionnaire administration which targeted the residents and was administered on household heads living in one out of every ten (10) houses located in the identified seven (7) political wards that formed the core area of the traditional city. The results revealed that most of the household size in the study area is between 5 to 9 persons, while most of the buildings in the study area were built between 30 to 40 years ago. Information on housing environment reveal that most of the buildings lacked toilet facilities, majority of the buildings depended on well for water supply and majority of the houses are not accessible by road. Similarly, a high number of the residents disposed waste through open dumps, while close to the average respondents' practiced burning method and the remaining few engaged in central collection. In a nutshell, the study revealed the need to formulate strategy in which decayed inner cities such as the core area of Ile-Ife is revived urgently. This study therefore concludes that inner-city of Ile-Ife needs provision of decent and adequate housing units as well as healthy environment for the dwellers.

Keywords: Decay, Environment, Inner City, Rehabilitation and Residents

INTRODUTION

Rapid rate of urbanisation resulting from rural-urban migration is a major contributing factor to slum development in developing countries (UNCHS, 2003; 1986). Due to the unsustainable planning and management, immigrants tend to congregate and seek accommodation from less desirable areas of the city. Most slums in cities of developing countries including Lagos in Nigeria, Bogota in Colombia and Cairo in Egypt resulted from rapid population increase without a corresponding housing and social services provision (Jerome, 1990; UNCHS, 2003). Also, the fact that emerging new estates and neighbourhoods and the old parts of our cities and towns are turning to slum is evident. This has therefore involved the fact that the Nigeria housing environment needs more than construction of new housing units and accompany infrastructure; it requires the rehabilitation and redevelopment of some of the existing ones (Onibokun, 1985).

The problem of urban centres in Nigeria is that most of them are grown and unplanned. Consequently, this has led to the development of disorganized, overcrowded, declined, dilapidated and blighted areas and then slums in our cities. Urban slums are characterised by deplorable living conditions with poor land use planning, inadequate social services, coupled with high levels of communicable diseases, and exposure to fire outbreaks, floods and violence (Agyarko-Oduro, 2009; Butala et al., 2010).

The deterioration of Nigerian urban centres has been a process, not a willful act that may be corrected on command or legislation. The reality in the big cities in Nigeria such as Lagos, Ibadan, Port Harcourt, Aba and Enugu presents a number of problems that are worth mentioning.

Yoade, A. O. & Olayiwola, L. M. (2016). Inner City Decay and Rehabilitation in Ile-Ife, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1432-1439

These include urban decay, slum, overcrowding and lawlessness which lead to the loss of land and natural resources (Njoku and Okoro, 2014).

Housing, as a substantive unit of the environment is described as a residential environment. This includes the physical structure used for shelter, all necessary services, facilities, equipment and devices needed or desired for the physical and mental health and social well-being of the family and individual (Aribigbola, 2001; Adedeji, 2008; Owoeye and Sogbon, 2012a). The United Nations Ad-hoc Group of Experts on Housing and Urban Development defines it as physical environment in which a family must develop, being the basic unit in the society. Housing, this is often defined as a multi-dimensional bundle of services but comprises a number of facilities, services and utilities which link individuals and his family to the community in which it evolves. It is universally acknowledge, therefore, as one of the most basic needs with a profound impact on the lifestyle, health, happiness and the productivity of the individual (UN Habitat, 2003; Owoeye and Sogbon, 2012b).

Researches have shown that many Nigerian cities are still characterized by filth and squalor, decrepit structures, poor sanitary conditions and poor accessibility, among others. These generalized conditions also apply to the cradle of the Yoruba race (Ile-Ife). Strategies tried to reduce and transform slums in different countries, with varying degrees of success, include a combination of slum removal, slum relocation, slum upgrading, urban planning with city wide infrastructure development, and public housing projects. Studies have shown that challenges of the implementation cannot be over-emphasized, despite the overwhelming aesthetic value, environmental health, economic and social benefits that are expected to be derived from the program, its implementation in African countries has not always been without challenges especially, faced with opposition from inhabitants' disagreement and misunderstanding and even violence between the renewal agencies and the inhabitants in extreme cases.

In furtherance of previous studies on the subject of urban renewal, this study seeks to examine inner city rehabilitation, and on this basis suggest and provide a framework for the implementation of urban renewal programmes in Ile-Ife, Nigeria. Along this line, the study examines the socio-economic characteristics, building and facilities characteristics of inhabitants regarding rehabilitation of the inner-city.

LITERATURE REVIEW

The Inner-City

One important feature of human settlements in many parts of Africa including Nigeria is the notion of the centre. This may be the physical or conceptual geometric centre of group settlements. This according to Davidson (1969), are extant cosmologies and myths in many sedentary societies which point to the relevance of the centre as the mythical source of any story connected with group origins, and linked up with the ancestors to whom supra-sensible intelligence had shown the land and how to cultivate it.

In many societies, the center occupies strategic importance in the spatial scheme of settlements. For instance, in the radial-concentric shape of the Yoruba town particularly as a reflection of its social and political organization, the centre is the most strategic for a number of reasons. It is the magnetic centre of the town, which contains the most important unifying symbols, namely: the palace (Afin), a playground, and all the important shrines and Oba's market (Onibokun, 1985). These features draw (to the centre) all the members of the society in connection with rituals and ceremonies associated with it. The same principle applies to other settlement layouts in many parts of Nigeria. The centre as the spatial and structural core of settlement layouts ought to constitute its most vital point of architectural 'energy' in the

sense that the centre of the town or city ought to provide the conceptual core of architectural planning. When these corporate symbols are designed in response to the demands of design culture, towns and cities may begin to assume a unique character of their own.

While commenting on the issue Dimuna and Omatsone (2010); Omole (2000) and Owoeye and Omole (2012) stated that the haphazard residential morphology of the core has not altered significantly in recent years. The residential environment is "unhealthy" and "filthy". Most of the buildings are structurally and qualitatively deficient; dwellings are chaotically and densely jumbled together while, the few roads that traverse the built-up area are poorly maintained; and basic urban amenities necessary for good health and happy existence sparsely and sporadically distributed. Environment's sanitation is at an appalling level, and machineries of the civic government are perfunctorily operated.

Also, Adeniji (1987) described the inner city areas (core) as homes of the poor and disadvantaged people, including the old, the lonely and the homeless. He therefore concluded that inner city areas as an area characterized by such pathetic social conditions as low income, unemployment, illiteracy and juvenile delinquency, among others.

Jelili et al (2006) examined the planning implications of housing redevelopment in high-density areas of Ogbomoso, Nigeria. In their survey, they highlight the effects of the nature of such redevelopment on the adjoining properties, as well as assess the perceived value of such redevelopment in the area. They recommended a strict enforcement of development control with special emphasis on development permit before the commencement of redevelopment.

Core Rehabilitation

The components of urban renewal include city expansion, redevelopment, comprehensive road development, redesigning and beautification of settlement layout, upgrading of facilities and public goods and services, repair, construction and silting of drainage system within an urban centre, and enforcing slum upgrading and city development (Njoku and Okoro, 2014).

According to Egbu et al. (2014), rehabilitation involves the enhancement of the quality of deteriorating neighborhoods through code enforcement and private actions of the owners. Onibokun (1972) cited in Umunnakwe, (2009) sees rehabilitation as a process of improvement at both micro and macro levels. At the macro levels, it is the process of neighborhood revitalization through the elimination of grossly dilapidated houses, renovation and construction of streets and the provision of infrastructural and communal facilities. At the micro level, it means environmental upgrading of individual housing units. In this case, defective houses are improved upon and made to be conducive to healthy human habitation. It is applicable where the building structures are still in good conditions and can be improved, that is where the squalid condition arose as a result of lack of maintenance. It has though been criticized that full rehabilitation does not replace the main fabric of buildings, and does not significantly improve their life span. The protagonists of this approach recommend it for cities in developing countries, because it is less expensive, less radical and has relatively favorable financial and social implications.

The inner-city of Ile-Ife exhibits these sub-humane conditions, where substandard houses are prevalent in unkempt environments. It is very important that the structures and building as well as facilities characteristics of the core areas are clearly identified. The emerging problem structure will assist in the articulation of adequate rehabilitation for the core areas.

STUDY AREA

Ile-Ife is made up of two (2) Local Government Areas (LGAs), Ife East and Ife Central LGAs, whose headquarters are at Oke Ogbo and Ajebandele respectively. The two (2) LGAs

comprises of twenty one (21) political wards (eleven in Ife Central and ten in Ife-East) in the council areas with the population of 355,818,000 with projected population of over 500,000 by the year 2020 (Federal Republic of Nigeria Official Gazette, 2009). The core, which happens to be the oldest residential portion of the city, consists of the oldest parts of the city. The study area conforms to the general morphology of the traditional core areas of Yoruba cities, with the major elements, which include the palace, the king's market (Oja- Oba) and the seven (7) selected core wards (Yoade, 2013). See Figure 1.

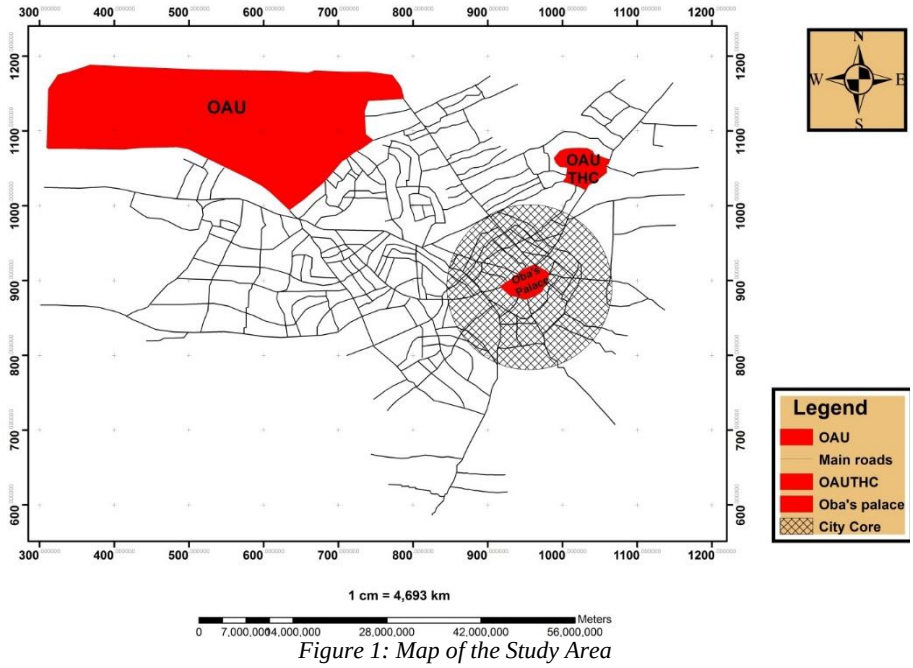

Figure 1: Map of the Study Area
Source: Ife Central Town Planning Office, 2013

METHODOLOGY

Both primary and secondary data were used in the study. The primary data were sorted and gathered using direct observation and questionnaire administration to sampled households in the study area. The copies of the questionnaire, targeted at the residents'; were administered using systematic sampling method on household heads living in one out of every ten (10) houses located in the identified seven (7) political wards that formed the core area of the ancient and traditional city (this represents 10% of the residential buildings in the study area). A total of 477 household heads were selected for questionnaire administration. Meanwhile, only a household was interviewed in each of the building selected. The street guide was well mapped during the reconnaissance survey and pilot study provided a useful direction. Data collected laid emphasis on socio-economic characteristic of respondents, age of buildings, materials and building facilities as toilets, bathrooms and their types, water supply, solid and liquid waste disposal, ventilation, accessibility, pollution, occupancy ratio, land use and disease occurrences. The data collected was compiled, summarized, presented in tables and converted to percentages for easy analysis. Secondary data were sourced from various institutions, base map from ministry of land and physical planning. Also, the population data were obtained from the National Population Commission.

FINDINGS AND DISCUSSIONS

Socio-Economics Characteristics

The result of the finding revealed that a great percentage of contacted respondents (33.5% and 31.4%) had primary and modern school. While 24.3% of the respondents had no formal

education and about 9.2% had secondary school. Just 1.4% of the respondents had tertiary school. The respondents' occupation in the study area established that, closes to two-fifth (32.5% and 31.4%) of the respondents are traders and self- employed respectively. About 13.6% are farmers, 1.5% civil servants, 9.4% artisans and others 11.5%. The study also revealed that it is possible for the level of education and occupation affects the monthly income, as shown in the table 2. Close to two-fifth (35.6%) of the respondents earns below #5,000 while 28.7% less than #10,000. Also, 21% of the respondents earns between #10,000-#15,000, 8.8% earns between #15,000 -#20,000. While a few 5.9% earns #20,000 and above (see Table 1). The finding here revealed that the general income is below the average income level of N10, 000 per month. With this low income distribution, to afford good quality housing, proper maintenance of existing ones and adequate feeding might be very difficult, if not impossible. Besides this, the household level of education is low. Majority of the households were either with primary school leaving certificate of secondary school certificate. This accounts for about 57.8% of the respondents in the study area (See Table 1).

Table 1: Socio-Economics Characteristics

Variables	Number	Percentage
Level of education		
Not educated	116	24.3
Primary school	160	33.5
secondary school	44	9.2
Modern school	150	31.4
Tertiary school	7	1.4
Total	447	100
Occupation		
Agriculture	65	13.6
Trading	155	32.5
Civil service	7	1.5
Private employees	150	31.4
Artisans	45	9.4
Others	55	11.5
Total	477	100
Monthly income		
Below 5,000	170	35.6
5,001-10,000	137	28.7
10,001-15,000	100	21.0
15,001-20,000	42	8.8
20,001 and above	28	5.9
Total	477	100

Physical Characteristics

The study revealed that a large percentage 65.2% of the land use is residential, 21.2% are mixed, 0.2 % industrial, 2.9% religious, 8.0% commercial while just 2.5% is institutional. The findings also revealed that more than four-fifth (83%) of the buildings was built more than 30years ago while 8.8% was built between 20 to 30 years ago. Just 2.1% of the buildings was built less than ten years. It was established from the finding that mud is the major material for construction which is 70% while one-fifth (20.3%) is mud blocks. Just 9.6% of the buildings are made of cement blocks. The structural condition of the buildings in the study area is categorized as good, fair or poor. From Table 3, majority 50.3% of the houses are classified as poor, 46.8% are classified as fair and only 2.9% are classified as good. With the foregoing, the rating of the poor and fair conditions of the houses confirms the need of the renewal in the study area (see Table 2).

Facilities and Services

The study revealed that most 87.4% of the respondents depend on PHCN for electricity while few 12.6% source power through electricity. On road condition, more than half of the respondents believed that their road are un-tarred, 42.0% said are tarred while remaining few use footpath. Even those respondents that claimed that their roads are tarred, part of that roads are in bad state. Therefore, the road condition in the area is in bad state which needs urgent attention of the concerned authority. The study showed that most of the total respondents uses pitlaterine, 29.4% of the respondents' uses bucket system while few of the respondents' uses water closet. According to the study majority of the respondents get water through well, 16.0% gets water through tap water while 4.0% get water through bore-hole. Various methods of waste disposal employed by the residents in the study area as illustrated in the Table 3. One major feature of an undeveloped core area is the dirty environment and Ile-Ife is no exception (UNHSP, 2008). 49.1% of the respondent dumps their refuse by the road side due to lack of facilities provided by the Waste Management board, 35.0% practice burning while the remaining 15.9% use central collection and the result of this is that the refuse emits an offensive odor and is quite unsightly and most refuse gets into the gutters and clog them up (see table3). Investigation on drainage condition reveals that 61.0% is in a very poor condition, 22.4% is in a poor condition and the remaining 16.6% is in average condition. This implies therefore that the condition of drainage system in the environment is generally very poor as shown in Table 3. On the state of health facilities in the area; a large number of the respondents are having the facilities either farther away from their dwellings or completely absent within their neighbourhoods. Most respondents indicate non-availability of health facilities while only few are accessible to health facilities in their area (See table 3).

Table 2: Physical Characteristics

Variables	Number	Percentage
Land-use		
Residential	311	65.2
Commercial	38	8.0
Mixed	101	21.2
Institutional	12	2.5
Industrial	1	0.2
Religious	14	2.9
Total	477	100
Age of the building		
Below 10 years	10	2.1
11-20 years	29	6.1
21-30 years	42	8.8
30 years and above	396	83.0
Total	477	100
Material for consumption		
Mud	333	70.0
Mud block	97	20.3
Cement block	46	9.6
Total	477	100
Condition of buildings		
Good	14	2.9
Fair	223	48.6
Poor	240	50.3
Total	477	100

However, the regression analysis computed to investigate the relationship of physical characteristics with the availability of facilities and services show a positive significant relationship of 71.1%. This strong relationship establishes the priority of such factors as

considered in the study to be determinants for good living and aesthetic pleasing environment. The summary is shown in Table 4 below.

Table 3: Facilities and Services

Socio-cultural factors	Number	Percentage
Source of Electricity Supply		
PHCN	417	87.4
Generating plant	60	12.6
Total	477	100
Road Condition		
Un-tarred	263	55.1
Tarred	200	42.0
Foot path	14	2.9
Total	477	100
Toilet Facilities		
Water closet	45	9.4
Pit latrine	292	61.2
Bucket latrine	140	29.4
Total	477	100
Water Supply		
Pipe born water	76	16.0
Bore hole	19	4.0
Well water	382	80.0
Total	477	100
Waste Disposal		
Open dump	234	49.1
Burning	167	35.0
Central collection	76	15.9
Total	477	100
Condition of Drainage		
Very poor	291	61.0
Poor	107	22.4
Average	79	16.6
Total	477	100
Health Facilities		
Accessible	40	8.4
Not accessible	437	91.6
Total	477	100

Table 4: Regression Analysis (Model Summary)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.911a	0.711	0.708	0.20

CONCLUSION AND RECOMMENDATION

The study established that the deplorable state of the Ife core requires urgent attention to ameliorate the harsh and unhealthy conditions experienced by the slum dwellers as most physical condition, facilities and services are in bad state. Corroborating the study of Ogunleye (2013), the decaying nature of the core areas in Nigerian cities and other developing countries over the last decades has also brought into focus the need for housing researchers and decision makers to develop a better understanding of the structure, operation and dynamics of urban centres. However, it has become imperative to look for the way forward out of the unprecedented growth rate that generated various problems such as lack of inadequate social, medical, educational and recreational facilities, over-utilization of existing inadequate facilities and environmental deterioration.

The study therefore recommends that there is need for provision of adequate housing facilities and healthy environment. In other to achieve this, extensive redevelopment and

rehabilitation programmes should be employed in the study area. Also, Waste Management Authority should be funded more for effective service as well as improved hygienic environment in the area. Furthermore, there is need to rehabilitate some old structures and buildings, upgrading the roads especially the un-tarred ones and damaged roads. It also involves improving the existing infrastructural facilities as well as providing new ones with a view to improving the structural quality as well as to ensure aesthetics pleasing environment.

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Socio-Environmental Dimensions of Urban Drainage Development in Unplanned Neighbourhoods

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ABSTRACT

Informal urbanism is the major driver of city development in African cities. In such a scenario where most settlements do not have defined or formal layouts, urban drainage development can become quite a challenge. This paper examines the phenomenon of urban drainage development in Palladan, an unplanned neighbourhood in Zaria, a city in northern Nigeria. The study focused more on the social and environmental aspects of drainage development. This paper adopted a case study, field survey approach. 150 households were selected through systematic random sampling and questionnaires were administered to them to get their opinions on the environmental and social aspects of drainage development in their neighbourhood. Simple descriptive statistics were used to analyze the data. The findings revealed that drainage provision at neighbourhood level is largely subject to individual and communal efforts. There is also no defined drainage hierarchy and connectivity in the area, while solid waste is often dumped in existing drainage. These result in residents experiencing perennial flooding. The paper also found that residents in the area had at one time or the other been involved in drainage related social conflict. On the positive side, most of the respondents were owner occupiers who are ready to contribute and make sacrifices towards drainage development. The paper concludes by suggesting strategies for sustainable drainage development in unplanned neighbourhoods which includes a coordinated collaboration of actors in drainage development.

Keywords: development, Palladan, socio-environmental, urban drainage, unplanned

INTRODUCTION

Informal urbanism is the major driver of city development in African cities. As asserted by Nwaka (2005) "only about 20 – 40% of physical development in Nigerian cities is carried out with formal government approval. The density of development in most unplanned neighborhoods leaves little or no space for the provision of services. In such a scenario where most urban settlements do not have defined or formal layouts, urban drainage development can become quite a challenge. Formal intervention in such informal neighborhoods is usually like 'a drop in the bucket'. As noted by Hall and Pfeiffer (2013) residents of informal neighborhoods usually create local organizations to manage their local environment and urban needs.

The social environment according to Barnett and Casper (2001) refers to the immediate physical and social setting in which people live or in which something happens or develops. In a recent study of informal settlements, Armitage (2011) emphasized the need to cater for greywater (domestic wastewater) in addition to stormwater in high density urban areas. Armitage was of the opinion that high density, unplanned urban areas should be given more serious consideration in the area of adequate drainage provision via pertinent strategies. Jiusto and Kenney (2015) corroborate Armitage's position in their study of a series of small projects in South Africa. Very few studies have focused on urban drainage development particularly in the area of informal urbanism. In the case of Jiusto and Kenney, and Armitage, their studies were based on the South African context where state policy has increasingly

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embraced upgrading since the advent of full democracy in 1994, though its successful realization on the ground remains challenging. (Graham, 2007). There is therefore a need to examine the socio-environmental dimensions of urban drainage development in other climes such as a Northern Nigerian unplanned neighborhood context.

Informal Urbanism

Informal urbanism is development occurring outside the purview of state planning or administrative systems (Prescott, Vollmer and Heisel, 2013). It should be noted that the development being referred to could relate to the informal economy, and informal housing or built environment. A characteristic of industrializing cities is the presence of both formal and informal settlements. Formal settlements are planned areas with established zoning, infrastructure and municipal services supplied by governments. Informal settlements are areas where residents often lack official property rights (Huchzermeyer and Karam 2006). Werthmann (2014) states that "Informal urbanism ranges from poor rural migrants who build their homes in an emerging community through gradual processes of informal land occupation and consolidation to the developer who subdivides land without complying with all regulations. The informal cannot be simply equated to illegal, since the informal may be the only possible way of urbanization in cities where no other options exist; the informal cannot be equated to inferior or marginal, since there are many examples where informally developed communities become better place to live than dysfunctional public housing projects and housing estates produced by commercial developers. Also, the informal cannot be equated to poor, since increasingly middle class families (even millionaires) find their housing and place to live in non-formal neighborhoods. In fact, as asserted by Hall and Pfeiffer (2013) informal neighborhoods through local self-management and local taxes spent according to local political decisions, spread rapidly through emulation. These areas progressively become middle-class suburbs. Informal urbanism is an urban phenomenon that defies clichés; its only common denominator is its origin." For this paper, informal settlement refers to the unplanned context of urban development, particularly prevalent in the cities of developing countries.

Urban Drainage

'Urban drainage,' is defined by Armitage (2011), as '[including] the removal of all unwanted water from urban areas. Such water includes wastewater – including sewerage and greywater – and stormwater.' As depicted in Table 1.

The responsibility for urban drainage development in most unplanned areas is usually characterized by sharp differences between residents, local authorities, politicians and civil society groups. These tensions are usually exacerbated by severe resource constraints. (Jiusto and Kenney, 2015)

Table 1: Sources and Types of Urban Drainage

Stormwater	Greywater	Sewage
Heavy precipitation	Dishwater	Flooded or clogged toilet blocks
Flooding from higher ground	Bathwater	Night soil
Water accumulation due to poor soil drainage	Laundry water	Private latrines

Source: Adopted from Jiusto and Kenney (2015)

Principles of urban drainage development

According to Tucci (2001), the experience in flood control of many countries has led to the development of some principles in urban drainage management. Although these principles may require some adaptation to the conditions of each country, the principles are listed below:

i. Flood control evaluation should be done in the whole basin and not only in specific flow sections.
ii. Urban drainage control scenarios should take into account future city developments.
iii. The impact caused by urban surface wash-off and others related to urban drainage water quality should be reduced.
iv. More emphasis should be given to non-structural measures for flood plain control such as flood zoning, insurance and real time flood forecasting.
v. Management of the control starts with the implementation of Urban Drainage Master Plan in the municipality.
vi. Public participation in the urban drainage management should be increased.
vii. The development of the urban drainage should be based on the cost recovery investments.

Challenges of urban drainage management in unplanned settlements

Urban drainage development and management in unplanned settlements particularly in cities of developing countries, is fraught with several challenges among which are:

i. Urban development in cities of developing countries occurs fast and unpredictably. Usually the tendency of this development is from downstream to upstream which increase the challenges.
ii. Suburban and risk areas (flood plains and hill side slope areas) are occupied by low income population of unplanned settlements without any infrastructure services.. Spontaneous housing development are on land prone to flooding e.g. Bangkok, Bombay, Guayaquil, Lagos, Monrovia, Port Moresby and Recife; hill sides prone to landslides e.g. Caracas, Guatemala City, La Paz, Rio de Janeiro and Salvador (WHO, 1988).
iii. Local Government and residents of unplanned settlements usually do not have sufficient funds to supply the basics of water, sanitation and drainage needs.
iv. Lack of appropriate garbage collection and disposal decreases the water quality and the capacity of the urban drainage network due to filling. Desbordes and Servat (1988) mentioned that in some African countries there is no urban drainage and when system drainage exists it is filled with garbage and sediments. Tokun (1983) also mentioned this type of problem in Nigeria where the drainage systems are used as garbage collector.
v. There is no prevention program for risk area occupation and when the flood occurs non-returnable funds are given to the local administration to cope with the problem, without any requirement of future prevention programs.
vi. Population, States and Local Governments administration do not have enough knowledge on how to deal with floods using the above principles.
vii. Lack of institutional organization in urban drainage at a local level such as: regulation, capacity building and administration. In Asian cities there is a lack of comprehensive project organization and clear allocation of responsibilities; adequate urban land-use planning and enforcement; capability to cover all phases and aspects of technical and non-structural planning (Ruiter, 1990).

Governance of urban drainage

As depicted in Table 2, Porse (2013) in his study of stormwater governance and future cities, states that, 'while cities with existing infrastructure (developed countries) seek to integrate "greener" approaches, cities lacking existing infrastructure (less developed countries) face stark challenges to expand system capacity and reliability'. These realities show that, while cities in the developed world are aligning with larger regional growth plans to promote smart and sustainable growth via Sustainable Urban Drainage Systems (SUDS), cities in less

developed countries are still befuddled with the task of understanding urban growth patterns and meeting infrastructure needs for industrialization.

Table 2: Urban stormwater management priorities in cities

Goal	Cities with Established Stormwater Management Systems	Cities Lacking Established Stormwater Management Systems
Municipal Management Capabilities	● Meet budgetary requirements ● Satisfy municipal codes ● Meet standards for reliability and performance ● Align with larger regional growth plans to promote smart and sustainable growth ● Engage residents in management programs	● Expand services to keep pace with rapid growth in planned and unplanned areas ● Reduce corruption ● Increase system reliability ● Leverage training and knowledge transfer from external sources to develop internal expertise ● Reduce illegal system draws by residents while also servicing the population ● Secure capital for infrastructure improvements ● More comprehensive planning for long-term growth and urban development
Environment	● Satisfy local, regional and national environmental standards ● Improve local water quality ● Facilitate healthy ecosystems for recreation and economic benefits ● Minimize effects of Combined Sewer Outflows	●Reduce environmental impacts at little cost ●Improve quality of urban runoff ●Expand infrastructure capacity to consider supply, treatment and runoff
Public Health	● Prevent transmission of disease and infections ● Meet public health standards	● Improve system capabilities to reduce disease transmission and ensure clean water supplies ● Promote evacuation during floods
Social	● Enable citizen action and engagement ● Facilitate adoption of Best Management Practices by landowners ● Contribute to regional goals within constraints of social attitudes	● Enable local citizens access to clean water and municipal services at affordable prices ● Understand urban growth patterns and to meet infrastructure needs for industrialization

Source: Adopted from Porse (2013)

Table 2 clearly points out the wide gap existing in drainage governance between cities in developed countries and those of less developed countries. To borrow from Jiousto and Kenney (2015), SUDS and other drainage techniques will simply not work in the context of informal urbanism which is characterized by unplanned settlements unless adapted carefully to their particular social, legal, and environmental realities. Also, without local community consultation, participation and buy-in, most drainage interventions will fail. Lastly, drainage strategies informed by experience and designed explicitly for unplanned settlements are needed to deal with the unique and variable circumstances within these communities, which are often distinctly different even from neighboring communities within the same city.

Aim and Research Questions

This paper examines urban neighborhood drainage development in the social and physical context of unplanned urban development in Palladan. Given the social environment and peculiarities of unplanned neighborhoods, and in the context of the study area, how is the neighborhood urban drainage provided and maintained; what are the challenges of drainage development in such areas? And which strategies are best in promoting urban drainage development in such areas?

METHODOLOGY OF THE STUDY

The Study Area

Palladan is an unplanned but fast growing neighborhood in Zaria urban area of Kaduna state, in northern Nigeria. This fast growth could be attributed to its proximity to two major institutions in Zaria. The first is the Nigerian College of Aviation Technology (NCAT) to the South-west of the area, while the Nigerian Institute of Transport Technology is to the North-west. To the South-east of the area lies Kabama, a planned residential layout adjoining the study area. Palladan is inhabited by a heterogeneous population from several parts of Nigeria, although the larger percentage of residents in the area are indigenes of Hausa/ Fulani origin. The study area is plagued with problems of very poor drainage provision and maintenance; lack of street gutters and culverts, refuse dumping in existing drains, among other urban service problems. The area is generally characterized by haphazard urban development and poor urban facilities and services provision.

Sources of Data, Sampling Techniques and Data Analysis

The study adopted a case study and field survey approach. Primary data were captured via personal observation, semi-structured questionnaires administered to households and also, interviews held with community leaders, officials of the Primary Health Department at the Sabongari Local Government, officials of the Kaduna State Urban Planning and Development Authority (KASUPDA), officials of the Kaduna State Public Works Agency (KAPWA), and officials of the Kaduna State Environmental Protection Agency (KEPA). Secondary data was acquired from Google satellite imagery of the area, web search on urban drainage development, and both published and unpublished literature on urban drainage, informal urbanism and other related works.

The study area has a population of 21,384 and a total of 2,673 households, estimated by assuming a household size of 8 persons per household, given the socio-cultural background of the area *(estimates from the Primary Health Department, Sabongari LGA).* The questionnaires were administered through systematic random sampling within three clusters (*The three wards; Palladan core, Anguwan Fulani, and Layin Zomo; figure 1*) selecting one out of every five households. Kabama Layout was not sampled in this paper because it is a planned layout and the paper does not intend to do a comparative analysis. 150 households were selected, representing 5.6% of the total number of households in the study area. 20 field assistants were utilized in the field surveys and data gathering. Simple descriptive statistics were used to analyze the data gathered and conclusions were subsequently drawn.

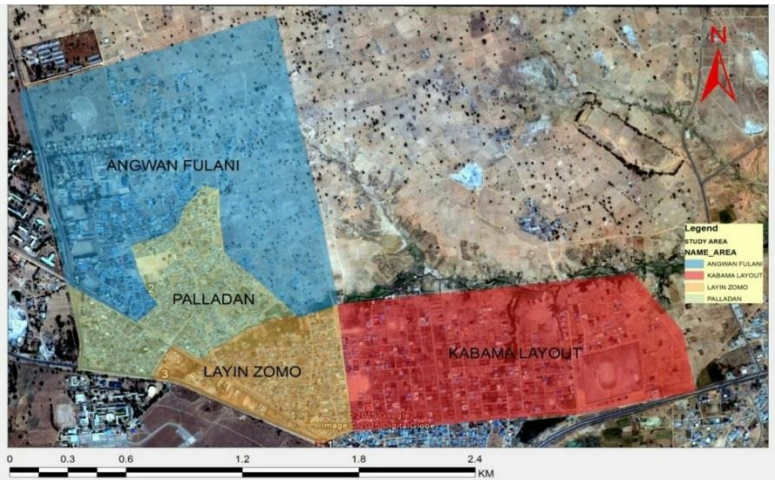

Figure 1: The Wards in Palladan Neighborhood

FINDINGS AND DISCUSSIONS

During the field survey, it was observed that the existing drainage situation in Palladan was grossly inadequate. The nature of housing development in the area leaves little or no space (setbacks) in-between buildings. Even in cases where spaces are left more often than not the spaces are used as passages/footpaths and for refuse/sewerage disposal. This scenario would make drainage provision more costly and difficult. 127 street links were identified during the survey. Out of these, only 61 (48.03%) street links had stormwater drainage provided. As Table 3 depicts, 60.7% of the 61 stormwater drains are improvised hand-dug drains, while 39.3% are lined drains. Also, the neighborhood drainage system is disjointed and not connected to the primary city-wide drainage system (Plate 1 and 2). In fact, even the Zaria Urban Area drainage system lining the primary and district road distributors, lack connectivity and continuity at several points. Moreover, 47 (77%) of the existing drainage in the study area have been converted to refuse disposal points, consequently blocking the drains, impeding stormwater flow and causing perennial flooding in the area during rainfall. It was also apparent from the field surveys and discussions with the community leaders that drainage provision and maintenance in Palladan is largely a community affair. Government intervention has been limited to drains along primary and district distributors. As shown on Table 4, available drains have been provided by either individuals, households, or youth organizations in the study area, usually supported by willing individuals and households.

Table 3: Types of storm water drainage identified in the study area

Types of Drainage	Number of Cases	(%)
Hand dug	37	60.7
Lined drainage	24	39.3
Line and covered drainage	Nil	Nil
Total	**61**	**100**

Table 4: Drainage providers in the study area

Drainage Provider	Number of Cases	(%)
Individuals&households	13	21.3
Local Government	6	9.8
CDAs(Youths)	42	68.9
Total	**61**	**100**

Plates 1 and 2: A stand-alone paved stormwater water drain along Kasuwan Mata street and a blocked drain in the study area

Socio-economic and cultural context of drainage development

From the surveys, 33% of the respondents were found to be indigenes of Hausa/Fulani origin. While the remaining 67% were non-indigenes. This accounts for the significant presence of traditional mud compounds in the area which has implications for drainage and sanitation due to the nature of such housing design and the large number of household members in such a

Hausa/Fulani setting. Most of the residents in the study area fall into the low-income category because out of the 150 households surveyed, 76% (114) earn below 50,000 Naira (about 250 US Dollars) monthly (see Table 5).

Table 5: Income of respondents

Level of Income(In Naira)	Number of Cases	(%)
Below 18,000	57	38
18,000-30,000	15	10
30,000-50,000	42	28
>50,000	36	24
Total	**150**	**100**

This could affect their ability to contribute to infrastructure upgrading in the area. Most of the residents are also literate and educated. 60% have attained unto secondary or tertiary level of education and only 20% are informally educated. This depicts a potential for higher awareness on the health implications of drainage development. The study also revealed that most residents (82%) were owner occupiers' while only 18% of the respondents were tenants, as depicted on Table 6.

Table 6: Tenure status of households

Housing Tenure Type	Number of Cases	(%)
Owner occupier	123	82
Renting	24	16
Leasing	3	2
Total	**150**	**100**

Drainage Induced Social Conflicts

In some cases, while a resident makes efforts to solve his drainage problem, it creates a problem for another neighbor. There was more cooperation in drainage development observed at Anguwan Fulani, towards the North, the area is less dense in development and harbours the more enlightened and middle class residents. The Palladan core and Layin Zomo has more dense development and more drainage conflicts. The field data reveals that out of the 72% who claim to have had drainage related conflicts with neighbors, only 8% came from Anguwan Fulani, while 64% were from the Palladan core and Layin Zomo. This shows that there are more drainage conflicts/challenges in the higher density parts of the study area. Table 7 shows the range of types of drainage related conflicts experienced by neighbors/residents in the study area. Neighbors not cooperating in drainage maintenance (30%) takes the highest number of cases.

Table 7: Reasons for drainage conflicts

Nature of Conflict	Number of Cases	%
Deliberate Blocking of drain passage	39	26
Dumping of refuse	24	16
No Maintenance	45	30
No response	42	28
total	150	100

Failure of Governance Institutions

The Sabongari Local Government Health Department is responsible for ensuring that the existing drains are kept clean by engaging in regular inspections, awareness creation on health implications of environmental situation, conflict resolution on drainage issues, fining of environmental offenders, among other responsibilities. However, the study revealed that the department rarely carried out their responsibilities. Respondents in the study area reported that officials from the local government office are only seen when a resident takes a report to them.


Plates 3 and 4: Hand-dug drains for Greywater in Palladan

The Kaduna Public Works Agency (KAPWA) informed the survey team that no drainage project has been carried out in the study area, and there are no future plans for such. Kaduna Environmental Protection Agency (KEPA) and the Kaduna State Urban Planning and Development Authority (KASUPDA) also confirmed that they were not involved in any form of drainage development initiative in the study area. Therefore most of the existing drains in the area are hand-dug by the residents (Plates 3 and 4).

Potentials for urban drainage development

All respondents (100%) consider drainage development to be important mostly because of health reasons. Although 16% of the respondents were not willing to contribute to drainage development in the area, 84% were willing to contribute financially and through manual labour. Also, studies have shown that secure tenure promotes willingness to contribute to infrastructure development in informal settlements (Choguill and Choguill, 1996). This probably explains the large number of those willing to contribute to drainage improvements. Since 82% of the respondents are owner occupiers in the study area, as earlier shown on Table 6.

CONCLUSIONS AND RECOMMENDATIONS

The study findings in Palladan corroborate the assertions of Jiusto and Kenney (2015), highlighting the reality that governments in developing countries mostly avoid interventions in drainage development in unplanned neighbourhoods. In the Palladan example, it is clear that Government intervention in urban drainage development, when found, largely focuses on city primary drains. This is unlike South Africa where state policy clearly embraces upgrading of informal settlements. It is also clear from the Palladan context that drainage development in Nigerian cities take on a very myopic approach that is still far from the regional SUDS perspective as rightly observed by Porse (2013). This assertion is arrived at because of the disjointed and unconnected existing drainage system observed in the study area. Considering the high incidence of indiscriminate solid waste disposal into open drains in the study area, it is also obvious that until an integrated approach to solid waste and sewerage management is adopted in unplanned neighborhoods drainage development will continue to pose a great challenge. Given the efforts already being made by residents in the study area, more progress can be made in drainage improvement if government institutions can be more committed and offer technical support to communities that are already involved in drainage development.

There is also need for proper public enlightenment and participation in urban drainage management in our cities. This is important, in order to educate people on their roles in achieving sustainable urban drainage systems for city regions.

The study has shown that social and environmental factors shape urban drainage development particularly in unplanned neighborhoods like Palladan. It is clear that the development pattern and social environment will inform the kind of strategies that can be employed in drainage development for specific unplanned neighborhoods. The Millenium Development Goals (MDGs) had a target of improving the lives of 100 million slum dwellers by the year 2020. The task is an arduous one. However, when the political will and right strategies are adopted, incremental upgrading efforts can be made in selected informal settlements to make a difference over time. Governments in cities of developing nations should not view urban drainage development just at the micro-neighborhood level but rather at the macro-regional level where Integrated Urban Water Management (IUWM) and Sustainable Urban Drainage (SUD) considerations are made.

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Building Tradition, Slum and Housing the Urban Poor: An Exploratory Study

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ABSTRACT

In most developing countries today, the provision of housing is grossly inadequate, coupled with the fact that the available housing falls below the standard of appropriate habitable models. This is so despite decades of direct government intervention in the housing sector. It is estimated that more than 50 percent of the urban population in the developing countries lives at the level of extreme poverty. The adoption by the United Nations General Assembly of the Global Strategy for Shelter to the Year 2000 (GSS) in 1988 implied a global recognition of the severity of the housing problem in the developing and underdeveloped countries. There is the need to address these gross inadequacies in terms of quantity and quality of housing provided. According to the Nigeria population census figures of 2006, Nigeria has over 140 million people (currently estimated to be 173.6 million in 2015); placing it as the most populous country in Africa. Many of this population are found living in the major urban centres, with over 70 per cent classified as living under poor and inadequate condition of housing. The paper, using case study approach, explores the issues surrounding the provision of adequate housing in a millennium city of Akure, Nigeria. It made use of data and information collected from both primary and secondary sources. Data were collected through physical investigation of poor inner- city neighbourhoods of the study area; stating some of the findings as framework for the design of future developmental policy. In conclusion, the paper argues for a rethink of policies and increase in investment in the built environment to positively alleviate the adverse housing condition.

Keywords: housing need, human development index (HDI), inner-city neighbourhood, slum, urban poverty

INTRODUCTION

Considering the world population of six billion people, 1.1 billion people fall below the poverty line (Ravallion, 2013; Alkire, Conconi, Robles and Seth, 2015). Half of the people in Sub-Saharan Africa in which Nigeria is one, fall below this poverty line while one third of India are considered poor by this definition (Alkire and Santos, 2014). Poverty is a multidimensional phenomenon; hence it cannot be reduced to a single definition. However, to be able to have a full grasp of the distribution and depth of poverty, it is generally acceptable to evaluate real per capital expenditure on an indicator of welfare (Atkinson, 1999). Hence the need to draw a line that will help to define the cost of living standard below which a person is classified as being poor. Income can be used to draw an absolute poverty line or a negative poverty line can be drawn based on percentages of household at the bottom of the income distribution (Atkinson, Piketty and Saez, 2011). The poor are the most vulnerable of the masses and they often lives in deplorable condition, such as inhabiting ramshackle houses that has no door with leaking roofs (Stokols, Rall and Schopler, 1973). There are categories of poor people that include the not so rich, the moderately poor, the poor and the poorest of the poor. Parental death often thrown children into unwarranted poverty in Africa, hence the orphaned, the internally displaced (due to war, such as in Rwanda genocidal war and Boko Haram terrorist attacks in Northern Nigeria) and abandoned children form special group of the 'vulnerable' amongst the poor.

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LITERATURE REVIEW

Factors Contributing to Poverty in the Built Environment

There are three distinct components to the measurement of poverty. First, we have to specify what is meant by 'standard of living'. Second, we have to delineate a critical level of the standard of living below which there is poverty. Third, need to compress information in the standard of living below the critical level into an index of poverty (see figure 1). It has been noticed that what contributed to the underdevelopment of the poor nations is the stagnation of their agricultural output, which has failed to keep up with their population growth rates (Kanbar, 1991; Odeyale, Sodagar, Temple and O'Coill, 2011; United Nations, 2014). The standard of living has increased slowly in poor countries of the world. The gap between the rich and the poor nations due to the gap created as a result of free trade and protection exercised by the developed economic/countries. Factors that contributed to acute poverty in Sub-Sahara Africa, and Nigeria inclusive are identified as follows:

i. Population increases due to lack of birth control, rural urban migration resulting into acute food shortages, high prices of food and services, inflation, poor housing and living condition and high rate of unemployment.
ii. Economic recession with very low price for exports raw material high indebtedness, debt servicing, reduced capital inflow, and imbalance of trade.
iii. Structural adjustment programme introduced by IMF to Nigeria during Babangida era, resulting in reduced government expenditure and high prices of food increasing the poverty of masses.
iv. Political instability and insincerity brought corruption and financial downturn affecting housing and the built environment.

Although Nigeria as a country is blessed with natural resources, it still remains a poor developing country. Gilbert and Gulger (1994) suggested that human development in part of the comprehensive process of societal change. This encompasses the economic, social, moral, physical and financial aspects of the society. Pertinent question to consider is the link between housing condition and poverty and its consequences.

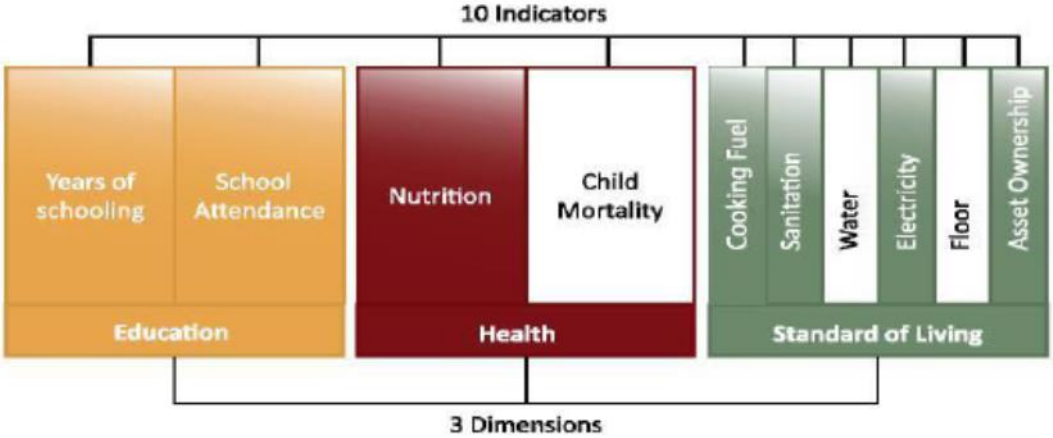

Figure 1: Multidimensional Poverty Index (MPI). Source: OPHI, 2015

There is the need to look at other economic platform in other part of the world, in order to draw out vital lesson for the alleviation of poverty and human development of Africa's most populous country Nigeria. The World Bank criterion for classifying economies is Gross National Product (GNP) per capita. Every economy is classified as low income, middle income (with lower middle and upper middle) and high income. Low-income economics are those with a GNP per capita of $635 or less in 1991. Middle- income economics are those with a GNP per capita of more than $635 but less than $7,911. Lower middle income has

income per capita between $2,555. High-income economics are those with a GNP per capita of $7,911 or more.

Poverty Indicators

These are pointers to the level of poorness of an individual or group of people, such as nutritional, social welfare, economic factors. Examples of such indicators are:

Nutritional Indicators:

This is a measure of both health and wealth. These represent the result of insufficient food intake and/or inadequate access to basic health care. The results of insufficient food intake are stunted growth or severe growth in children below the age of 6, considering the height to age measurement (Roche, 2013; UN-HABITAT, 2003b).

Social Indicators:

As earlier stated, one parameter is not enough to adequately define poverty. Apart from per capital income per month, another strong indicator of poverty is the measure of the effective uses of social services such as (immunization, school attendance, nutrition and access to water) the accessibility and quality of such services e.g. maternal or child mortality rate (Kapoor, 1993; Alkire and Foster. 2011; Cribb, Robert and Phillips 2012).

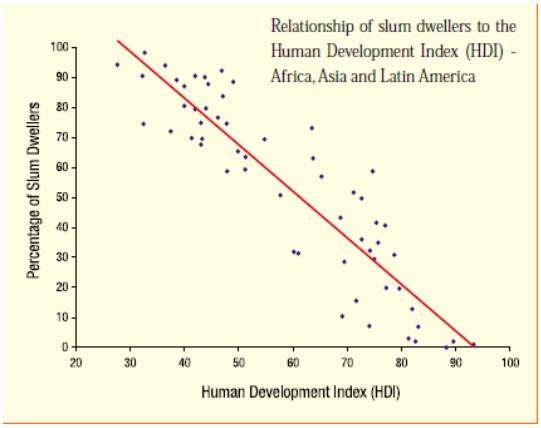

Figure 2: Correlation between Percentage of Slum Dwellers and Human Development Index (HDI). Source: UN-HABITAT (2003a).

Economic Indicators

These refer to the purchasing power of an individual or group of people in a given area. How much do they earn? How much is their expenditure, do they spend a larger amount on food? How much do they spend on education? For instance, considering the example of Uganda, the average of the total population spent an average of 1percent on education and 67 percent in food which is quite high little or within is lest for saving (UNDP, 2014).

Building Traditions, Development of Slum and Housing Problems in Nigeria

Housing itself is influenced by various factors that include social structure, climate, economic growth, technology and culture. The sociocultural heritage and tradition of a people can be observed through the evolutions of its housing forms, pattern and types. Hence, the pattern expressed by the buildings in a community is a pointer to it search for cultural identity and self actualization (Odeyale, 2010). The troubles facing the housing sector in Nigeria are enormous and complex. In Nigerian urban centres, the problem is not only restricted to quantity but also to the quality of available housing units and environment. Severe overcrowding and insanitary physical environment characterize the housing in these urban centres (Olotuah, 2000; 2002); culminating effect of this is the growth of slum areas. The result is clearly revealed in several poverty indices such as growing overcrowding in homes, neighbourhoods and communities; lack of adequate infrastructural facilities and rapidly

deteriorating environment resulting to slum like conditions. For instance, figure 2 provide a window into the relationship between the slum dwellers and human development index.

According to Turnstall et al (2013:5), evidence shows that "poverty affects housing circumstances is stronger than evidence that housing circumstances affect poverty", such evidence is seen in the formation of slum. Slum condition in housing exists when a house or a neighborhood is in poor condition which is generally considered unsafe and not nice to live or be in (Costello, 1987). UN-HABITAT (2009:106) defines slum as "any specific place, whether a whole city or a neighbourhood, as a slum area if half or more of all households lack improved water, improved sanitation, sufficient living area, durable housing, secure tenure, or combinations thereof." It is also an overcrowded area of a city in which the housing is typically in very bad condition (Davis, 2004; see also figure 3 below).

It is often quoted that the economies and societies of the poor countries had been "conditioned" by their relationship with colonial and neo-colonial powers (Deininger and Lyn, 1996; Dollar and Aart, 2002). One aspect of shelter that constitutes serious problem in housing delivery is its affordability to the low income class that forms a large percentage of many nations particularly a developing nation like Nigeria. The factor contributing to housing choice has been attributed to lower incomes, less wealth or less access to credit (typically due to worse employment positions). This led to less desirable or poorer housing conditions than others, including homelessness; and leaving in slum like conditions. The attendant high value of landed property and increasing labour cost in construction, the housing is beyond the reach of the majority of people, hence the springing up of slums and rickety building.

The problem of housing in Nigeria is not significantly different from those of the other developing nations of the world. Research findings have confirmed that there is a drastic housing shortage in Nigeria. Due to upsurge in urban population, the process of urbanization, diversified economic activities, poor management of activities within the framework of the National Development Programme and the heterogeneous nature of the society in urban centres, very many Nigerians cannot find an ideal environment or house (Izomoh, 1997; Odeyale, 2015). Onibokun (1990), estimated acute shortage in housing sector providing the following figures as summarized in Table 1.0.

Table 1.0 Estimated Housing Need between the periods of 1990 - 2020

Income Group	1990	2000	2020
Low-income	8,413,980	14,372,293	39,989,286
Medium-income	7,770,005	13,273,291	33,,573,900
High-income	7,624,230	12,419068	28,548,633

Source: Onibokun, 1990

Poverty and sub-standard housing are closely related (Onibokun, 1985), extreme housing densities coupled with pitiable environmental conditions in which the poor majority lives are characterized by acute sanitary problems and pollution of air, surface water, and solid waste; all pitiable significant conditions of slums (Mabogunje et al, 1978; Filani 1987; Wahab et al 1990). Olusanya (2001) attest to the fact that urban housing problems in Nigeria over the years have acquired an overwhelming proportion that threatens to undermine the very basic fabric of the urban society, underscoring the need for a rethink of policies.

METHODOLOGY

The study made use of data and information collected from both primary and secondary sources. Primary data were collected through physical investigation of poor inner- city neighbourhoods in core area of Akure, Nigeria. The methodology is driven by qualitative approach involving ethnographic field investigation, (with focus on core area of Akure,

namely Erekesan-Erekefa, Idiagba-Ijemikin, and Obanla) and comparing findings with archival documents. Other secondary data includes relevant information from related studies in literature.

DISCUSSIONS AND FINDINGS: STRATEGIES FOR POVERTY ALLEVIATION IN THE HOUSING SECTOR

The World Development Report of 1990 stated that the countries that have been most successful in attacking poverty have encouraged a pattern of growth that makes efficient use of labour and have invested in the human capital manpower especially the built environment. First, those countries gives the poor the opportunity to use their most abundant asset – labour. The second step is to improve their immediate well-being and increases their capacity to take advantages of newly created possibilities (Kapoor 1993; Roche, 2013). If the Nigerian government is to make headway in poverty alleviation, it will have to make policies that will deliver key services to the poor. This will include investing in human capital and ensuring that the poor are able to participate equitably in that growth and make policies that will accelerate economic growth. These must be implemented efficiently, vis-a-vis:

Figure 3: Inner city configuration and ugly face of poverty in housing as exhibited in core-city neighbourhoods of Akure, Nigeria. Source: Author's Fieldwork (2014).

Accelerating Economic Growth and Macroeconomic Stability

The economy of the country in which urbanisation is taking place has been described as stagnant and the growth of industrialization is negligible (Salau, 1992); hence, the need for growth-oriented economic recovery and poverty alleviation. In order to ensure accelerated growth, a concerted effort by the government and private sector is required. This will empower the poor by giving them room to participate and share in the economic growth. This will also be accomplished by the reduction in the income inequality, increase in the standard of living and generation/operation of policies that will enhance labour intensive method of production for the large masses/urban poor by tapping into the rich building tradition. This gives people the opportunity to make long-term investment in any economy.

Non-Governmental Participation (NGO) in Poverty Alleviation

NGO have large experience in poverty alleviation through community self-help projects. There is need for proper coordination between the government and the NG0's for effective poverty eradication and inner city redevelopments to correct city anomalies such as seen in figure 3.

Facilitating High rate of Investment in Infrastructural Development

The need for increase in investment and developing indigenous technology is also observed in the study area. Adequate resource and platform for development of the built environment is a veritable deterrent to poverty, especially in the inner-city. Investment should be encouraged not only for foreign expatriate but local investments in forms of factories and small scale industries should be given room to take root in Nigerian and African economy.

Emphasis on Technological development and technical education

Need to master modern technological system, used in the developed nation of the world. There is every reason, for a "huge" technology transfer from the developed nations to the developing ones. This should be given a priority. Rapid growth in the housing sector demand more technical training.

Adequate Role of Information System

The policy makers need to be well informed on the happenings at the grassroots. Development is both bottom up and top-down. Policy makers need to know the need of the people and what impact their policies is having on the masses.

Stemming inflation rates

Government should get firm control over its budgetary spending. The transformation of the agricultural sector is at the heart of feeding the country, to supply food to the market, to produce raw materials and to act as catalyst for small scale industrial growth. The development of indigenous building materials and methods, this will lead to a decrease in the cases of capital flight through foreign exchange.

RECOMMENDATIONS

There are important steps and ways to develop the housing sector and offer required setting for the urban dwellers. Such steps include: the government should de-emphasis the reliance on oil economy through economic reforms in Nigeria, a step the current government is assiduously working on. Encourage technology transfer and training of manpower in modern science and technology. Establish policies and framework to cause the incomes and living conditions of the rural/urban to improve. Empower the masses and to break the shackle and circle of poverty. Eradication of illiteracy and improvement in high rates of literacy and numeracy, those are vital for rapid economic growth. Local investment should be encouraged and small scale industry favoured in policies formulation. Solution to the problem of incessant power outage and development of sustainable or alternative energy sources for the production of industrial scale building materials. The government in Nigeria, both at federal and state level should set up agencies and organs that will oversee wealth creation and job creation. The need to provide basic modern infrastructures in metropolitan centres across the country and natural economic empowerment development strategies should be encourage. The Nigerian government also need to popularise local entrepreneurships among the youth, in order to increase the economic base for wealth creation and sustainable lifestyle. Partnering with international donor agencies and Non-Governmental Organisations (NGO) in the development of rural and urban area in the country will decrease urban-rural migration. This will reduce the pressure on urban infrastructure and mitigate poverty.

CONCLUSION

There is need to strengthen the database and develop a poverty monitoring system which can provide policy makers with regular information in the impact of economic and social policies in the lives of the urban poor. Making land available to the working class and the poor for housing development and encouragement should be given to macroeconomic growth and stability that will revitalize the provision of adequate housing for all.

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Infrastructure Management in Peri-Urban Communities of Developing Nations: A Focus on Akure, Nigeria

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ABSTRACT

Peri-urban communities in developing nations are characterized by non-functioning infrastructure, uncontrolled physical growth, poor building and environmental conditions. As a result of increase in the rate of urbanization especially in cities of developing nations, government must continue to provide infrastructure for more people and in new areas. This paper therefore examines: the management of infrastructure; building and environmental situations in 11 peri-urban communities in Akure, Nigeria. Data were sourced primarily using the questionnaire instrument. The study utilized simple random sampling technique to select 30% of 3,207 dwellings in the communities giving a total sample size of 962. Empirical analysis from fieldwork reveals that, individuals, families and Development Associations (DAs) are substantially involved in the provision and management of infrastructure with limited government coordination. Building and environmental conditions in the communities are very unsatisfactory. A management-cum-institutional framework for effective coordination of activities of all stakeholders is suggested for sustainable peri-urban development in the city.

Keywords: Akure, Developing Nation, Infrastructure, Nigeria, Peri-urbanization

INTRODUCTION

Synonyms of peri-urban areas include: urban fringe, metropolitan fringe, rural-urban fringe, urban-rural interface, the near urban, urban tract, peri-metropolitan, ex-urban, urban hinterland, semi-urban and even sub-urban (Buxton et al, 2006). Peri-urbanization originates from the French word *périurbanization*; used to describe spaces between the city and the countryside, that are shaped by the urbanization of former rural areas in the urban fringe both in a qualitative (e.g. diffusion of urban style) and in a quantitative (e.g. new residential zones) senses (W.J, 2015). Griffiths (2010) defined peri-urban as the rural-urban transition zone where urban and rural uses mix and often clash. In developing countries, peri-urban areas can be broadly characterized as a mosaic of heterogeneous land uses and people but with lack of infrastructure and a deteriorating environment (Olujimi and Gbadamosi, 2007). Most peri-urban areas are sprawled and dispersed development outside of compact urban areas along the periphery of cities, along highways, and along arterial roads connecting a city, due to ad hoc approaches in planning and decision making (Sudhira et al, 2007). Urbanization trend in developing nations has been responsible for influx of population to peri urban zones with its consequent stress on existing infrastructure. This problem is compounded by the actions of individuals, traditional family landowners and landlords associations who are members of Development Associations. These individuals and groups of people are responsible for the management of infrastructure in their various communities.

The management of infrastructure in peri-urban communities of Akure is undertaken without any consideration for collective decision making from the larger community. In the study area, there is a lack of operational coordination among the various individuals, families and Development Associations (DAs). Government involvement in infrastructure provision and management is minimal and in some instances absent. UN Habitat (2003) reported that this trend is detrimental to the larger community by creating environmental degradation, urban sprawl, slum, and diverse natural disasters; and these account for lack of electricity by 50%

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of residents in Africa while about 30% of the houses are not accessible due to poor street layout.

It is now obvious that provision of infrastructure need a coordinated system of supply and management; through the cooperative efforts of all stakeholders in order to ensure a balanced city form and image. Oyesiku (2002) observes that, in physical planning, a rational decision about the use of land is necessary so as to ensure that, services are available, accessible, convenient and efficient. The paper, therefore, examines the role of individuals and families in the provision and management of infrastructural facilities such as roads, drainages and electricity in peri-urban communities of Akure and its resultant effects on both the building and immediate environment.

A SUMMARY OF EXISTING LITERATURE

The provision and management of infrastructure in Nigeria are largely in the hands of the public sector (Adewusi and Akinbogun, 2010). Soyido (1998) reported that the reduction of infrastructure investments over the years coupled with the other factors endemic to the Nigerian public institutions, such as, wastages, mismanagement, fraud, lack of maintenance policies and inept leadership have led to the collapse of most infrastructure in Nigeria urban areas.

Mabogunje (1999) observes that, Nigerian cities are dirty, most insanitary, minimally aesthetically pleasing, least safe and secure and most poorly managed in the world. Adewusi and Akinbogun (2010) concluded that the state of infrastructural facilities in Nigeria is dismal: roads are in very advanced state of disrepair and the maintenance of drainages is completely neglected resulting in poor economic development, frequent accidents, environmental hazards, discouragement of investors and decline in quality of life among the citizenry. FRN (1992) reports that infrastructure in most Nigerian cities are grossly inadequate, erratic and unreliable.

The Asian Development Bank (1997), notes that, peri-urban areas in large and medium cities in Latin America, Asia and Africa are likely to experience huge population growth in the coming years. The effect of this growth is stress on already inadequate infrastructure and aggravated poverty of the population. In Latin America, cities of Mexico and Sao Paulo are losing population in their most important central areas, while distant suburbs (*Peri-urban areas*) experience strong demographic increases (Salas, 1994; Torres, 2002). Haroldo (2008) observes that peri-urban areas in Latin America are not only typically ill-regulated and distant from key employment hubs, but also present appalling sanitation conditions and significant environmental problems, including deforestation and pollution of rivers and streams. The author concluded that in order to tackle peri-urban issues, the quality of government information systems and their data on low income settlements must substantially increase.

In Ghana, the supply of water in the peri-urban zones of Accra is hampered by narrow diameter of pipelines which could not carry the amount of water demanded (Yankson and Gough, 1999). Owusu and Asamoah (2005) concluded that most peri-urban areas of Kumasi do not have basic infrastructure to support sustainable living; this has been attributed to: lack of infrastructure policy and poor funding of infrastructure by SHGs among others.

In Kenya, community-run small-scale water systems play a critical role in supplying and improving access to water services in peri-urban and rural areas. This is largely because municipally-owned water services providers currently supply only 25 per cent of the country's population and 39 per cent of the population within their service areas (World Bank, 2011).

Meera, Purushotthaman & Brook, (2003) concluded that most Indian cities experience infrastructure provision in the form of widened highways in the city core; while the infrastructure problems of peri-urban communities around the cities are not being addressed. For instance most un-tarred roads become blocked during the rains as well as the clogged up sewers, which are not being attended to by any government agency.

In Akure, the focus of government in infrastructure development is on the city core at the expense of the peri-urban areas. Individuals, families and development associations are left uncoordinated by appropriate government agencies to provide infrastructure for roads, drainages, water and electricity. This trend has been responsible for poor street layout, drainage system and associated flooding hazards (Olamiju, 2014).

In summary, the trend in peri-urban communities in Latin America, Africa and Asia is similar: infrastructure problem is very rife; government neglect of infrastructure development is acute; problem of long commuting distance due to poor land use planning are prevalent and; stress on available infrastructure owing to rapid urbanization is ubiquitous.

DATA AND METHODS

Research Locale

Akure is the local government headquarter of Akure South Local Government Area (ASLGA) and the capital city of Ondo state of Nigeria. It is the major town in ASLGA which, situates 204 kilometres east of Ibadan, capital of Oyo state; 186 kilometres west of Benin, capital of Edo state and; 311 kilometres north-east of Lagos (see figure 1).

Since the creation of Ondo state in February 1976, the population of Akure has been growing at an alarming rate. Akure had a population of 38,852 in 1952 which increased to 71,106 in 1963 giving rise to a growth rate of 5.5% per annum (Olanrewaju, 2004). According to the 1991 census count, the population of Akure was 239,124 which was projected by the National Census Board to 269,207 in 1996. The current estimated population of Akure at the annual growth rate of 3.18 is 413,060 (NPC, 2006).

Basically, Akure has an agrarian economy with prevalent low productivity. DPA (1980) observes that, the major industrial activities in Akure are saw-milling and furniture making. Due to its weak economic base, there is high unemployment, low per capita income and poor standard of living, all affecting negatively, the ability of the populace to support urban utilities, municipal services and community facilities.

The land use pattern in Akure is a replica of most traditional *Yoruba* cities which have the Oba's palace, the city market, and the traditional place of worship at the centre of the town. The share of population living in Akure urban areas increased from 20.2 per cent in 1971 to 23.7 per cent in 1981 and to 26.1 per cent in 1991 (Okoko, 2004). Population growth, rise in household income, subsidization of infrastructure investments like roads, ineffective land-use, excessive growth, social problems in central cities and poor land policies are taken to be the main causes of sprawl in Akure (Tofowomo, 2008).

This study looks at private residential layouts in Akure located at the peri-urban zones - a transitional environment of mixed land uses between the city's continuously built up area and its rural hinterland where economic and social activities are directly affected by the expansion of the city (Nwafunpe, 1994). Akure has expanded beyond its original extent in 1980 when a Master Plan was prepared (Figure 1). Figure 2 is the street guide map of Akure showing the peri-urban zones (the direction of the city's expansion) as identified for the purpose of this study. The zones contain residential layouts from which samples of houses were taken.

Peri-urban zones are usually characterized by infrastructure under severe stress as a result of rapid growth in population, inadequate supply of housing units, and improper coordination of physical development (Olujimi and Gbadamosi, 2007). In addition, DPA (1980) reveals that, the existing layouts in Akure were developed contrary to planning regulations, lacking essential facilities such as schools, clinics, play areas, markets, library, places of worship, police post and postal agencies among others. This situation explains the planlessness of land use in Akure and the prevalence of private administration of modern day residential layouts.

Data Base Description

Data was collected through the instrumentality of a structured questionnaire. The simple random sampling technique was used to select 30 percent of houses from 11 peri-urban communities due to homogeneity characterizing the study area (See Table 1)

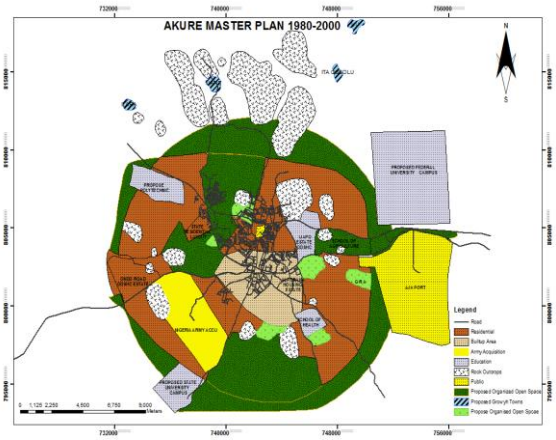

Figure 1: Akure Master Plan (1980-2000)
Source: DPA, 1980 (digitized in AutoCAD by the authors)

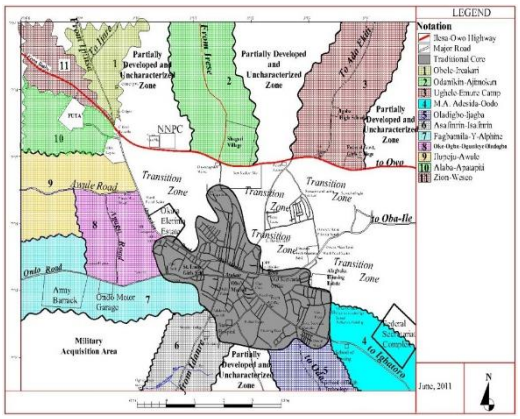

Figure 2: Peri-urban Zones in Akure, Nigeria

Table 1: Sampling in Peri-Urban Zones of Akure

Peri-Urban Zones	Population, (NPC, 2006)	Total Number of Buildings	30 Percent of Buildings
Obele-Ireakari	1,642	59	18
Odanikin-Ajimokun	15,400	550	165
Ughele-Emure Camp	4,835	173	52
Adesida-Oodo	5,052	180	54
Oladigbo-Jigba	1,125	40	12
Asafinrin-Isafinrin	1,958	70	21
OkeOgba-Ogunleye	7,951	286	85
Familugba-Yeosta	24,360	870	261
Ilupeju-Ifelere	2,143	77	23
Alaba-Apatapiti	21,840	780	234
Zion-Wesco	3,480	124	37
Grand Total	**89,810**	**3,207**	**962**

A smaller sample of 5 percent was considered valid and reliable by Ojo (2005), while a 7 percent sample was used by Fasakin (2000) to obtain acceptable results in the study of commercial motorcycles in the transport system in Akure. Houses and people were selected in the sample corridors at regular intervals during the field survey. Table 1 shows sampling in peri-urban zones in Akure. Out of the total number of 962 questionnaires administered, 959 of them were retrieved in useable form giving a 99.97% response rate.

DISCUSSION OF RESULTS

Provision of Infrastructure and Basic Services in Peri-urban Communities of Akure

From Table 2, it is obvious that, 43.6% of respondents believed that, individual landlords were responsible for the provision of infrastructural facilities, while 26.8% admitted that, the families who own residential layouts in the communities were responsible. Twenty-five percent (25%) of respondents said that Development Associations (DAs) were accountable, while only 4.1% held that, it is the government that provides infrastructure in the communities.

Table 2: Sources of Provision of Infrastructural Facilities in Peri-urban Communities of Akure, Nigeria

Source	Frequency	Percent
Individuals	418	43.6
Family Members	257	26.8
Development Associations	240	25.0
Government	39	4.1
Total	**959**	**100.0**

It is apparent that, the involvement of individual landlords and families as well as youths', tenants', and landlords' associations is substantial. An immediate implication of this is a resort to self-help provision of infrastructure that is not coordinated by planning agencies. Interactions with the Development Control Department (DCD) in Akure, confirmed the prevalence of individuals in the provision of infrastructural facilities in the layouts over other sources. In contemporary Nigeria, poverty, corruption in government, lack of environmental consciousness and adequate technology are potent factors responsible for inadequate provision and management of infrastructural facilities in peri-urban communities. Ipso facto, a huge proportion of individuals and families providing infrastructure has led to residential disorderliness in the city. These individuals lack the required environmental education to guide their development efforts. While government at the local or state level provides infrastructure, corruption and lack of requisite technology could also contribute to substandard facility provision. With a master plan prepared in 1980 which lapsed in 2000, Akure lacks good frameworks and policies to guide infrastructure development. The city keeps on expanding haphazardly at the mercy of unprofessional and uncoordinated developers, with un-tarred roads, substandard electricity, haphazard water supply and poor drainage. Efforts of DAs compliment those of individuals in the provision of infrastructural facilities. At present, there exists no coordinating agency for the supervision of the providers of infrastructure in Akure. Adeniyi (2011) concluded that the absence of land use information to guide rational urban development, has led to adoption of personal discretion in city development.

A meager 4.1% of respondents attributed the provision of infrastructural facilities to governments. Some government parastatals such as Power Holding Company of Nigeria (PHCN), Water Corporation and Local Government Councils occasionally visit residents to collect rates on facilities put in place by citizens. This may have accounted for the few who felt that government has anything to do with facility provision and management in the city.

Management of Infrastructural Facilities in Peri-urban Areas of Akure

Table 3 shows the structure of management of infrastructural facilities in peri-urban areas of Akure where 41.3% of respondents stated that individual property owners in the communities are responsible for the management of roads. About 6.1% said family land owners are answerable, while 37.3% and 15.3% attributed facility management to DAs and government respectively. Cumulatively, over 75% of respondents held that individuals, families and DAs are mostly responsible for the management of roads in the communities.

Construction and management of roads are capital intensive. It is however implausible that the onus of road maintenance should shift to individuals and families. The net result is rapid deterioration and even disappearance of poorly constructed roads in residential neighbourhoods in the communities.

As for drainages, water supply and electricity, over 43.9%, 48.8% and 36.7% of individuals in the communities are responsible for facility management respectively. The proportions of respondents stating that families are responsible for the management of these facilities are 6.4%, 10.7%, and 5.4% respectively; while 39.2%, 11.3% and 36.3% attributed management to DAs.

Table 3: Management of Infrastructural Facilities in Peri-urban Areas of Akure

Infrastructure	Managers/Providers								Total	
	Individuals		Families		Development Associations (DAs)		Government			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Road	396	41.3	58	6.1	358	37.3	147	15.3	959	100
Drainage	421	43.9	61	6.4	376	39.2	101	10.5	959	100
Water Supply	468	48.8	103	10.7	108	11.3	280	29.2	959	100
Electricity	352	36.7	52	5.4	348	36.3	207	21.6	959	100

A typical road/drainage facility in the study area is shown in Figures 3 and 4. The drainage facility in Figure 3 varies in quality, width and depth from one building to the other. At certain places, the drainage is covered while at some other places it is left open. In Figure 4, there is no drainage facility on both sides of the road; a building was constructed across the road causing an abrupt dead-end street. This trend is as a result of poor land use planning and lack of coordination of infrastructure provision and management in the city

Figure 3: A Typical Road/Drainage Facility in Peri-urban Communities in Akure, Nigeria

Figure 4: Abrupt Dead-end Road due to Poor Management of Infrastructure

The results show clearly that, individuals, families and DAs are mostly involved in the management of infrastructural facilities in peri-urban areas of Akure, while the involvement of government is limited. The minimal involvement of government is partially due to the operation of few public residential estates (3 in number) to which government is more committed. Government does not see its social responsibility in managing community facilities for social and good governance. Due to this fact, there has emerged a city form, characterized by an array of unplanned areas and pockets of well-planned and maintained estates.

ENVIRONMENTAL AND BUILDING CONDITIONS IN THE STUDY AREA

The environment and building condition in any community is a function of the nature of infrastructure such as roads and drainages. The residential building condition in the study area was measured using the age of building; type of toilet facility; location of bathroom and kitchen in the building; and type of access to the building, (see Table 4); while the environmental condition was measured using the following variables, namely: waste disposal method, sources of domestic water supply, type of drainage facility, and type of landscape around buildings, (see Table 5).

Building Condition

From Table 4, the mean age of buildings in the study area is 35years. Buildings above the age of 40years constitute about 36% of the total number of buildings. This trend shows that buildings in the study area are relatively old. Majority (45.6%) of respondents use pit latrine; 30.2% defecate in surrounding bushes; just 12.8% uses water closet systems in their houses; while a meagre 6.0% uses bucket latrine. Respondents without any form of toilet facility in their building constitute about 5.4%. This phenomenon shows that over 40% of respondents will end up using surrounding bushes as toilets, thus denigrating the environment.

Bathroom is another crucial housing facility; its availability and location of in a building has its impact on the general environmental condition of that building and the community at large. From Table 4, about 41.1% of respondents have their bathroom located within the buildings, while 34.3% have their bathrooms located outside their buildings. Buildings without bathroom constitute about 24.1%. The implication is that since bathrooms outside the building have no soak-away-pits, the building environment is messed up with bath water constituting blot on the landscape and defaming the environment.

Only 24.7% of respondents have their kitchens located within buildings; 51.7% cook outside their buildings while 23.6% use the building lobbies and verandas for cooking. It is pertinent to note here that those who cook outside use firewood as source of energy, while those who cook at lobbies and verandas use kerosene stove. The implication is that about 50% and 20%

of respondents experience air pollution within and outside the building environment respectively. No safe place!

From Table 4, based on the type and condition of housing facilities in the study area, 3.7% of buildings were considered as 'very good'; 43.9%, 'good'; and 12.5%, 'fair'; while 47.6% and 1.3% as 'poor' and 'dilapidated' respectively.

Table 4: Residential Building Conditions in Akure

Age of building	**Freq.**	**%**
-Below 10 years	128	13.3
-10 – 19 years	106	11.1
-20 – 29 years	130	13.6
-30 – 39 years	252	26.3
-40 years and above	343	35.7
Mean=35		
TOTAL	**959**	**100.0**
Type of Toilet Facility	**Freq.**	**%**
-Water closet	123	12.8
-Bucket Latrine	57	6.0
-Pit Latrine	437	45.6
-Bush/dunghill	290	30.2
-None	52	5.4
TOTAL	**959**	**100**
Location of Bathroom	**Freq.**	**%**
-Indoor (self-contained)	151	15.8
-Indoor (Shared)	243	25.3
-Outdoor (Covered)	127	13.2
-Outdoor (Open air)	202	21.1
-Not Available	236	24.6
TOTAL	**959**	**100.0**
Location of Kitchen	**Freq.**	**%**
-indoor (Self-contained)	122	12.7
-Indoor (Shared)	115	12.0
-Outdoor (Covered)	272	28.4
-Outdoor (Open air)	223	23.3
-Lobby/Veranda	227	23.6
TOTAL	**959**	**100.0**
Condition of Building	**Freq.**	**%**
-Very good	36	3.7
-Good	335	34.9
-Fair	120	12.5
-Poor	456	47.6
-Dilapidated	12	1.3
TOTAL	**959**	**100.0**

Environmental Condition and Urban Basic Services in Akure

From Table 5, it is evident that about 12.2% of respondents use dustbin/controlled tipping for disposing solid waste; while 13.7% dispose refuse through burning. About 50.9% and 23.2% dispose their wastes in dunghills and stream/drainages respectively. From the data presented, it is evident that air/environmental pollution and flooding hazards cannot dissociate from the communities. This trend was documented by Dauda and Osita (2003), Oso and Taiwo (2004), who concluded that considerable percentage of urban waste in Nigeria are deposited along streets, roads/road sides, unapproved dump sites, water ways, and drainages or in open sites. The resultant effect of these 'management' options do not only reduce scenic resources, and environmental friendliness; dump sites are a form of nuisance and breeding ground for

mosquitoes, pests and disease outbreaks such as cholera, diarrhoea etc. (Ulloa et al, 2003; Mosler etal, 2006; Okoya and Ogunkoya, 2009; and Oyelola et al, 2009)

Table 5: Existing Environmental Conditions in the Study Area

Waste Disposal Method	**Freq.**	**%**
-Dust bin/controlled tipping	117	12.2
-incinerating/burning	131	13.7
-Nearby Bush/dunghill	488	50.9
-Stream/drainage	223	23.2
Total	959	**100.0**
Water Supply Sources	**Freq.**	**%**
-Public tap	50	5.2
-Closed well	148	15.4
-Open well	246	25.7
-Rain	338	35.2
-River/Stream/Pond	177	18.5
Total	**959**	**100.0**
Drainage Type	**Freq.**	**%**
-Concrete Block	142	14.8
-Concrete Cast	40	4.2
-Piped	23	2.4
-Earth	450	46.9
-None	304	31.7
Total	**959**	**100**
Landscape Condition	**Freq.**	**%**
-Planted with Grass and Trees	94	9.8
-Paved	288	30.0
-Bare	430	44.8
-Overgrown with Bushes	147	15.4
Total	**959**	**100**

The source of water supply is another variable crucial to the health of residents in the study area. Table 5 shows that residents' sources of water supply include: public tap, 5.2%; closed well, 15.4%; open well, 25.7%; rain, 35.2%; and river/stream/pond, 18.5%. Most residents in the communities got water for domestic uses (including drinking) from open wells, rainfall and river/stream which the WHO/UNICEF (2006) classified as unprotected sources. This trend is dangerous to the health of residents as they are vulnerable to scourge of sicknesses and diseases due to use of poor and sub-standard facilities (Health Canada, 2008).

The availability and type of drainage facility is another determinant of environmental condition in the study area. Table 5 shows that 14.8% and 4.2% of respondents respectively identified concrete block and concrete cast as the type of drainage facility available in the study area; while piped and earth drainages were identified by 2.4% and 46.9% of respondents respectively. A considerable number (31.7%) of respondents said there was no form of drainage facility in their communities.

From the analysis, it is clear that less than 20% of drainage facilities in the study area are in good condition. The remaining 80% is either very bad or not available. The implication is that the area will be susceptible to erosion and flooding hazards which degenerates the environmental landscape.

The type of landscape around buildings was examined as they are fashioned by the character of roads and drainages in the community. A few (9.8%) of buildings were planted with grass and trees; while 30.0%, 44.8% and 15.4% of building surroundings are respectively paved, bare and overgrown with bushes. It is obvious that paved surfaces increase the volume and

speed of runoffs; bare surfaces are susceptible to erosion and; bushes around buildings are breeding grounds for mosquitoes and other dangerous insects and pests. It is therefore apparent that less than 10.0% of buildings in the study area are safe and liveable. The reason for this situation can be found in the words of Ofomata (1984) that the people are passive and apathetic to plans aimed at combating soil erosion; they are unwilling "to adopt the procedures deemed necessary to heal the land". The author concluded that the main reasons for the observed failures of past attempts to combat erosion in residential communities included: lack of communication between the Government and the people; inadequate knowledge of the environment, and exploitative excesses of the people (Ofomata, 2000).

CONCLUSION

Individuals, families and Development Associations have been identified, in this paper, as the sources of provision and management of infrastructural facilities in peri-urban communities in Akure. The facilities examined included roads, drainages, electricity and piped water supply. The sanitary condition of buildings and the environment were equally examined as they reflect the state of infrastructure in any society Eleven peri-urban communities were identified and samples were taken from each based on the number of buildings in them. The simple random sampling method was employed to interview 959 respondents using a structured questionnaire. Results from the data collected show that, individuals and families are majorly responsible for the provision and management of infrastructural facilities in peri-urban communities in the city. The building and environmental conditions in the study area is adjudged to be very poor, which have been responsible for urban sprawl, environmental pollution, deterioration, and general urban decay.

This paper recommends that, for effective provision and management of infrastructural facilities in peri-urban communities of Akure, there is a need for government to see both as a social responsibility. Consequently, government should at least increase its involvement to: 100% on road and drainage because of the huge capital outlay involved and for the sake of uniformity and aesthetics; 60% on water and 80% on electricity provision for the purpose of Private-Public-Partnership; leaving the rest to individuals and CBOs (see Table 3). There is need for a calculated coordination of activities of citizens to concord with development proposals (if any) for the city. This recommendation becomes critical as more than 95% of residential layouts in the peri-urban communities of Akure are owned and controlled by private individuals (Olamiju, 2014).

Specifically, each community in the study area should form a Peri-urban Development Committee (PDC) to be registered with the State Ministry of Physical Planning and Urban Development. Members of the Committee should include selected members of building owners and tenants headed by a Development Control Official from the State Ministry of Housing and Urban Development. The function of this Committee shall be to guide and coordinate the activities of individuals and families embarking on any infrastructural facility development in line with set standards for facility provision and management. This may call for the review of the city master plan and relevant development regulations for Akure.

In addition, there is the need for provision of quality housing and hygienic environment. To achieve this, extensive redevelopment and upgrading programmes through the provision of urban basic services are essential in the communities. Priority should be given to provision of portable water, solid waste disposal facilities, and proper maintenance of drainages. Sanitary inspections should be regularly carried out on provision of household facilities with the enforcement of environmental sanitary laws. Adequate funding should be given to Waste Management Authority for effective service as well as improved health facilities in the

communities. Public enlightenment and Environmental Education (EE) would be necessary to keep the people well informed about the importance of healthy and hygienic environment.

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A Survey on Social Studies Teachers' Opinion on Factors Inhibiting Successful Implementation of Millennium Development Goals in Nigeria

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ABSTRACT

Nigerian governments over the years have devised measures in the form of policies and programmes aimed at fulfilling their social contracts with the Nigerian populace by providing basic social services and to generally improve their lots. The study surveyed "Social Studies Teachers' Opinion on Factors inhibiting successful Implementation of Millennium Development Goals (MDGs) in Nigeria". The study used survey research design and utilized 114 male and female teachers as sample for the study basing the decision on Research Advisors' (2006) sample size table. The study employed purposive sampling technique to select the sample. However, the study used questionnaire titled "Teachers Opinion on Implementation Factors on Millennium Development Goals (TOIFMDGs). The study was guided by one (1) objective, answered one (1) question and tested one (1) null hypothesis. The data analysis tools were percentage and frequency counts, mean and standard deviation and independent sample t-test respectively. The study rejected the null hypothesis at 0.05 alpha and 95% confidence level. The study discovered significant difference on account of gender of social studies teachers on their opinion about factors inhibiting successful implementation of Millennium Development Goals in Nigeria. In the light of the findings made by the study, it is recommended as follows; the need for project and programme continuity, planning implementation of home-grown policies that explains the reality on ground in Nigeria, the need to stamp out corruption and mismanagement in the business of governance among others.

Keywords: Factors, Implementation, MDGs, Opinion, Social Studies

INTRODUCTION

The MDGs are a United Nations development strategy that targets poverty reduction in all its ramifications as against prescriptions usually foisted on Nigeria by its development partners that seek growth at the expense of equity and development. The MDGs share the realism that development is about poverty reduction and once the people notice that development is targeted at them, their commitment will become easy to exploit and sacrifice for its success genuinely assured. In this vein, Bello & Suleiman (2011: ix) state that:

> *The Millennium Development Goals (MDGs) comprised eight ambitious goals that were approved by world leaders in 2000. The goals are to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality rates; improve maternal health; combat HIV/AIDS, malaria and other diseases; ensure environmental sustainability; and develop a global partnership for development. The first seven goals are meant for developing countries while the eighth goal is for the developed countries to meet their obligations.*

In a related development, Imoudu (2012) observes that with the right policies and choices, domestic resources can be more effectively mobilized, capital flight minimized and consequentially, the economy can be strengthened as the capabilities of the people are channeled to the cause of development.

Nigerian governments over the years have devised measures in the form of policies and programmes aimed at fulfilling their social contracts with the Nigerian populace by providing

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basic social services and to generally improve their lots. These development plans ranges from short-term, medium-term and long-term plans. Some of these plans introduced over the years include but not restricted to the following; Operation Feed the Nation, Green Revolution, Mass Mobilization for Social Justice and Economic Recovery (MAMSER), Family Economic Advancement Programme (FEAP), Family Support Programme (FSP), Better Life for Rural Women, National Economic Empowerment and Development Strategies (NEEDS), The Seven Point Agenda, The Transformation Agenda among others. These policies and programmes hardly translate into practical reality as a result of some teething socio-economic and political challenges facing the country over the years.

It has been claimed that Nigeria has often formulated good policies but these get bungled at the implementation stage, Eminue (2005). Universally, Nigeria is widely acknowledged for her effective planning in terms of policies and programmes but the problem has always been the implementation. Some of the Nigeria's policies and programmes have been accused of being imported and therefore lack direct bearing with the reality on ground. Examples of such programmes are the Vision 20:2020, and the Millennium Development Goals (MDGs). Some critics have considered these policies and programmes as diversionary tactics aimed at derailing Nigeria from the current situation and realities on ground by her detractors.

However, despite the skepticism by critics on Millennium Development Goals, quite a number of Nigerians believed that well implemented MDGs will assist in improving the lots of Nigerians. Available literatures have identified some of the problems inhibiting successful implementation of Millennium Development Goals in Nigeria. These challenges facing Nigeria in her quest to attain MDGs are slow growth prospects; resource constraints; lack of institutional reforms; inadequate capacity development; uneven income distribution; global economic situation; lack of political will and commitment to the MDGs; lack of an enabling environment to attract investment and encourage private sector development; and the lack of inclusive growth among others. It is against this background that this study examined the factors inhibiting successful implementation of Millennium Development Goals (MDGs) in Nigeria through the perspective of social studies.

Objective of the Study

The main objective of the study was to examine the Opinion of Social Studies Teachers on Factors Inhibiting Successful Implementation of Millennium Development Goals (MDGs) in Nigeria. The study was guided by the following specific objective:

i. To determine whether gender has influence on Social Studies Teachers' Opinion regarding factors inhibiting successful implementation of Millennium Development Goals in Nigeria.

Research Question

The study was guided by the following question:

i. Does gender affects the opinion of social studies teachers on factors inhibiting successful implementation of Millennium Development Goals in Nigeria?

Null Hypothesis

The study postulated and tested the following null hypotheses at 0.05 Alpha:

i. Gender has no influence on the opinion of social studies teachers regarding factors inhibiting successful implementation of Millennium Development Goals in Nigeria.

METHODOLOGY

Descriptive survey research design was adopted for this study. The survey attempts to examine the existence or occurrence of phenomenon or variable. It is usually employed by collecting

data and describing in systematic manner the characteristic features or facts about a given population from a few people or items considered to be representative of the entire group, Akuezuilo & Agu (2002).

The design corresponded with motives of the study which seeks to examine the Social Studies Teachers' Opinion on Factors Inhibiting Successful Implementation of Millennium Development Goals (MDGs) in Nigeria. The study has the entire social studies teachers in the study area as population. The study was delimited in scope to Zaria Education Zone Kaduna state-Nigeria. The collection and retrieval were done simultaneously. The study retrieved 114 questionnaires that were distributed through purposive sampling technique. The four point modified Likert scale questionnaire titled "Teachers Opinion on Implementation Factors on Millennium Development Goals (TOIFMDGs) was used as data collection instrument. The inferential statistical techniques were used in the analysis of the data. The Mean and standard deviation were used to answer the question raised by the study. Moreover, t-test independent sample statistic was used to test the null hypothesis postulated by the study at 0.05 alpha level of significance.

RESULTS AND DISCUSSIONS

Presented below are quantitative and qualitative answers provided for the question raised by the study. The frequency table, mean standard deviation and standard error were used as statistical tools to answer the question raised.

Research Question 1: Does gender affects the opinion of social studies teachers on factors inhibiting successful implementation of Millennium Development Goals in Nigeria?

Table 1.1: Female and male students view regarding the opinion of social studies teachers on factors inhibiting successful implementation of Millennium Development Goals in Nigeria

Factor Inhibiting Successful Implementation of Millennium Development Goals	Male		Female	
	Mean	SD	Mean	SD
Pervasive corruption	3.56	1.42	4.27	0.99
Lack of policy/project continuity	3.08	1.16	3.16	1.21
Lack of political will and commitment to the MDGs	2.34	1.19	3.19	0.52
Inadequate capacity development	2.94	0.82	2.70	1.02
Non diversification of economy	2.66	1.21	3.24	1.14
Global economic situation	2.81	0.81	2.79	0.82
Lack of institutional reforms	2.79	0.85	2.73	0.80
Lack of an enabling environment to attract investment and encourage private sector development	2.77	0.74	2.34	0.91
Lack of inclusive growth	2.56	0.73	3.19	1.07
Slow growth prospects	2.61	0.91	3.03	0.83
Misplacement of priorities	2.61	0.69	3.00	0.91
Resource constraints	2.68	0.75	2.87	2.56
Uneven income distribution	2.87	0.89	2.43	0.84
Poor and ineffective leadership	3.03	0.90	3.51	1.26
Cumulative mean	**2.808**		**3.03**	

Decision mean 2.50

The table 1.1 above shows the mean opinion of social studies teachers on factors inhibiting successful implementation of Millennium Development Goals in Nigeria. The response of male and female teachers regarding their opinion on factors inhibiting successful implementation of Millennium Development Goals in Nigeria was positive but diverse. This was due to the fact that their cumulative mean responses of 2.808 and 3.03 for male and female teachers respectively were higher than the decision mean of 2.50.

On the other hand, the male respondents' highest mean responses were M3.56 (pervasive corruption), followed by (lack of policy/project continuity) M3.08 and (poor and ineffective leadership) M3.03 respectively. On the part of the female respondents, their highest mean responses were M4.27 (pervasive corruption), (poor and ineffective leadership) M3.51 and non diversification of economy M3.24 respectively.

On the contrary, other items on the questionnaire that were not favoured by the teachers responses were (lack of political will and commitment to the MDGs) M2.34, on the part of male respondents and (uneven income distribution) M2.43, (lack of an enabling environment to attract investment and encourage private sector development) M2.34 for female teachers respectively. This was because their individual mean responses fall below the decision mean of 2.50. The table above shows the response pattern of male and female teachers arranged from highest to the lowest mean response.

Hypothesis Testing

H_{01}: Gender has no influence on the opinion of social studies teachers regarding factors inhibiting successful implementation of Millennium Development Goals in Nigeria.

Table 1.2: Independent t-test statistic on the opinion of social studies teachers regarding factors inhibiting successful implementation of Millennium Development Goals in Nigeria

Variable	Gender	N	Mean	S.D	Df	t-cal.	t-crit.	P (sig)
Opinion of Social Studies Teachers on Factor Inhibiting Successful Implementation of Millennium Development Goals	Male	77	95.8442	9.86096	112	2.172	1.96	0.032
	Female	37	99.8919	8.04081				

P < 0.05, t calculated > 1.96

Table 1.2 shows that significant difference exist between male and female respondents on Factor Inhibiting Successful Implementation of Millennium Development Goals in Nigeria reason being that the calculated p (sig) value of 0.032 is less than the 0.05 alpha level of significance while the calculated t-value of 2.172 is higher than the t-critical value of 1.96 at df 112. The mean scores were 95.8442 and 99.8919 for male and female respectively. Therefore the null hypothesis which states that "there was no significant difference between the opinions of social studies teachers on factor inhibiting successful implementation of millennium development goals in Nigeria" is rejected.

Major Findings

The study discovered the following:

i. There was significance difference between the views of male and female teachers on the factors inhibiting successful implementation of Millennium Development Goals in Nigeria.
ii. Pervasive corruption, lack of policy/project continuity, poor and ineffective leadership were the major factors inhibiting the successful implementation of Millennium Development Goals in Nigeria as identified by male social studies teachers.
iii. Pervasive corruption, poor and ineffective leadership, non diversification of economy were the major factors inhibiting the successful implementation of Millennium Development Goals in Nigeria as identified by female social studies teachers.
iv. Lack of political will and commitment to the MDGs, Uneven income distribution, lack of an enabling environment to attract investment and encourage private sector development were rejected as factors inhibiting successful implementation of

Millennium Development Goals in Nigeria as identified by male and female social studies teachers.

Discussion of Findings

The pattern and nature of policy implementation is said to be the major explanation for the failure or success of any given policy in Nigeria and many African countries. In this regard, Nwankwo and Apeh (2008) opined that the implementation of a policy is the most crucial stage in the policy process as it is at this stage that determines the success or failure of any policy. Similarly, Ikelegbe (2006) and Nweke (2006) noted that many policy failures result from ineffective implementation. The views presented by the above authorities corroborate the findings of this study which identifies lack of project/policy continuity and poor plan implementation as major setback in Nigeria's effort to attained Millennium Development Goals. The problem of poor plan implementation and policy/project continuity not only affects Nigeria as a nation but majority of African countries and the Third World.

In a related development, Egonmwan (1971) opined that implementation in developing countries (Nigeria inclusive) often turns out to be the graveyard of policy where the intentions of the designer of policies are often undermined by a constellation of powerful forces of politics and administration in cooperation with people. Little attention is paid to the subject of policy implementation by policy decision makers while it is often taken for granted that once a policy is adopted by government it must be implemented and the desired goals achieved. The above hitch has often resulted in poor policy implementation, which, in effect, gives rise to implementation gap. There is policy failure when there is a sizeable gap between a policy decision and its implementation.

The Nigeria's House of Representatives some years back has threatened to stop financial allocation to any Ministry or Parasatals that has failed to implement the MDGs (Vanguard 2009). The real challenge that militates against the realization of the MDGs is those of policy implementation because adequate budgetary allocations have been made by the government. Furthermore, the implementation of MDGs has been characterized by deeply entrenched corruption and gross inefficiency, and wastefulness. To buttress the above points of view, the Senate report on MDGs described the MDGs office as a "cesspool of corruption and shady deals, (The Guardian (2009). Corruption has been a major problem because "it makes the country unattractive to investors as it raises the cost and risk of doing business in the country" (UNDP, 2004). In addition, there is the problem of duplication of projects in the same areas by the Federal Government, and multilateral donor agencies. Pervasive corruption tops the respondents' ranking as single most important factor that hinders Nigeria's quest to attain Millennium Development Goals. It must be noted that corruption goes with power and therefore, must be located first within the ranks of the powerful Egonmwan (1991). Since independence, corruption has been a major source of cost escalation of government projects. Government contracts in Nigeria have always been a conduit pipe for making fast and easy money by government officials and contractors through dubious means. Another critical factor inhibiting effective implementation of policies in Nigeria is that some agencies or institutions saddled with the responsibility of implementing given policies do not possess the requisite manpower and financial resources to effectively implement them. On the issue of inadequate resources, for instance, Government, sometimes, do not budget adequately to enable the public bureaucracy properly implement formulated policies, Ikelegbe (2006) and Dick (2003). The current war against corruption by the Buhari/Osibanjo administration has started yielding positive results as sanity in the public and even the private sectors is restoring. The Nigeria's image in the eyes of other countries especially the western world is

improving. There is a slight improvement in Nigeria's ranking on corruption perception index in 2015 compared to 2014.

Another cause of implementation gap is the failure of the policy makers to take into consideration the social, political, economic and administrative variables when analyzing for policy formulation. A policy that runs contrary to the manifesto of the government in power may suffer at the implementation stage because it may lack support, both financial and administrative. Also, failure to take the economic variable into consideration may also spell doom to policy implementation.

Moreover, Egonmwan, (1991: 213) states that apart from the ego problem which sometimes culminates in lack of continuity as explained above, it should be noted that for policies to be successful they should involve target groups and they should allow for participatory system, whereby policy makers plan with the people rather than for the people in meeting their felt needs. Such participation will give the target groups a sense of belonging as well as get them committed to the successful implementation of the policy.

Additionally, Igbuzor (2011) observed that there were capacity constraints by the public sector, private sector and civil society and the challenge of coordination between the three tiers and arms of government as factors inimical to successful implementation of millennium development goals in Nigeria. Another issues that has confronted efforts at development in Nigeria is overconcentration on economic reforms/transformation and neglect of political and social reforms/transformation.

Nigeria tends to over indulged in over ambitious policies either owing to the desire to establish support base and legitimacy for government to bring about economic development or to serve ideological ends. Such policies cannot work as they will lack adequate financial, manpower, technical resources, institutional and organizational capabilities and the necessary political will for implementing such fundamental policies, Eminue (2005).

Indeed, most policy making goals in Nigeria are subordinated to the personal rewards and interests of the political leaders and their colleagues with the result that a policy is judged more on its political merits with the real development need rarely factored into consideration. For these, most policies in Nigeria are either inappropriate or lack well defined objectives and programmes for their effective implementation. In this regard, Okoli and Onah (2002) state that implementation of policies in Nigeria take the form of "learning process" or "trial and error". Indeed, in Nigeria there are usually no comprehensive policy standards and objectives to guide the bureaucracy in its policy implementation activities and procedures, Makinde (2005). Sometimes the implementation guidelines are rarely considered as a result of vested interest and lack of adequate monitoring and evaluation.

CONCLUSION

The study has to a reasonable extent examined the Opinion of Social Studies Teachers on Factors Inhibiting Successful Implementation of Millennium Development Goals (MDGs) in Nigeria and by extension Africa and the Third World countries. So far, the Nigerian government score sheet is unimpressive if situations on ground are anything to go by. The deadline for the attainment of these goals has expired in 2015. The findings indicate some teething issues and problems that hinder Nigeria's effort to realize the MDGs goals in Nigeria. These issues and problems must be addressed tactically and effectively in order to ensure the attainment of other future Developmental Plans likes vision 20:2020 and Agenda 2063.

RECOMMENDATIONS

In the light of the findings made by the study, it is recommended as follows;

i. The need to stamp out corruption and mismanagement in the business of governance in Nigeria. This will go a long way in sanitizing the system;
ii. The need for project and programme continuity. Governments at all levels should as a matter of importance continue with laudable projects and programmes initiated by other governments. Laws should be enacted to enforce project/programmes continuity;
iii. Planning and implementation of home-grown policies that explains the reality on ground in Nigeria should be promoted;
iv. The Nigerian government should strive to diversify it economy. This is because no country can attain development on single commodity.
v. There is the need for Nigerian electorates to set aside all sorts of sentiment and insist on visionary and transformative leaders who have the ideas and know-how to take the country to the Promised Land.

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Assessment of Local Government Council and Community-Based Development Associations in the Provision of Infrastructure in Ilawe-Ekiti, Nigeria

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ABSTRACT

In the contemporary world today, a nation develops through the provision and maintenance of infrastructural facilities that facilitate and promotes socio-economic development as well as supports urban and rural dwellers in their production, distribution, and consumption activities. The purpose of the study was to classify the existing infrastructure according to ownership and to assess their conditions. This study adopted the survey research method and used three different questionnaires to collect research data from the authority of the Ekiti South-West LG Council, Community Development Unit in-charge of Community Development Projects in Ekiti South-West LG Council, and the officials of the available 61 (CBDAs) in the study area. The findings revealed that provision of urban infrastructure by the LG Council and CBDAs has helped in enhancing the living conditions of the people to some extent; those infrastructural facilities include: road construction, water supply, electricity power supply, and healthcare centres/hospital. However, the condition of some facilities in the town was dilapidated and had not been adequately maintained, which is affecting the level of patronage of these facilities. The findings among others revealed that the area was faced with the problems of low level patronage of services and infrastructure; inadequate funding resulted into low level of provision of social facilities. The recommendations called for the need to improve infrastructural facilities capacity through provision and maintenance; encourage people's participation in the conceptualization and implementation of infrastructural projects.

Keywords: Community-Based Development Association, Infrastructure, Local Government Council, Provision

INTRODUCTION

The world is increasingly urbanizing and the growth of cities is becoming alarming. A United Nation Report noted that in 2005, the World's urban population of 3.18 billon people constituted 49% of the total population of 6.46 billion. The urban areas are growing fast and, consequently, the urban infrastructural facilities have to meet the needs of rapidly increasing users. These problems of inadequate urban infrastructure are more evident in the traditional core of the cities and other settlements that accommodate the poor (Ayoola and Ogundiran, 2014).

The United Nation report predicted that the urban population would grow to 6.4 billion by 2050, and it also estimated that Africa's urban population at 2025 would be 54 % of the population, while total African population is projected to almost two billion by 2040 (United Nation,2013). In Nigeria, according to the World Health Organization / United Nations Children's Fund, between 1990 and 2004, urban population growth had increased from 35% to 48%, which was estimated at 170 million people in 2014. The increasing level of urbanisation and the inadequacy of urban infrastructure in Nigeria were reported by various urban analysts (Agbola 1994, Mabogunje 2001, and Olujimi 2009). Urbanisation is a global phenomenon and is a process of spatial concentration of urban population. The urban areas and cities serve as the engines of economic development. On the other hand, poor infrastructural facilities provision is evident in most cities in Nigeria and this has a serious effect on the quality of life of the residents. The poor state of most urban facilities has created health, social and economic problems. Okpoechi (2010) has highlighted that a good urban

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infrastructure does not only improve the general appearance of the cities but also have effects on the mental health of the people who live, work and visit cities.

Infrastructural facilities development is at critical stage in the world today. Countries of the world ensure the provision of infrastructure to improve the livelihoods of their citizen and their qualities of life (Khoza, 2009). Infrastructure plays a key role in both socio-economic and political development and enrichment of living standards. The shift from focus on construction of infrastructural facilities to the delivery of infrastructure facilities drew the attention of so many countries in Africa, particularly, Nigeria to focus on the provision and delivery of infrastructural facilities especially at the local level. A study conducted by Udoh (2010) revealed that less than 40% of the population has access to safe drinking water. Access to infrastructure such as; safe water supply, electricity and roads are necessary to reduce vulnerability and poverty in Nigeria. Urban infrastructural facilities development that need be provided should include among others, good roads, electricity, schools, portable water supply and drainage networks. The depleting conditions of these services in Nigerian urban areas are of great concern to the Local Government Council Authorities, Community-Based Development Associations, and other agencies. Governments have come to term with the LG for the need to be involved in grassroots development. However, the establishment of LG Councils in Nigeria aimed among others to facilitate rural and urban development through infrastructure development and delivery (Sehinde, 2008). The LG Council is statutorily empowered to construct and maintain roads, street lighting, water and drains and provide other public facilities (Federal Government of Nigeria, (FGN) 1999). The recognition and importance of this process is to tackle local socio-economic problems and to manage grassroots development (Wunsch, 2001). Despite these provisions, lack of adequate, affordable and reliable infrastructure services still touches the life of urban and rural Nigerian family everyday, water supply is neither safe nor adequate for their needs, and many roads are impassable. Sehinde (2008) concluded that in Nigeria, the overriding impression is that LG Councils are weak in their response to the challenges posed by the infrastructural development. This has led to self-help programmes through which private sectors are now involved in infrastructural facilities development. The CBDAs form one of the main actors of the Local Economic Development (LED) process. They have been responsible for the provision of communal facilities such as schools, markets, water points, health clinics or health centres and town or community halls. (Emmanuel, 2013). In view of these encouraging roles, this study assesses the effects of the efforts of the LGC and the CBDAs in the provision of infrastructure.

Problem of the Study

Infrastructure facilities play a crucial role in the socio-economic development which supports urban and rural dwellers in their production, distribution, and consumption activities as well as promoting socio-economic development in any area. Infrastructure facilities also play a significant role in the modernization and growth of agricultural productions, incomes and increase in employment opportunities for the inhabitants. Their development is an important tool in the socio-economic development of any given settlement. However among the thirteen (13) natural resources available in the world, Nigeria has twelve (12) of them, yet the country (Nigeria) is still faced with problems of inadequate/lack of infrastructural facilities which have brought about poverty, rapid urbanization and high crime rate. Olayiwola (1998) has confirmed that many people are living below poverty line because they do not have access to basic infrastructural facilities. The provision and maintenance of infrastructure and services is essential for the promotion of the efficient operations of a settlement in safeguarding health, protecting the living environment and enhancing the general standard of living (Soyibo, 1999).

Infrastructure relates to the aggregates of all facilities that allow a society to function effectively. As stated by Okwakpam (2010), human needs are insatiable and the government alone cannot meet them. In recent times, various efforts have been made by government. One of the strategies being employed to enhance development is through grassroots participation in development process. Government has come to terms with the need to partner with the LG Council and CBDAs as agents (or institutions of development) in addressing shortage in infrastructural facilities. In Ilawe-Ekiti, the most prevalent problems are lack of portable water supply, inadequate healthcare facilities, incessant power failure (electricity), inadequate and poor state of the existing schools, and poor conditions of the roads. This study assesses the LG Council and the CBDAs in the provision of infrastructure in Ilawe-Ekiti, with a focus on (i) Water supply (ii) Health care facilities (iii) Electricity, and (iv) Roads. However, the objectives to achieve include:

i. classification of existing infrastructures according to ownership and conditions in the study area;
ii. highlighting the existing functioning infrastructural provided for the people on the basic of wards in the study area.
iii. highlighting the effect of infrastructure on the living conditions of the people in Ilawe-Ekiti

RESEARCH METHODOLOGY

The survey research method was adopted for this study. The target population is classified into four (4) groups; Ekiti South West LGC, Community Development Unit in-charge of community development projects in the area, Community/Quarters-Heads in the study area and CBDAs in Ilawe-Ekiti. A Non-probability sampling approach was employed for use in this study. It is carried out when the researcher is not concerned about the representativeness of sample. In this study a total census (i.e 100% coverage) survey was conducted on all the 61 (CBDAs). Meanwhile, only the President/Chairman/Secretary per CBDAs was interviewed. One copy of the relevant questionnaire was administered to the Ekiti-South West LGC Caretaker Chairman. Also one copy of the questionnaire was designed for the official in-charge of the Community Development Project Unit in the LG Council office was administered to him. Data were collected with the aid of structured-multiple choice questionnaire. It consists of sixty-one (61) questions which were set to elicit specific information from the respondents. This study employed the use of four sets of questionnaire for data collection. In this study, the researchers in conjunction with the three (3) Field Assistants administered the questionnaires. Students from Crown Polytechnic Odo, Ado-Ekiti, Department of Urban and Regional Planning, were used. The data collected from the field were collated and analyzed to give meaningful information. The processing of data was carried out using the Statistical Package for Social Sciences (SPSS) version 19. The analysis of data was done, using frequency count; distribution and such information were presented through the use of tables, and percentages.

RESULT AND DISCUSSIONS

In this section, discussion of the findings were based on the research objectives as follows:

The Existing Roads Constructed in Ilawe-Ekiti

Road construction was mostly carried out by the government while CBDAs involvement and individual efforts on road construction projects were not reflected. Roads were constructed in Aaye, in 1991; Okebedo I, in 1990; Adin, in 1984; Oke-Emo, in 1990; and Okepa/Iro/Okeloye, in 1985. Findings revealed that there were no newly constructed roads in Ilawe-Ekiti. The Government embarked on opening up (i.e. bulldozing) and

rehabilitation/upgrading of roads in the town; however the criteria used in assessing the condition of the roads were based on perception. Findings further revealed that the roads lack drainage and are grossly inadequate.

Table 1: The Existing Roads Constructed in Ilawe-Ekiti as at, 2015

S/N	Wards/Location	Ownership	Length of Road	Year of Establishment	Condition
1	Aaye	Government	-	1990	Fair
2	Okebedo I	Government	1..35km	1990	Bad
3	Adin	Government	-	1984	Good
4	Oke-Emo	Government	-	1990	good
5	Okepa/Iro/Okeloye	Government	0.85km	1985	Fair

The Provision of Water Supply in Ilawe-Ekiti

The analysis in Table 2 shows that ownership of water supply project in Ilawe-Ekiti was by the government, the Community and the individual. Findings revealed the provision of water supply was mostly carried out by the Government and the Community; they provided water supply i.e boreholes in all wards in Ilawe-Ekiti. Provision of water by individuals in the town is limited to wards in Aaye, Okebedo 1, Okepa/Iro/Okeloye, Oke-Emo and Okepa/Iro/Okeloye. Based on the findings, it was revealed that water supply in Ilawe-Ekiti is in a terrible condition and grossly inadequate. However it's characterized by low level of coverage and difficult geology.

Table 2: Existing Sources of Water Supply in Ilawe-Ekiti as at, 2015

S/N	Types	Wards/Location	Ownership	Year of Establishment	Condition
1	Borehole	Aaye	Government	2007, 2009, 2013	Functional
	Borehole		Community	1995, 2012	Functional
	Hand-dug well		Individuals	1999	Functional
2	Borehole	Irorin	Government	1999, 2007, 2000	Functional
	Borehole		Community	-	Functional
3	Borehole	Okebedo 1	Government	-	Non Functional
	Borehole		Community	2008	Functional
	Hand-dug well		Individuals	2010, 2013,2014	Functional
4	Borehole	Okebedo 11	Government	1999	Non Functional
	Hand-dug well		Community	-	-
5	Borehole	Adin	Government	-	Non Functional
	Borehole		Community	-	Functional
	Borehole		Individuals	2007,2011	Functional
6	Borehole	Oke-Emo	Government	1998	Non Functional
	Borehole		Community	-	Non Functional
	Borehole		Individuals	-	Functional
7	Borehole	Okepa/Iro/Okeloye	Government	1994	Non functional
	Borehole		Community	-	Functional
	Borehole		Individuals	-	Functional

The Ownership of Existing Healthcare Facilities in Ilawe-Ekiti

In Table 3 the Healthcare centres/hospital was mostly owned by the government, while few were owned and make provision for by the private individual. Findings reveal that past governors of Ekiti State in Nigeria provided the public healthcare centres/health post and the only general hospital in Okededo II, while the Ekiti South West LG Council is responsible for the maintenance of the government healthcare centres. Further findings reveal that the LG Council is also responsible for the payment of the Government health workers' salaries in the area.

Electricity Supply in Ilawe-Ekiti

Electricity supply (i.e. Transformer) provision is the sole responsibility of the governments; this represents 100% ownership/involvement by the government in power. This is found in Aaye, Irorin, Okebedo I, Okebedo I1, Adin, Oke-Emo, and Okepa/Iro/Okeloye. Other electric power supplements are in the form of power generators provided by individual. As seen in Table 4 electricity supply are present in all wards in the town, The electricity power supply in the town is unsatisfactory as power outages are frequent and the power sector operates well below its estimated capacity. This has made most residents/industrialists to install their own power generator which very few in the community can afford.

Table 3: The Existing Healthcare Facilities in Ilawe-Ekiti, 2015

S/N	Names/Types	Wards/Location	Ownership	Year of Establishment	Condition
1	Health Post	Aaye	Government	-	good
2	Health Post	Irorin	Government	-	poor
3	Health Post	Okebedo 1	Government	-	-
4	Divine Citadel Hospital Annex	Okebedo 1	Private individual	-	fair
5	Health Post	Okebedo 11	Government	-	fair
6	General Hospital	Okebedo 11	Government	1980	Poor
7	Comprehensive Healthcare centre	Adin	Government	1957	fair
8	Basic Health Care	Oke-Emo	Government	-	fair
9	Divine Hospital	Oke-Emo	Private individual	-	fair
10	Health Post	Okeloye/Iro/Okepa	Government	-	fair
11	Health Post	Okeloye/Iro/Okepa	Government	-	-
12	Tayo Tayo	Okeloye/Iro/Okepa	Private individual	-	fair

Table 4: The Existing Sources of Electricity Supply in Ilawe-Ekiti as at, 2015

S/N	Wards/ Location	Ownership	Year of Establishment	Condition
1	Aaye	Government	2007	Fair
		Prospective homes with electric generators	-	-
2	Irorin	Government	-	-
		Prospective homes with electric generators	-	-
3	Okebedo I	Government	2011	poor
		Prospective homes with electric generators	-	-
4	Okebedo I1	Government	-	Fair
		Prospective homes with electric generators	-	-
5	Adin	Government	-	Fair
		Prospective homes with electric generators	-	-
6	Oke-Emo	Government	2011	-
		Prospective homes with electric generators	-	-
7	Okepa/Iro/Okeloye	Government	1997	Poor
		Prospective homes with electric generators	-	-

Infrastructural Facilities in Ilawe-Ekiti

The provision of community development projects in Ilawe-Ekiti were carried out through participation/involvement/effort of individual, government and CBDAs. As seen in Figure 1 which shows the existing functioning infrastructural facilities provided for the people in Ilawe-Ekiti, on the basis of wards. Those include; schools, boreholes water supply, electricity supply (transformers), healthcare centres and town halls, all of these facilities were found in all wards in Ilawe-Ekiti. Tarred roads were found in Adin, Okapa/Iro/Okeloye and Oke-Emo, one general hospital in Okebedo 11 and one community viewing centre situated in Oke-Emo,

There is also one bank in Okapa/Iro/Okeloye, four markets were provided in the town, one post office was built in Okapa/Iro/Okeloye by the elite of Egbe Araromi club in 1971 and was the first self-help project not championed by a religious body in modern times which was later handed over to the government. The findings revealed that provision of infrastructure in the study area has helped in enhancing the living conditions of the people in the town to some extends; those infrastructural facilities include: schools, road construction, water supply, electricity power supply, market, bank, and healthcare centres/hospital. Those afore mention infrastructure have the power of attracting investors to the area, which in-turns brings about development/growth to the urban area. However the people in (Ilawe-Ekiti) are smiling and enduring suffering, smiling because there is present of infrastructural facilities and food to eat, enduring sufferings because of the low level of infrastructural services, such as roads, electricity, bank and water which had been overstretched by the increasing population and have affected agricultural production/distribution and employment opportunities of the people in the town. No doubt Ilawe-Ekiti did not enjoy government patronage that commensurate their size and population.

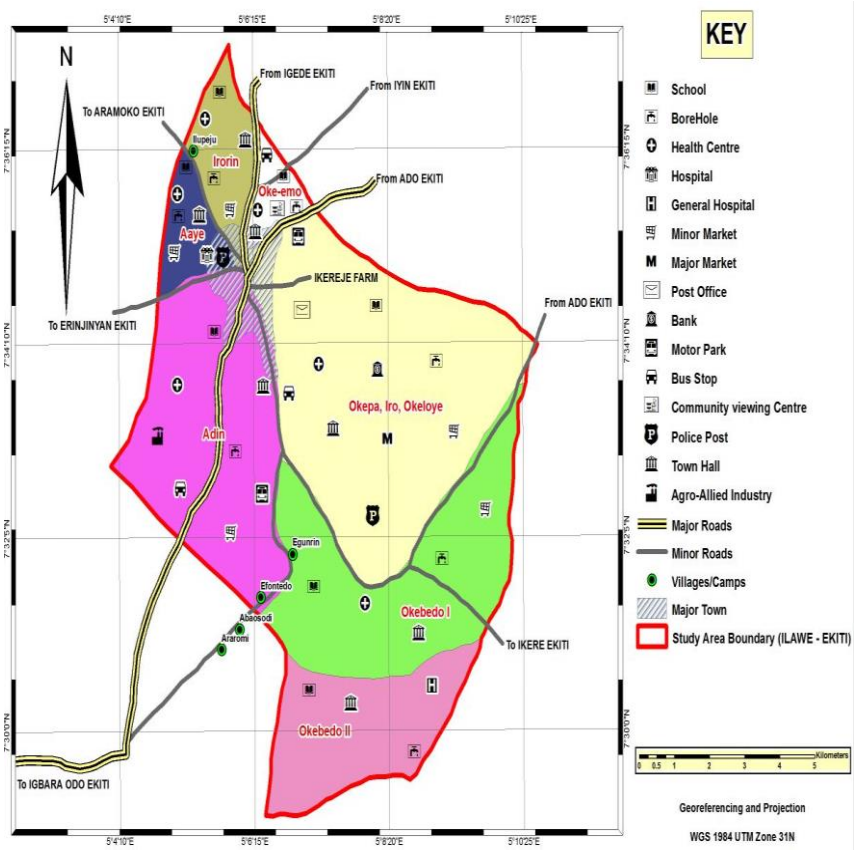

Figure 1: Facilities Map, Ilawe-Ekiti

Effect of Infrastructure on the Living Condition of the People in Ilawe-Ekiti

Table 5 shows the effects of provision of infrastructure on the living condition of the people in Ilawe-Ekiti. The majority of the bore-holes projects are fairly effective; this represents 62.5% while 25.0% attested to the fact that it is highly effective. The majority of the power supply is not effective, this represents 75%, and while those respondents that claimed it was not fairly effective represented 12.5% same percentage with those who claimed power supply project are very effective. The majority of the roads are effective, those are the wards that have tarred roads such as Aaye, Adin, Okepa/Iro/Okeloye and Oke-Emo this represents 50.0% while those roads that are not effective are represented by 37.5% the wards are Irorin, and Okebedo II. The remaining 12.5% attested to the fact that the roads are fairly effective,

was Okebedo I. The healthcare centre/hospital is very effective, this represents about 50.0%. However it should be noted that development in any urban /rural areas of the world can be facilitated and accelerated by the provision of infrastructure. If those social welfare services, such as electricity, potable water supply, healthcare services, roads and educational facilities are not put in place and made accessible in the urban /rural areas; development will be very difficult to come-by.

Table 5: Effect of Provision of Infrastructure on the Living Condition of the People

S/N	Infrastructure	Respondents' Opinion				Total (%)
		Not Effective (%)	Fairly Effective (%)	Highly Effective (%)	Effective (%)	
1	Bore hole	12.5	62.5	25.0	-	100
2	Power supply	75.0	12.5	12.5	-	100
3	Motorable roads	37.5	12.5	-	50.0	100
5	Healthcare centres	25.0	25.0	50.0	-	100

RECOMMENDATIONS

One, people's participations /involvement in the formulation and implementation of policies and projects. People need be consulted to know their needs before projects are initiated for them. Two, encouragement of maintenance culture among target population is inevitable. Infrastructure needs to be maintained as this will prolong its durability and efficiency. Furthermore, considering financial crisis in the LG Councils, the Federal Government of Nigeria should re-route the monthly financial allocation straight to all LG Councils in the federation rather than relying solely on federal allocation that is not enough to provide infrastructure. Also the Government should intensify programme of environmental awareness through the use of community/quarters-heads to compliment efforts of the government officials in the protection and monitoring of infrastructures such as schools, primary healthcare centres, market and roads, in the urban areas. Finally, the office of the community development unit should be equipped with qualified personnel to direct the government efficiently in implementing projects.

CONCLUSION

The present monthly allocation from Federal Government to LG Councils is grossly inadequate; the LG Councils use the money to settle only their recurrent expenditure, i.e pay salaries and allowances of staffs and political appointees. And it is not enough to embark on infrastructural provision; however, the LGC and the CBDAs are good examples of grassroots development. They had shown to be a very useful tool and beneficial both to the government and the community in supplementing government efforts in the urban areas. The availability of infrastructure served as means of reducing poverty, thereby improving the standard of living of the people. Furthermore, the destiny of a great community (Ilawe-Ekiti) lies on the shoulders of the community continues participation/involvement in provision and maintenance of projects, because the government alone cannot provide all their needs.

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Spatial Pattern of Public Transport Access Points in the Federal Capital Territory (FCT), Abuja-Nigeria

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ABSTRACT

The study is aimed at investigating the pattern of public transport access points by commuters in view of the perceived poor public transport access level in the Federal Capital territory (FCT). It provides answer to the question of the pattern of distribution of public transport transit routes, terminals and bus stops in the study area. Relevant data were generated from Google map and field work using the Germin 64x GPS and manipulated on Arc-GIS 9.3 software environment. The result shows that public transport routes, bus stops and terminals were not evenly distributed in the study area and by this reason, most locations have poor access to public transport services within the framework of international standard recommended by World Bank (2000). This is because buffering and Nearest Neighbour Analysis of public transport routes, terminals and bus stops shows high degree of clustering towards the City Centre, a situation which could not have been as a result of random chance. In order to raise the current level of commuters access to public transport service in FCT, it is recommended that bus stops, terminals and public transport routes must be redesigned in line with the current spatial physical development of the FCT.

Keywords: Access, Pattern, Public , Spatial, Transport

INTRODUCTION

Public transport is defined as a system of carrying passengers and or goods for money by private or public operated carriers (Adeniji 1984). It is a means of carrying large number of people 'en mass' as opposed to individual vehicles carrying very few people at a time More narrowly, public transport has been described as a vehicle licensed to provide stage carriers service (Bus and Coach Council, 1984). The need for public transport in globally and locally will continue to grow, the population of people residing in urban areas increased from 13% in 1900 to 40% in 2005. Numerically, this represents a move from 220 million people in 1900 to 3.2 billion people in 2005. By 2011, there were already 480 cities with population in excess of one million as against 80 of such cities in 1950. Currently, more than half of the world's population lives in cities, about three billion people currently resides in urban centres and the figure is expected to rise to five billion in 2050 (Akunnaya and Adedapo (2014). Perhaps, more striking is the fact that most of the population growth in the population growth in the coming decades will occur in low and middle-income countries.

Accessibility has been defined as the ease of getting to a place and as nearness to place or nearness to activities (Richardson and Young 1981). Accessibility has many dimensions (physical, economic and social). In transportation planning accessibility is defined as the ease with which desired destinations can be reached (Niemier 1997). It is a function of land use patterns and of the transport system (Morris, Demble and Wigan (1979), therefore making it an important consideration in the planning and development of policies associated with public transport and in determining land use configurations within urban space management. Public transport commuters seek a convenient access to bus ride between their point of origin and destinations. They neither want to walk very far to get to bus stops/terminals nor wait very long at the bus stop (Faulk, 1990). Added to this, they require comfortable ride at a fare which they can afford (Disney, 1998). The Federal Capital Territory (FCT) Master Plan is premised on sound mass transit system designed to link the city centre at different corridors. The bus system is also designed to provide access to the population, providing for a short

Oluwole, M. S. (2016). Spatial Pattern of Public Transport Access Points in the Federal Capital Territory (FCT), Abuja-Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1484-1491

distance between bus stops of approximately 500-700 meters interval and to be provided with adequate complimentary facilities. Despite the vital role public transport is able to play in an urban area, their services in FCT are frequently insufficient to meet demand and the services that they provide suffer from low output (Ali and Onokala, 2009) making them difficult to access by commuters. The public transport system in the FCT which cater for about 1.4 million commuters (Oniyangi, 2012) is facing numerous challenges despite the effort of Government to improve the system. Beginning from 2007, the traffic and commuting situations in Abuja appear to be reminiscent of the Lagos experience of the 1970's. It is common to see commuters walking over long distance to access public transport transit network, wait longer than necessary at bus stops and, when the bus eventually arrives, the transit time from trip origin to destination is unusually longer than usual and the fare paid is exorbitant for commuters who must make several trips per month. The FCT authority attempts to address the situation through expansion of the two-lane highway that lead to the city centre from the northern end (Kaduna-Abuja), South-Western (Abuja-Gwagwalada) and Eastern (Abuja-Keffi) to six-lanes. How much this has improved commuters' access to public transport in FCT has not been well documented. Murray (2001), opined that for the purpose of ridership forecasting and service performance evaluation, the concept of accessibility in transport planning often only refers to the assessment of transit stops and stations in terms of their catchments potential. There are usually no regards to the destinations and activities that the users can actually reach. The underlying assumption is that, access to the public transport network act as a proxy for access to a range of specific destinations (Kerrigan and Bull, (1992). Studies in this direction will not only help in mitigating the present commuting challenges, but will also form a reliable and objective information source for the transport operation and management, which the FCT Transport Policy admitted will be dynamic and could be subject to change as the city grows and as the commuting pattern is formed over time. It is in the light of the foregoing that this study focuses on the spatial pattern of public transport access points the Federal Capital Territory. This paper therefore answer the fundamental question of what is the average physical distance (in metres) from one public transport access points (public transport routes, bus stop or terminal) to the nearest one and what is the percentage of the total area (in sq/km) covered by the different buffers zones?.

MATERIALS AND METHODS

The Study Area

The Federal Capital Territory is located in the geographical centre of Nigeria. The objective was among others to move the administrative capital to a location that is centrally accessible to and from every part of the federation. The FCT falls within Latitude 07^0 25' N and 09^0 20' N of the equator and longitude 06^0 45'E and 07^0 39'E. With an area of about 8,000 sq/km of which 250 sq km is being developed as the Capital City site, the territory compares in land mass size with the states of Rivers, Enugu, Ondo and Osun while states like Anambra, Ekiti, Lagos, Imo, Akwa Ibom, Ebonyi and Abia are much smaller in size. It is bounded in the North by Kaduna state, on the West by Niger state, on the East and South by Nasarawa and South-West by Kogi state (Fig.1). As the extensive Territory is not intended to become one of the states of the Federation, it has been conceptualized and operationalized as the administrative territory of the country. The Federal Capital Development Authority (FCDA) was established in 1976 as a government parastatal to handle the design, construction and management of the Territory. The territory is divided into six area Councils to differentiate it from states with Local Government Areas. These include Abuja Municipal, Bwari, Gwagwalada, Kuje, Kwali and Abaji Area Councils.

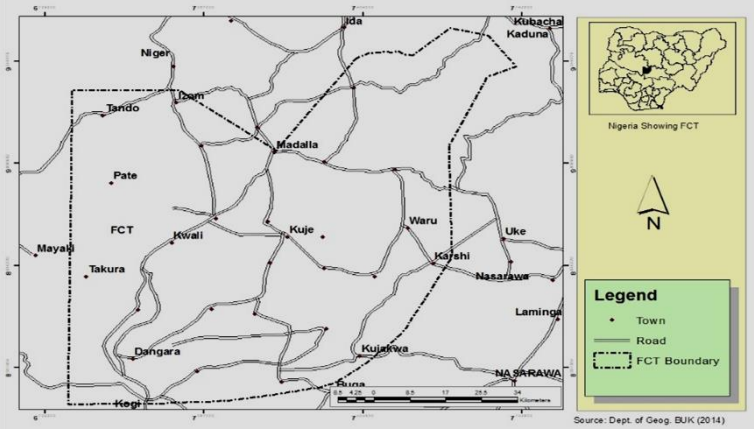

Fig. 1 the Federal Capital Territory

The Data Base

The google earth image was downloaded and stored; the image was zoomed to the lowest level (Scale 1:200) to ease identification of points and locations in the area. The image of the area was saved in JPEG format, while the control points were identified in the field using GPS Germin 76cxs during Ground Truthing Observations (GTOs). A database was developed and used in entering the coordinates of the ten selected control points for the locations of the Bus stops and terminals distributed within the study area. The saved image from the Google Earth was imported into the GIS environment and the selected controlled points were used for geo-referencing with each point registered individually. Image rectification was performed using the Geographical Coordinate Systems in GCS_WGS_1984 and the Datum of D_WGS_1984. Some slight modifications were made on the tie (coordinates) to ensure a good match with the ties on the existing map. This was done with a view to minimizing error during digital projection and transformations. Different symbols were used during the on screen digitization in an Arc GIS 9.3 operating environment. Three main themes namely: the road networks (lines), the built-up area (Polygons) and the bus stops (Points) were used having been initially typed in Microsoft Excel format was later imported into GIS environment. The database includes name of location, address, type of Bus stop and their locations (latitude and longitudes). Three different buffer zones were created in line with the World Bank (2000) guideline to identify areas that are within the different buffer zones and also run the Nearest Neighbour Analysis of the bus stops and terminals.

RESULTS AND DISCUSSION

The distribution of public transport routes, terminals and bus stops with respect to commuters' trip origin and destination are critical to commuter's adoption of the public transport system. The distance of commuter's trip origin and destination to the nearest bus stops/ transit highways is one important element that determines the level of access to public transport service. The spatial distribution of bus stops, terminals and bus routes in the FCT is presented in Fig. 2. The result of Nearest Neighbour Analysis (NNA) on the bus stop and terminal distribution shows a clustered pattern with the ratio value of (R) 0.317272 and the Z-score of -17.33. The significance level ranges between 0.01 and -2.58, implying that there is less than 1% likelihood that the clustering pattern could be the result of random chance. From this result it can be inferred that bus stop distribution within the FCT is not evenly distributed within the settlements and land uses. Some areas in the city centre like Wuse and Garki districts have high clusters of bus stops at short intervals because of the bus route which traverse them, other areas like Asokoro and Maitama have less density of bus stops, perhaps because it is scarcely a public transit routes.

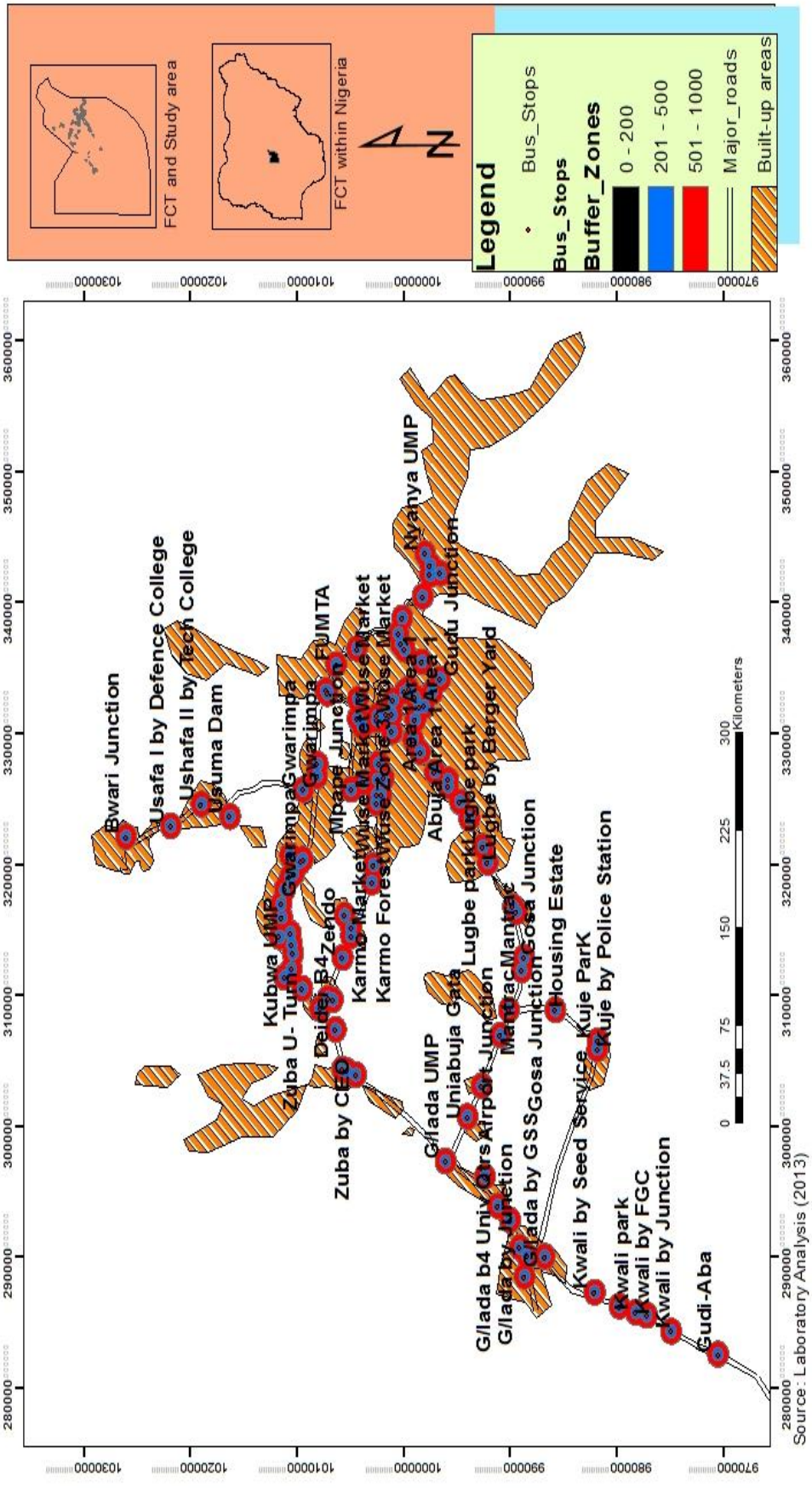

Fig. 2 Bus Stops Distribtuion and Buffering in The Federal Capital Territory

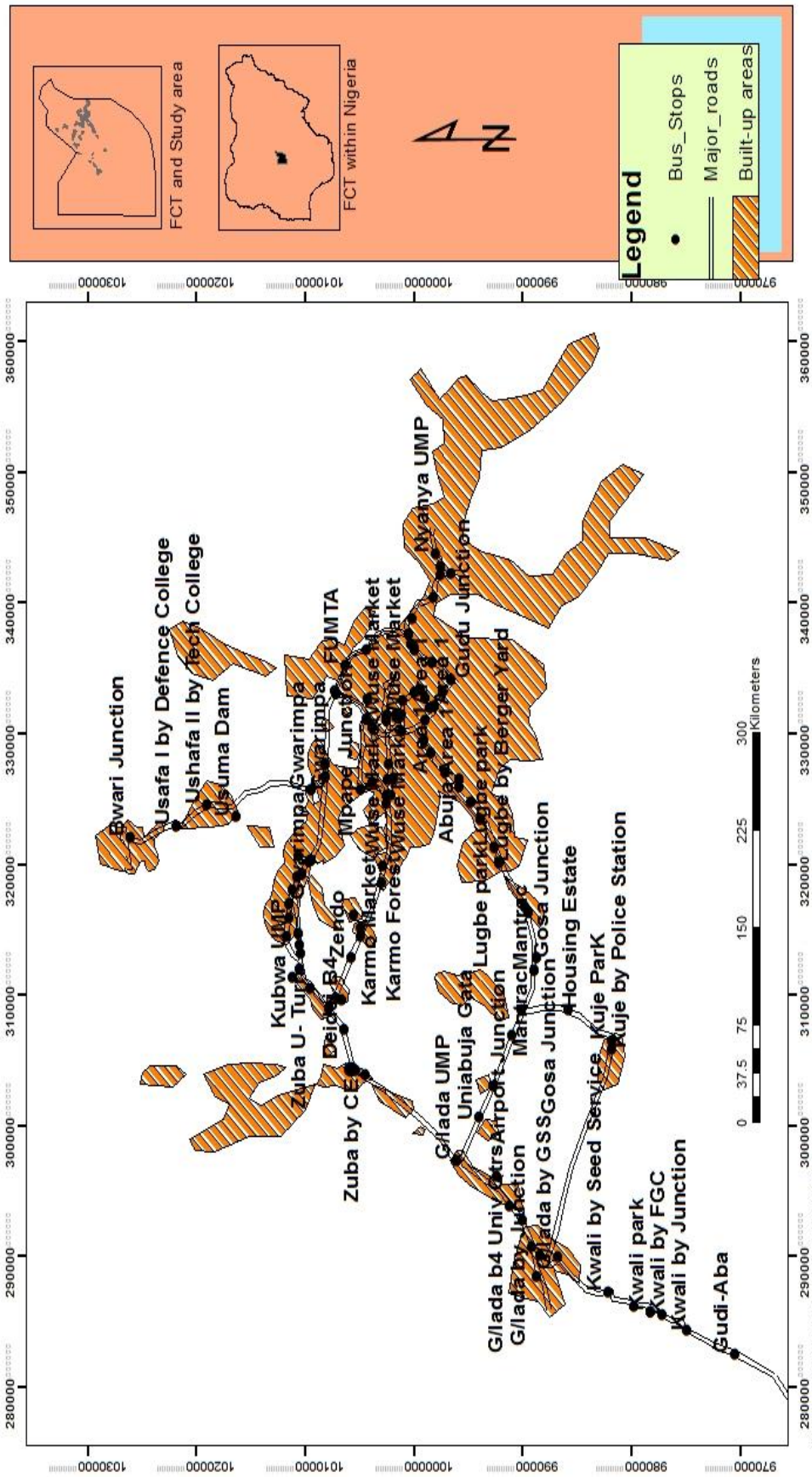

Fig. 3 Public Transport Routes and Bus Stops Distribution in the Federal Capital Territory

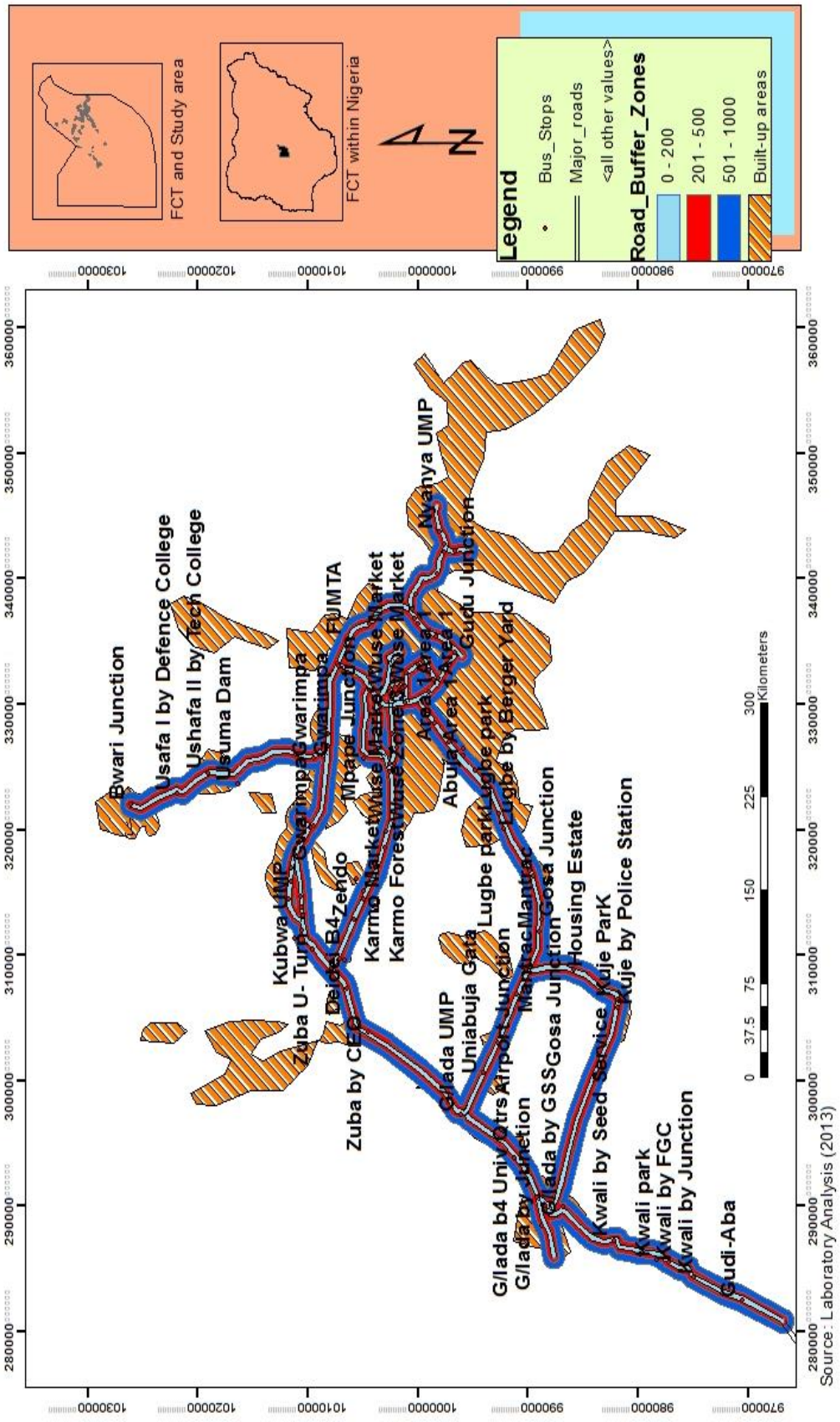

Fig. 4 Public Transport Routes Buffering in the Federal Capital Territory

It is therefore expected that commuters around the Wuse and Garki axis of the City centre will have shorter walking distance to bus stops public transport commuters around the Asokoro and Maitama districts will have longer distance. The evenness of bus stop distribution in satellite towns is worst because of the poor planning implementation and infrastructural provisions. These could create some disincentive to public transport usage. The geographical area in Kilometre Square (km/sq) served by the bus stops/transit highways relative to the size of total size of the settlements was investigated through buffering of the bus stops and transit highways as indicated in Table 1, Figures 3 and 4. Three buffers zone were generated in the categories of 0-200 meters buffers, 201-500 meters buffers and 501-1000 meters buffers based on world- wide averages for dense and less dense urban area (World Bank, 2000)

Table 1 Buffering Statistics for Bus Stops and Public Transport Routes

BufferZones (Metres)	**Bus Stops Area (KM^2)- A**	**% of A**	**Transit Highways Area (KM^2) - B**	**% of B**
0-200	17.529	3.3	62.204	14. 8
201-500	106.787	20. 1	148.974	32.8
501-1000	407.500	76.6	242.475	52.4
Total	**531.816**	**100. 00**	**453.653**	**100. 00**

Source: GIS Laboratory, Geography Department, BUK (2013)

The first category (0-200 metres) indicates areas with very good proximity or high accessibility to bus stops/transit highways, the second level 201- 500 meters buffer shows geographical areas with moderate accessibility to bus stops/transit highways while the third level of 501-1000 metres and above buffers depict geographical areas within the study area having poor access to bus stops and transit highways. Further discussion of the result in table 1 above indicates that about 17.529 sq/km or (3.3%) of the total geographical area of 531.816 sq/km has very good access to bus stops. About 106.787 km/sq or (20.1 %) have moderate accessibility and 407. 500 km/sq or (76.6%) have poor accessibility to bus stops. With respect to public transport routes, about 67.204 sq/km or (14. 8%) of the geographical area out of a total of 453. 653 km/sq have very good access to transit highways.

About 148.974 km/sq or (32.8%) have moderate accessibility while the remaining 242. 475 km/sq or (52.4%) have poor accessibility to transit highways. Generally, accessibility to bus stops and transit highways in FCT is relatively poor as 407. 500 km/sq or (76.6%) and 242. 475 or (52. 4%) of the of the study area have poor access to bus stops and transt highways respectively. Nevertheless, the accessbility level to bus stops in the study area is poorer.With respects to transit highways, about 67.204 sq/km or (14. 8%) of the study area have very good access to transit highways while, about 148.974 km/sq or (32.8%) have moderate accessibility and the remaining 242. 475 km/sq or (52.4%) have poor accessibility to transit highways.

CONCLUSION AND RECOMMENDATIONS

From the foregoing, it is safe to conclude that the distribution of public transport access points in the FCT is uneven and fall short of world standard, this can greatly influence access to public transport service in the FCT, because going by the World Bank standard (2000), no single location in FCT meets all the requirements for high level of public transport access. These findings therefore provide a strong basis for incorporating consideration of public transport accessibility to desirable locations of destination points into the FCT transportation planning and development programmes. In order to improve on the current level of public transport access points in the FCT, it is recommended that, there is the need to redesign a realistic public transport routes, bus stops and terminals across the study area in line with the reality of the current spatial pattern of the FCT. Such bus stops and terminals should be

provided with adequate complimentary facilities like shelters, seats and other infrastructures for commuters so as to ensure that women, children, aged and the physically challenged commuters do not find it difficult to use.

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Problems and Prospects of Faecal Waste (Excreta) in Human Societies

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ABSTRACT

Excreta called faeces are surrounded by taboos, and this explains why attention had been toward its deleterious effects. In Nigeria there are no sewers, hence, sewage is collected through various conservancies and subsequently discharged untreated into rivers, lakes, and sometimes mingled with solid waste. This destroys aquatic life, facilitates the transmission of diseases and has significant economic impact in terms of working days and earnings lost due to ill health. Human excrement is a resource that could be harnessed to promote human livelihood and used as manure and as biogas energy. This paper explores the problems associated with excreta and the benefits that can be derived from it. The paper tries to view how excreta had been turned to profitable material in other parts of the world and how the huge waste generated daily in Nigeria can be recycled and used to enhance livelihood.

Keywords: Biogas, Diseases, Excreta, Faecal waste, Manure

INTRODUCTION

There are no human societies where the act of excretion and its products are not subject to public and private arrangements. Human excrement otherwise known as faces is a contagious waste due to its biological origin. Waste is defined as any unavoidable material resulting from domestic activity or industrial operation for which there is no economic demand and which must be disposed of (Shridar and Hammed, 2014). There are a variety of wastes, liquid or solid, emanating from human activities such as agricultural, domestic or industrial. Wastes may be biodegradable or non-biodegradable, otherwise, hazardous or non-hazardous. Among the liquid wastes, are sullage, sewage, livestock and industrial wastes. Faeces, indeed, is a solid waste. Up to 2008 which was declared as the year of sanitation, social scientist, sociologists, planners and anthropologists had paid little attention to excreta and excreting. In Nigeria, there are no sewers or underground drainage system, consequently, all liquid wastes find their way into water courses. Many public areas lack urinals and toilet facilities, while most schools are devoid of functional toilets.

Waste is generated in Nigeria at the rate of 0.43 kg/head per day and 60 to 80 per cent of it is organic in nature (Sridhar and Hammed, 2014). In the markets, a variety of wastes are generated which include corn cobs, vegetable wastes, packaging materials, etc. Household wastes contain materials such as paper, glass, metal, plastics, and biodegradable materials.Essentially, most of these wastes are not suitable for incineration because of low Carbon/Nitrogen ratio. Paradoxically, these wastes have been found to contain a lot of valuable resources. These include nitrogen, phosphorus, potassium and other chemicals which are useful for fertilizer. (Hammed *et al*., 2011 in Shridarand Hammed, 2014).

Excreta refers to urine and faeces. They form a major health risk due to the presence of pathogens in faeces and the mobility of nutrients and micro-pollutants in urine (Paterson, Mara and Curtis, 2007;Katukiza, Ronteltap, Niwagaba, Foppen, Kanslime, and Lens, 2012). Pathogens are reported to be of faecal origin (Ottoson and Stenstrom, 2003). Pathogens of concern and indicator organisms for faecal contamination include enteric viruses, helminths (internal worms), bacteria, protozoa and faecal streptococci together with *E. Coli.* They are present in wastewater and biosolids contaminated with faecal matter (Sidhu and Toze, 2009).

A child dies every 20 seconds due to lack of access to clean water and sanitation. That is, 1.5 million preventable deaths every year (United Nations, quoted in Jewitt S., 2012). The key

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cause of these deaths is exposure to pathogens associated with human excreta. About 50 percent of all people in Asia and Africa have no access to basic sanitation and 95 percent of sewage in cities of the developing world is discharged untreated into rivers, lakes and coastal areas, where they destroy aquatic life and reduce the potential of their ecosystems to support food (Watson and Zakri, 2012).

In addition to fouling the environment, it facilitates the transmission of diseases such as typhoid and cholera, thus, having a significant economic impact in terms of the cost of medical care plus working days and earnings lost due to ill health and tourism (WaterAid, 2009). On the economic cost of poor sanitation, it is estimated that every dollar invested in sanitation improvements "generates an average economic benefit of $7" whereas, the economic cost of inaction is astronomic (United Nations, UNDP, 2008).

Nigeria is presently experiencing shortage of electricity, which in most cases is erratic. This is against the backdrop of the fact that most farmers depend on chemical fertilizers for agricultural production. At a population growth rate of 3.18% annually, the collection and treatment of excreta and urine (human waste) is presently a problem. This paper emphasizes that human excreta can be utilized economically for agricultural fertilizer and in the production of biogas as alternative renewable energy. The objectives of this paper therefore are, to highlight on the common types of toilet facilities used in human societies; prospects of human waste; collection and treatment of faecal waste/sludge; and on how human waste is used as a source of energy in many parts of the world.

METHODOLOGY

The methodology is on the review of relevant literature on the.problems and prospects derivable from faecal waste. The study started by considering methods for the collection and treatment of faecal waste. This was followed by considering the prospects of faecal waste. The third aspect of the study, considered how filth can be transformed into fertilizer based on the properties of excreta. The next section was on converting excrement to energy at small and commercial scale. The paper having considered the advantages that other nations had derived from excreta, recommended that Nigeria and other developing countries should treat excreta as a resource.

RESULTS AND DISCUSSION

Collection and Treatment of Faecal Waste/Sludge

In Nigeria, the data from WHO and UNICEF, (2013) showed that the proportion of households with sustainable access to adequate sanitation is about 33%. It implies that around 70% population does not have access to a safe, hygienic, comfortable sanitation that can keep the user and the surrounding environment from contact with human faeces. The system of managing sludge and wastewater in Nigeria is on-site, which include pit latrines, personal septic tanks, pour flush toilet and ventilated improved pit latrine (VIP). Inadequate and poor condition of sanitary facilities expose the people to environmental and health problems. The absence of good water supply and good sanitation predisposes people to ill-health and water- and excreta- related diseases (Evans and Mara, 2011). Not having household-level sanitation facilities means that women and girls are at risk of violence (assault and rape). Particularly when they go out at night, to a communal sanitation facility or to defecate in the open. This affects the personal dignity of women and girls (Evans and Mara, 2011). In addition, women are exposed to 'restricted toileting' which increases the chance of urinary tract infection and chronic constipation as well as causing psychological stress.

Poor sanitation and poor water supply cause disease and death. WHO estimated that poor hygiene, poor sanitation and poor water supplies caused 4% of all deaths in the world and were responsible for 5.7% of the total global burden of disease in 2001. Infant Mortality Rate (IMR) means the number of babies dying before their first birthday, while (U5MR) is the number of children who die before their fifth birthday expressed per 1000 live births. In industrialised countries, the IMR was $5^{0/00}$ and the U5MR $6^{0/00}$ in 2008 (Evans and Mara, 2011). The corresponding figures for developing countries were $49^{0/00}$ and $72^{0/00}$respectively. The main reason why such disparity exists is inadequate sanitation and water coupled with poverty. On account of poverty, people have poor sanitation and water supply, and insufficient food, thus, has a high incidence of excreta- and water- related disease. The major effects are diarrhoea, which kills around 400, 000 adults and norovirus around 200, 000 under 5 yearly. Coupled with the diseases mentioned is stunting or low height for age. Though a manifestation of malnutrition, it is exacerbated by diarrhoea, and further affects a child's verbal fluency, short term memory and speed of information processing (Evans and Mara, 2011).

The World Health Organization (WHO) and United Nations Cultural and Education Fund (UNICEF) JMP (2012), report that the sanitation coverage worldwide in 2011 was 64%. They concluded that the world is not on track to meet the Millennium Development Goals (MDG) sanitation target of 75%, and if current trends continue, it is set to miss the target by more than half a billion people. By the end of 2011, there were 2.5 billion people who still did not use an improved sanitation facility. Though, the number of people practising open defecation decreased to a little over 1 billion, but this still represents 15% of the global population(WHO and UNICEF, 2012). In the developing countries Nigeria inclusive only a minorityis served by piped sewerage systems.

In the advanced countries where water supply and excreta disposal imply pipes beneath the street, this is an advantage. In the context of the developing countries, a fundamental difference can be observed. Water supply means a tap in the street or a pump in the village square, clearly in the public domain. Sanitation on the other hand, means a toilet with an on-site disposal system. Usually, part of the owner's house, built on his land, at his expense and frequently with his own hands. Its use requires a change in some very intimate habits, in the privacy of the home, by all members of the family (Cairncross and Feachem, 1993). Indeed, sanitation facilities are unlikely to be used, still less maintained, unless people want them. As observed by Cairncross and Feachem (1993), health improvement does not motivate many people to install a latrine. Rather, social status and the desire for privacy and convenience are usually the motivating factors. Also, the design criteria for toilets should be a function of the price which the people are willing to pay. Furthermore, new toilets should be a modification of an existing practice or type of latrine. In addition, there must be 'after-installation' services if the technology is to be sustainable.

Pit latrines are the dominant type of excreta disposal facilities in Africa, Asia and Latin America (Mugo, 2006and Katukiza, 2012). The type of pit latrines that are common, includes the traditional ones which are made of wood poles and mud as well as the ventilated pit latrines (VIP). Unlined pit latrines are usually elevated where a high water table exists. In most cases, pit latrines that are available are shared by many households due to high population density and limited space.

The main advantage of the pit latrine is that it does not require water for its functionality. In addition, it can be built and repaired with locally available materials. It also has low capital, operating costs and can be modified to serve user preferences (squatting, anal washing and wiping). Infiltration of the liquid phase into ground water and overflows during the rainy

season from excreta collection chamber have made pit latrine a major cause of ground water pollution (Kalubako*et al,* 2012). Factors that are likely to increase the risk of contamination are: a high level of the water table and flooding during the rainy season as well as poor drainage (Katukiza, 2011).

The major challenge in the usage of pit latrine is the high-user-load and filling rate. Since the municipal councils and the landlords are not held liable for evacuation, the tenants are responsible. The problems are further compounded by lack of accessibility for vehicles coupled with the fact that tenants are not willing to pay for the services of vacuum/vehicular evacuators. In essence, local night –soil and local contractors manually empty the pit latrines. This they do by making a hole in the side wall of faecal sludge chamber. This method poses health risks to the workers and there is no control over the place where the evacuated materials are disposed.

It is therefore suggested that where the pit latrine is to be used, a prefabricated floor should be provided. This is to be in addition to squatting slab or with a seat. This provides the following advantages: the latrine will be structurally safer. Secondly, it will be easier to clean. Also, using the footrests,it will be easier for users to position themselves over the drop hole, so as not to foul it. In addition, the drop hole should have a dimension that is too small for a child to fall into, and is safer and less frightening. The floor should be cemented, this will prevent hookworm transmission. Finally, the toilet should be designed such that it permits a small measure of fly control, through the use of a tight-fitting lid (Cairncross and Feachem, 1993).

For the affluent in developing countries, the flush toilet is used. It is connected to a septic tank that receives grey water that collects and treats the sewage. This system requires water to transport the waste in pipes to a septic tank where it undergoes anaerobic treatment. Depending on the loading rate and effluent discharged into the soak away, it takes about 3 – 4 years to be filled. The effluents from the septic tank are thereafter discharged into a constructed wetland, where they are available. Otherwise, they are discharged to landfills or on open fields far away from settlements. Due to the absence of centralized sewerage, this technology is becoming popular, particularly by the minority with houses that have water connections. In addition, they have the ability to pay for the water, high cost of construction materials and have space for the septic tank and soak away (Katukiza*et al*., 2012).

In recent times, community sanitation blocks using flush toilets and a septic tank are used in urban areas of India and Africa (Mara and Alabaster, 2008). However, their sustainability requires the strengthening of the legal and institutional framework for planning, implementation, operation and maintenance (Katukiza*et al*., 2012).

Prospects of Human Waste

Historically, there has been a long association between excrement and money (Laporte, 2000). This had resulted in widespread "human ambivalence to bodily waste and discontinuity in systems for dealing with them (Laporte, 2000). Invariably, this had succeeded in tempering human attitude towards excreta. Excreta, a combination of human faeces and urine contains nutrients such as Nitrogen (N) – 12g; Phosphorus (P) – 2g; Potassium (K) -3g; Organic Matter – 90g. In addition, between 70 – 80% of the components of urine are Nitrogen (N) and Phosphorus (P) (Herrera, 2003). Except for children, an adult excrete the same amount of nutrient that is taken in, in their diet. This amount, by one person is the same as the amount that is needed as fertiliser to grow the food for that person (Jewitt, 2011). These nutrients are beneficial on land as a soil conditioner and land stabilizer. In spite of the enormous advantages derivable from faecal waste, many still show apathy to it.

Transforming Filth into Fertilizer

A normal stool is 75% water and 25% solid. The colour is brown because of stercobilin and urobilin that comes from bilirubin. The odour is aromatic upon defecation due to indole and skatole products of fermentation and putrefaction in the large intestine. Urine on the other hand, in acidic in term of pH. The colour is amber/straw and it is aromatic upon voiding (Herrera, 2003). In general, the apathy people show to excreta is because of health hazards associated with its improper disposal. Such hazards are: soil pollution, water pollution, food contamination and propagation of flies. The application of excreta to agriculture has been part of agricultural tradition in countries in South Asia like China and Vietnam. There, farmers perceive latrine waste as valuable fertilizer despite the potential health risk and exposure to helminth worm infection. That Human excretions as the best possible fertilizer was first expressed in Pliny's Natural History, Book xxvi (Laporte, 2000 quoted in Katukiza, 2011).

It was about the fourteenth century that attention of scholars was drawn to the relevance of excreta as a resource. An epoch making era was "the symbolic equation of money and shit with the translation of 'Opus ruralism commodorum (1307)' into French in 1532". The work was titled "nuffits comestres et ruraulx". Furthermore, in the nineteenth century, the 'hygienist's movement' in France, rediscovered the value of human waste as a fertilizer (Katukiza*et al.*, 2012). By emphasizing its superiority, they urge agricultural communities to incite growers on the national use of human secretions in their most natural state (Bertherand, 1858, as quoted by Laporte, 2000). In 1918, the discharge of disinfected sewer and cesspit waste out of public streets was denounced by hygienists for squandering a precious resource (Laporte, 2000). In using human excreta as fertilizer, the guiding principles are firstly that, it is the soil that is being fertilized not the plant. Secondly, excreta product should not be used on plants directly, but on the soil in which the plants are grown. Thirdly, urine should be applied in a furrow about 10 cm away from the plants. When properly applied, N. P. K., in human faeces improves soil structure, increases the water – holding capacity and ion-buffering capacity of the soil, and it supports soil microorganisms by serving as an energy source.Finaly, in regions where people are worried about eating food fertilized with human excreta, it can be used for other purposes such as trees, flowers, potted plants, fibre-producing plants and oil-producing plants(e.g. Olive trees).

Converting Excrement to Energy

Human waste is aesthetically unpleasing in terms of odour, and potentially harmful because of the presence of pathogens. Human waste is used as a source of energy in many parts of the world, the global north and south (Jewitt, 2011). For instance, Biogas was used as long as 10 BC to heat bath water in Assyria (Li and Mae-Wan, 2008 as quoted in Jewitt, 2011). Biogas was first produced using anaerobic digester from waste in a leper colony in Bombay in 1859 (GTZ, 2010 as quoted in Jewitt, 2011).Considering the ease of the process and no starter (micro-organism seed) needed in the process of biogas generation, human excreta has similar potential in biogas generation compared to the cattle manure. Human excreta contains: Potasium (8g/kg); Dry mass (216g/kg); nitrogen (11g/kg); phosphorus (4g/kg); moisture content (78%); dry matter content (22%) and pH (7-9). The population of Nigeria is about 170 million presently, with such a high population coupled with a growth rate of 3.12%, she ought to be able to utilize excreta to generate alternative energy. The problems regarding converting human excreta to biogas, include the technology itself and socioeconomic problems in Nigeria.

Methane derived for Biogas is used for A variety of purposes that include cooking and heating gas, electricity, vehicle fuel, and 'mains' gas when processed and introduced into a natural gas pipeline (Jewitt, 2011). In addition, the methanol derived helps to prolong the

storage of fruit and grain by inhibiting metabolism and killing harmful insects, moulds and bacteria (Mae-Wan, 2008 as quoted in Jewitt, 2011).

In term of energy production, China has been in the forefront since the nineteen century, by using Biogas digesters for energy production (Mae-Wan, 2008 as quoted in Jewitt, 2011). As a broader waste management strategy, Biogas units are linked directly to farms, sewage and municipal waste streams (Guardian, 2008). In China, anaerobic digestion is used for managing sewage and livestock waste which currently pollute over 10 million hectares of farmland (Mae-Wan, 2008).

In developing countries, household energy shortages can be addressed through a small scale biogas derived from human and or animal waste thus, providing an alternative to wood or other biomass fuel (Jewitt, 2011). This is particularly important in areas where deforestation is a problem, and the collection of wood fuel is an increasingly difficult and tiresome task. As observed by Mae-Wan (2008), 10 m^3 biogas digester can save 200kg of fuel wood, which is equivalent to reforest 0.26 – 4 ha. The drudgery, of collecting biomass fuel and the 'indoor' pollution can be ameliorated by burning dung-derived biogas as a cooking fuel (Venkataraman, Saga, Habib, Lam, & Smith, 2010).This is because biogas burns without smoke. In essence, women and children are the main beneficiaries of biogas adoption, as they are freed from the hazards and discomfort of cooking over smoky fires, cleaning smoke-blackened cooking pots and disposing animal dung (Shalaja, 2000 as quoted in Jewitt, 2011).

CONCLUSION

The utilization of human excreta for fertilizer and biogas can provide benefits in the areas of environmental and alternative sources of energy. Considering the threat Nigeria faces with her population of about 170 million and a growth rate of about 3.18% the potency of this neglected resource can only be imagined. This technology had been used by countries like China, India, Indonesia, it had proven to be clean and sustainable.

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Periodic Market System and Development of Rural Economy in Ijesa Region, Osun State, Nigeria

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ABSTRACT

This study examines the impact of periodic market system on rural economic development of Ijesa Region with the view to recommending a policy framework that could enhance the system to accelerate rural economy, growth and development in the region. The region, made up of six Local Government Areas (LGAs), is located in the south-western part of Nigeria. However, the study concentrated on Atakunmosa East, Atakunmosa West, Obokun and Oriade LGAs which are the four rural and semi-urban LGAs of the six LGAs. The remaining two LGAs (Ilesa East and Ilesa West LGAs) are urban; being located within Ilesa Metropolis. Primary and secondary data were collected and complemented with Focus Group Discussions (FGD) and physical observations for the study. The research frames were the periodic markets, the patrons of the market (i.e., the traders and buyers) in the study area. The research instrument used was a three-part structured questionnaire; with Section A generally administered on the patrons of the markets, Section B specifically on the traders and Section C specifically on the buyers. Inventory Schedule for the survey of the periodic markets and Discussion Schedule for Focus Group Discussions were also prepared and utilised. The ten per cent (10%) of the periodic markets and five per cent (5%) of the 487 settlements in the region were randomly sampled for the surveys across the four LGAs. In each sampled market, one in every five traders and one in every five buyers were sampled for survey. The collected data were processed using the Statistical Package for Social Sciences (SPSS) computer software. The result shows that there were differences between in the involvement in periodic market centres and the level of the people's contributions in the market system in the region. This study affirmed that the local economy was being strengthened through the operators of periodic markets in the region. The study recommends a better organisation of the markets and improvement of infrastructural facilities like roads, electricity and potable water to checkmate rural-urban migration which is a bane of rural economic development in the region.

Keywords: Periodic market, rural Economy, rural infrastructure, Ijesa Region

INTRODUCTION

Trading activities are fast replacing agricultural activities as major rural income generating activities in the developing countries [Food and Agriculture Organisation (FAO), 1978; 1998; Goldman, 2000; Lanjouw & Lanjouw, 2001; Reardon, Barrett & Webb, 2001; Haggblade, 2007]. Although a sizeable portion of trading activities has connection with agriculture, trading dominates sources of rural income and its contributing immensely to rural economic development (Faseun, 2014). Many of the trading activities take place in market places on either daily or periodic bases. However, substantial numbers and types of trading activities take place in periodic markets especially in the rural communities. Patronage of periodic markets play significant role in the economy of the rural areas.

Periodic markets are usually arranged in a ring form within close communities in such a way that the major markets in the major settlements within the connected communities are patronised within one or two period. Traditionally, between five and seven major settlements connect to form a market ring (Omole, 2012). Thus, we have markets operating every fourth, fifth or seventh day of the week in the traditional Yoruba communities. However, modernisation has brought in fourteenth-day and monthly market circles in many parts of Yoruba Region. The actual idea behind periodic market is to give enough room and time for local production to build up, so that producers and marketers would have sufficient products to exchange during the market days (Omole, 2014).

Faseun, J. O. & Omole, F. K. (2016). Periodic Market System and Development of Rural Economy in Ijesa Region, Osun State, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1498-1506

Aim and Objectives of the Study

The aim of this study is to examine the periodic market system and its impact on rural economic development in Ijesa Region. To achieve this, the study identified the periodic markets in the study area, categorised the market centres into hierarchical market order, examined the contributions of the markets to the development of the region, examined the hindrances of the periodic markets and assess the impact of the contributions to the rural economy in the region.

The Study Area and Scope of Study

The study was conducted in Ijesa Region located in Osun State, South Western Nigeria. It lies between Latitudes 7^0 17"North and 7^0 50" North of the Equator and Longitudes 4^0 33" East and 5^0 10" East of the Greenwich Meridian. The area falls within the humid tropical region characterised by high temperature and heavy rainfall. The terrain is gently undulating lying roughly between 170 metres around River Oni Valley and 700 metres above Sea Level in the eastern borderland with Ekiti and Ondo States.

Much of the landscape is dotted by steep inselbergs usually referred to as 'Yoruba Hills' particularly towards Ondo/Ekiti boundary. The soils are largely a mixture of sands and high percentage of clays on the surface, under-laid by grey granite in different proportions from one part of the region to another (Peel, 1983; Ekanade, 1984). This makes the area fertile for agricultural practice. This subsequently accounts for the abundant availability of variety of agricultural produce and products at low prices which consequently attract people from far and near to the periodic markets in the study area. The natives are called the 'Ijesas' who are renowned dexterous traders found across Nigeria.

This study is rural area-focussed and case-specific. Therefore, the two City-local government areas in Ijesa Region (Ilesa East and Ilesa West LGAs) were excluded; leaving four Less-City local government areas of Atakunmosa East, Atakunmosa West, Obokun and Oriade which are basically rural and semi-rural (Olayiwola & Aguda, 2009) [Figure 1]

The study identified the periodic markets and rural income generating activities in the study area and assessed the interaction of the activities and the markets and their impacts on rural economic development in the region.

RESEARCH METHODOLOGY

Primary and secondary data were collected and complemented with Focus Group Discussions (FGDs and physical observations for the study. The research frames were the periodic markets, the operators of the market (i.e., the traders and buyers patronising the markets) in the study area. The research instrument used was a three-part structured questionnaire; with Section A generally administered on the operators of the markets (traders and buyers), Section B specifically on the traders and Section C specifically on the sellers. Inventory Schedule for the survey of the periodic markets and Discussion Schedule for Focus Group Discussions were also prepared and utilised.

Ten per cent (10%) of the periodic markets and five per cent (5%) of the 487 settlements in the region were randomly sampled for the surveys across the four LGAs. In each sampled market, one in every five traders and one in every five buyers were randomly sampled for survey. The collected data were processed using the Statistical Package for Social Sciences (SPSS) computer software.

LITERATURE REVIEW AND CONCEPTUAL ISSUES

Rural development is concerned with household income, resource allocation, poverty, and access to basic needs such as health, education and food security. De Janvry, Sadoulet and

Murgari (2002) aver that the heterogeneity with respect to these issues among rural households is germane for the design of rural development strategies. For example, while households that derive their main income from farm activities can benefit from improved agricultural technologies, landless rural households that diversify toward the non-farm sector would generate greater welfare from policies that improve such employment opportunities.

Some scholars see rural development and regional development as synonymous while some separate them. United Nations Development Programme (UNDP) always mention them separately but discusses them together. One of its departments is tagged *Rural and Regional Development Department* which sees rural development and regional as inseparable; and, therefore, has a common comprehensive approach to rural and regional development at the local level by improving local government capacity to plan, identify priorities and deliver results; stimulating economic recovery through entrepreneurial activity, job growth and investment, increasing the competitiveness of local producers and income generation; strengthening local priority infrastructure; delivery of social services to vulnerable populations, and the sustainable use of natural resources and energy efficiency (UNDP, 2012). Rural development is concerned with improving the livelihoods of the population and especially the poor rural households (Datonjo and Chikagbum, 2015).

Omole, Lukman and Bako (2014) described a market as an authorised public gathering of buyers and sellers of commodities meeting at an approved place at regular intervals. Geographical space in a region is an amalgamation of a number of subspaces within the region (Johnson & Wanmali 1981). One of the many ways in which geographical space is divided for the provision of rural services, especially in the developing countries, is through the existence of periodic markets. Marketing, which is the backbone of economic activities, takes place at market centres where goods and services are traded. They are also places of social and cultural exchange.

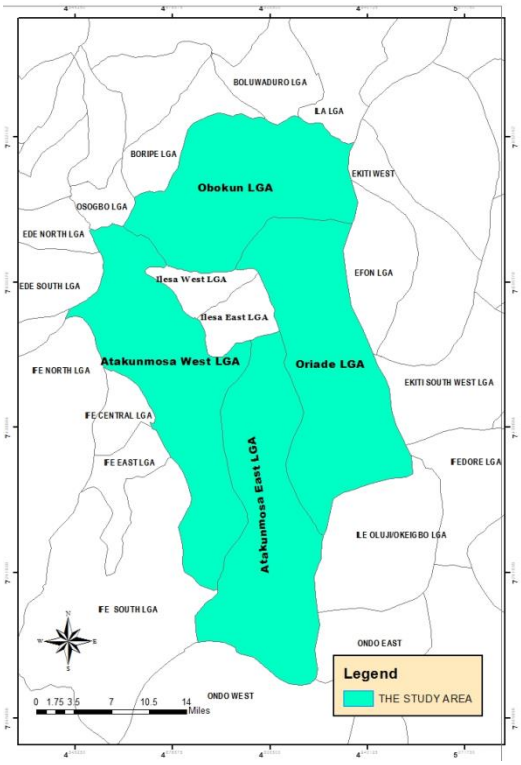

Fig 1: Digitized Map of Ijesa Region Highlighting the Four Rural/Sub-urban Local Government Areas that Constitute the Study Area
Sources: Osun State Ministry of Lands, Physical Planning and Urban Development, Osogbo, 2015.

Market place is the most ideal place for exchange system of goods and services particularly in agricultural societies and market system has come to be accepted as an axiom in modern geography for depicting the regional personality (Singh, 1980). To achieve sustained growth and transformation of rural sector, the market should be capable of handling increased production of commodities. Market place is one of the base and fundamental aspects in marketing geography and performs its predominant role to keep the marketing activities in a dynamic manner by arranging different spatial units into a place. Market centre performs numerous functions not only for the rural but also in the urban areas. With the growing size of market, it becomes more complex and differentiated by increasingly multifunctional process.

Periodic Market system is an arrangement of repeated movement of traders nearer to their customers. Bharathi (2000) asserts that the traders can carry out more efficient trading activities than infrequent movement of individual customers to a permanent market place. A periodic market is a trading market held on one or more days of each week and, most times, on the same days of the week. The market days are at regular intervals. Periodic markets bring extra shopping opportunities to rural residents.

Rural periodic market centres is one way through which development from grass root could be encouraged. Therefore, the role of market is very significant in the enhancement of economic activities for the development of regions. The rural people largely depends upon periodic markets for the sale transactions of agricultural and non- agricultural commodities that takes place in a retailing process at regular interval of a given time and place. These markets are responsible for establishing the links between its surrounding areas and paved the way for establishing the grass root level networking of trade systems throughout the developing world.

The rural markets provide an employment to the workers of unorganized sector and source of livelihood for itinerant traders who purchase the agricultural commodities from different places to sell in periodic markets (Eighmy, 1972). In the chain of production, processing and distribution of goods and services, the market centre has definite role to play as an outlet and inlet centre. Thus, the market centre performs this function for itinerant traders who purchase the agricultural commodities from different places to sell in periodic markets (Eighmy, 1972). The market centres also perform the function of service centres, helping in increasing the socio- economic and political contacts in the vicinity. However, the functions of markets, especially, periodic markets are largely dependent on the threshold population and the location, administrative character and road links between the market and its hinterland.

FINDINGS AND DISCUSSIONS

Findings from the study are presented and discussed below.

Analysis of Market Centres in Ijesa Region

Market centres are major land use and have contributed significantly to the economic and physical development of Ijesa region. Of importance is in the area of land development, employment generation and provision of goods and services among others. Paramount to this study are the types of markets, their spatial distribution and their hierarchical order in the study area.

Market Days and Market Periodicity and their Economic Distributions

Two most popular types of market discovered in the study area were the ‘daily markets, and the ‘periodic markets’. The daily markets hold everyday while the periodic markets hold at

intervals of days. The periodic markets days are arranged in a way that no market day within the same area falls on the same day. The idea behind this, as gathered during field survey, is that market patrons will be able to enjoy activities of each of the markets in the region, if they choose to patronise all the markets in the region. By this arrangement, a sort of 'market ring' is established. For instance, the Atakunmosa Market which is one of the biggest markets in the region comes up at 14 days interval. Within this period, other market centres like the Ijebu-jesa Market (in Oriade LGA) which is a 3day interval/periodic market takes place, while others like the Owena-Ijesa Market in Oriade LGA holds on a several other day. The same pattern of arrangement is found across the region.

Table 1 presents the number of major markets in each of the LGA in the study area. Apart from the fact that some of them make provision for daily needs, hardly would their periodic date conflict with other markets within the immediate and close communities within the region. By this arrangement, 'market rings' are formed for the benefit of all the market patrons and shoppers in the region and even beyond. Interestingly, there is no day a market will not be in operation in the region.

Table 1: Distribution of Periodic Market Centres in Ijesa Region

Local Government Area	Observed Number of Major Market-centres
Atakunmosa west	8
Atakunmosa east	9
Obokun	11
Oriade	3
Total	**31**

Apart from the numbers of market centres listed in table 1, there are other numerous market centres located in rural areas that contribute significantly to the rural economy of the area. Apart from the periodic markets, other non-periodic markets and of different hierarchies are always in operation. It was also discovered that the market centres in fairly big settlements like Ijebu-jesa and Ipetu-Ijesa (both in Oriade LGA) operate as daily markets as well as periodic markets.

Hierarchical Order of Market centres in the Study Area

Settlements were of different hierarchy in terms of land coverage, population, economic activities among others. The pattern of distribution also varies from one local government to another based on the morphology and historical antecedent of the towns. Hierarchically, markets in the study area fall into different hierarchies. Three distinct market orders were identified and categorised. The first order is made up of market centres in the local government headquarters while the second order is made up of market centres in other fairly big settlements. The third order consists of the rural market centres (Table 2 and Figure 2)

The three hierarchies vary in their catchment area, threshold population and the range of available goods and services. The Atakunmosa Market in Ilesa region stands as a rallying point for all other markets within and outside the region. The first hierarchy in the study area is made up of the main markets located in the LGA headquarters of Iperindo, Ijebu-jesa, Ibokun and Osu. The second order markets are located in other fairly populated settlements that are not LGA headquarters. The settlements are Ipetu-Ijesa, Owena-Ijesa, Ifewara, Imesi-Ile, Esa-oke and Okebode. All the other market centres in different village/settlements constitute the third hierarchy (Table 2 and Figure 2). The settlements include Itagunmodi, Iwara, Ilare, Ibodi and Ilaa as shown in Table 2.

Figure 2 shows the distribution of goods in the market system in the region. The market setting operates as a system in which the high order goods (mainly finished goods, 'polished rice' clothing materials, agricultural chemicals, building materials among others) flow from

the 1st order market centre to the 2nd and 3rd order market centres. In like manners, agriculture produce flows from the 3rd order market centres to the 2 and 1st order market centres (Figure 2). The flow of goods in this manner keeps the market system running and impacted on the economic development of the state and beyond. This aids food production, supply of raw materials to feed the local industries and also creating jobs and employment opportunities among others.

Table 2: Market Hierarchy in Ijesa Region

Order/ Centres	Names of Market	LGAs
First Order	Ijebu-jesa	Oriade
	Iperindo	Atakunmosa East
	Ibokun	Obokun
	Osu	Atakunmosa West
Second Order	Ipetu-Ijesa	Oriade
	Esa-oke	Obokun
	Owena-Ijesa	Oriade
	Ifewara	Atakunmosa East
	Imesi-Ile	Obokun
	Okebode	Atakunmosa West
Third Order	Itagunmodi	Atakunmosa East
	Iwara	Atakunmosa East
	Idoka	Obokun
	Ilare	Obokun
	Ibodi	Atakunmosa West
	Ilaa	Atakunmosa West
	etc.	

Hindrances to the Viability of Periodic Markets in the Study Area

The major problem militating against the existence of the periodic markets is that of bad state of roads and poor road connectivity. It was discovered that some of the market centres do not have direct motorable roads linking settlements where market centres are located. This is costly in terms of cost of travel time, time involvement on trips and delay. Due to poor road condition, motorcycles were found to be the major mode of transport to most of the rural markets in the study area.

Another problem is that of unplanned market spaces. Traders and shopper are found displaying their wares in bare floor, while buying and selling are going on in the open air under rain and sun. Store, stall and lock up shops are non-existent in virtually all the third order market centres.

It was also discovered that the threshold population could not sustain the existence of many of the markets. Findings reveal that cultural and historical arrogance was responsible for this type of situation in that each of the sub-regions wants to carve out an empire for themselves without considering the threshold population that will support the demand for the products from the markets.

Contributions of Periodic Markets to the Development of the Rural Economy of the Study Area

Findings show that market centres in the study area have contributed in the following ways:

i. Provision of jobs and employment opportunities for the local populace as farmers and traders in the market centres.
ii. The periodic market brought people from outside the vicinity in which the markets are established, thereby boosting the economy of the area.
iii. Similarly, periodic markets improved cross-fertilisation of ideas from other settlements.

iv. It has also enhanced the flow of goods both inward and outward of the market location such that, what cannot be produced is brought in from another location and the surplus from one area is taken to other areas and lastly
v. It has alleviated poverty among dwellers in the region.

Figure 2: Flow of goods and services in market hierachy

Source: Authors illustration

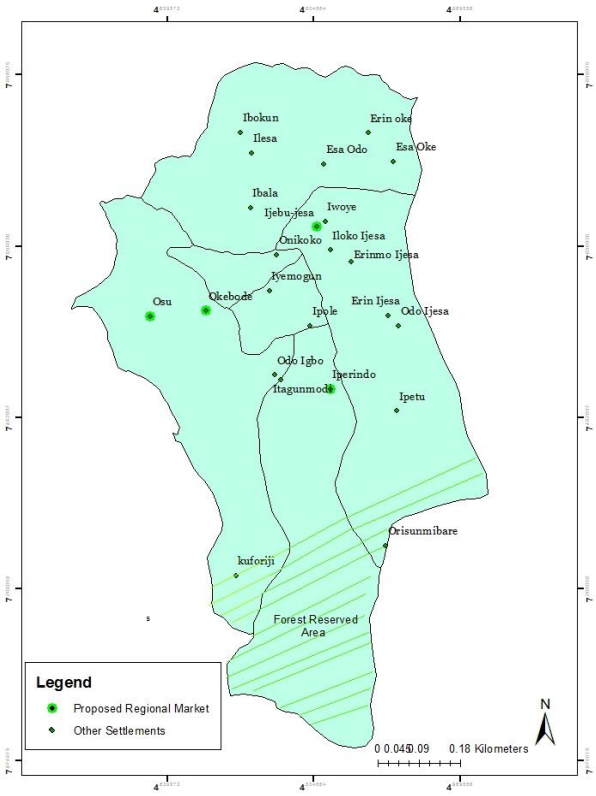

Figure 3: Map of Ijesa Region Highlighting the Locations of the Proposed Regional Markets
Sources: Osun State Ministry of Lands, Physical Planning and Urban Development, Osogbo, 2015.

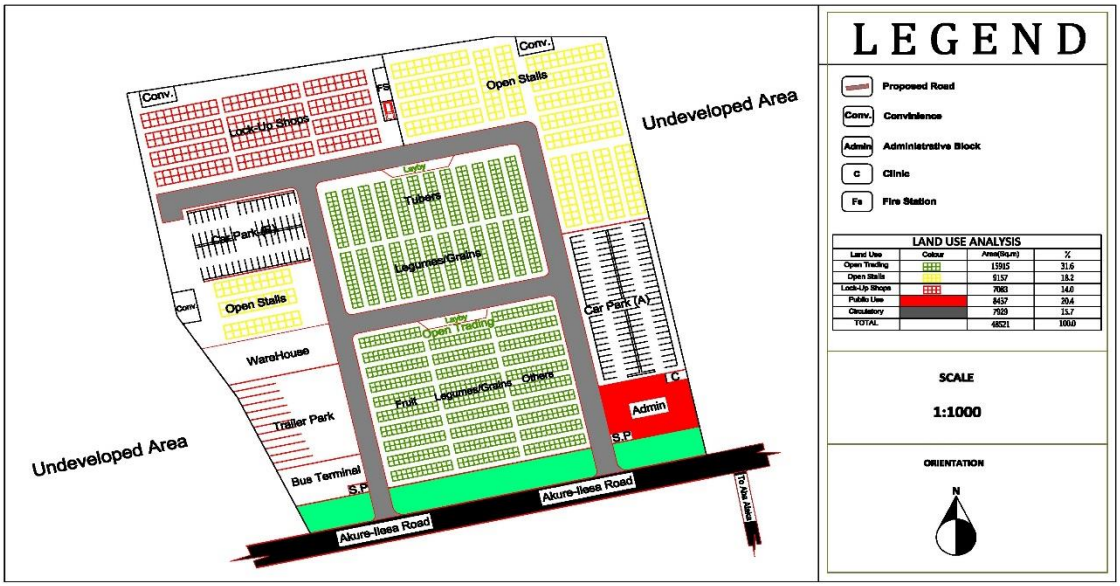

Figure 4: Proposed Development Plan for Owena-Ijesa Regional Market in a New Location along Owena-Ilesa Road, Iyana Reserve, Owena-Ijesa. Source: Authors' Proposal Design, 2016

RECOMMENDATIONS

This study recommends that regrouping of villages should be carried out to form 'Local Economic Development Areas' each with one "Central Rural Periodic Market" to be established and managed by the relevant Local Government Authorities. Factors for the regrouping should include socio-cultural affinity and compatibility as well as road connectivity, market connectivity, among others. The Local Government authorities should

be involved in designing and development of rural periodic market using their Urban and Regional Planning Department and Works Department.

There should also be mass rural road development by government. The region is well connected with access roads; but most of the roads are rough and unmaintained by the relevant government authorities.

More periodic markets, which should be regional markets, should be established at Ijebu-jesa in Oriade LGA, Oke-Ibode and Osu in Atakunmosa Local Government Area and Iperindo in Atakunmosa East Local Government Area (Figure 3).

The existing Owena-Ijesa Regional/Periodic Market in Oriade Local Government Area should be relocated to Iyana Reserve – some 2 kilometres to its present choky site towards Ikeji-Arakeji. Figure 4 depicts the Proposed Development Plan for the market at proposed new site.

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Akure Urban Land Use Change Detection Analysis Using Geographical Information System

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ABSTRACT

This study investigates Akure urban land use change detection using GIS and RS devises. Efforts were made to examine the direction of which the continuous expansion of the city tends towards. Using Aerial Imagery Overlay (AIO), the pattern of land use changes in Akure and its environs were determined. It focuses on imageries interpolation and overlaying to determine the land use changes, direction and extent of the expansion during the study period. Findings revealed unguided expansion in the growth of the city which affects the pattern of land uses within the city, as well as, in the adjoining settlements. There were incompatible conversions in land uses and undue encroachment into green areas in the adjoining communities. Therefore, the study suggests effective zoning strategy to check the indiscriminate nature of urban expansion whose effects on land use are well prominent in the study area. Adequate monitoring by the Development Control Department and other stakeholders in urban planning is equally suggested to mitigate the incompatible land use changes in the area.

Keywords: Urban Land-use, Change Detection, GIS, Imageries Interpolations, Zoning

INTRODUCTION

Land Use and Land Cover Changes (LULCC) is urbanization induced, which has led to dramatic changes in land use practices (Mirkatouli et al, 2015). Rapid pace of urbanization is believed to be a global problem present in most of the developing countries of the world. Balogun et al (2011) submitted that urban populations in developing countries have grown by 40% between 1900 and 1975; the trend will continue adding approximately 2 billion people to the urban population of the presently less-developed nations for the next 30 years. In similar way, Arnfield (2003) observed that the world is becoming increasingly urbanized with 45% of the population already living in the urban areas in the year 2000. With the projection as at then, half of the world will live in urban areas by 2007. It was also estimated that by the year 2025, 60.0% of the world's population will live in cities (UNPF, 1999).

Akure is not in any way going contrary to this prediction as the population has been more than triple of what it used to be before it became administrative headquarters of the state and local governments. For example, the population was just 71,106 in 1963; but with the influx of public servants into the town due to the state creation of 1976, the population rose to 239,124 by 1991 and 360,268 in 2006 (NPC, 1991 and 2006). Even as at 2010 and 2014, the population was estimated at 413,060 and 476,159 respectively using the 3.18 annual growth rates recommended by the National Population Commission of Nigeria (NPC, 2006).

Globally, land cover is often altered principally by direct human use such as agriculture and livestock raising, forest harvesting and management, urban and sub-urban construction and development. Hardly can we find any vegetation that has not been affected or altered by man in the world (Kufoniyi, 1998; Oyinloye, 2010; Olofin, 2012; Rimal, 2013; Oduwaye, 2013 and 2015). In this regard, about 400,000 hectares of vegetation cover are confirmed to be lost annually (Adesina et al, 1999; Balogun et al, 2011). Due to anthropogenic activities, the earth surface is being significantly altered by man's presence and several activities on earth.

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According to Fasal (2000), land transformation has been asserted to be one of the most important fields of human induced environmental transformation. Environmental protection is facing critical challenges due to several factors like increasing population, depletion of natural resources, environmental pollution, unplanned land use and several others. The trust of this paper, therefore, is to examine definite changes that have taken place in Akure urban land use in the past three decades with a view of generating a predictive model for managing the future trend and combating its possible effects.

LITERATURE VIEWPOINT

Several researches have shown that unplanned changes of land use due to urbanization have become a major problem (Zhao, 2003; Nanda, 2005; Balogun et al, 2011). Most land use changes occur without a clear and logical planning and without giving attention to their environmental impacts. Major flooding, air pollution in large cities as well as deforestation, urban growth, soil erosion, and desertification, are all consequences of a mismanaged planning and inappropriate projects' execution without considering their environmental impacts. As observed in Nicholson (1987), the rapid land use changes by the growing population have reduced natural vegetation cover in most countries of the world.

Urban growth observation and management remains a major concern of Geographic Information System (GIS) and Remote Sensing (RS) applications. The duo provides historical vehicle to monitor, determine and evaluate long term changes in land use due to urbanization process. They have been proved to be effective means for extracting and processing varied resolutions of spatial information for monitoring urban growth. According to Masser (2001), the collection of remotely sensed data facilitates the synoptic analyses of earth in terms of system functioning, burbling, and changes at local, regional and global scales overtime. Such data provides import data link between intensive, localized, ecological research and regional, national and international conservation and management of biological diversity (Wilkie and Finn, 1996; Hegazy and Kaloop, 2015).

Land use changes arising from urbanization, housing development, agriculture, and deforestation are some of the contributing factors to land cover changes in Akure. These changes reflect on the population growth, land consumption rate and local climate. Expansion of Akure has resulted not only in depletion of natural resources, but also in deterioration of the environment due to incompatible changes in land use pattern. Agriculturally productive land and forestland are being converted to residential and other private and public uses. Balogun et al (2011) argued that the land use land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Hence, the uncontrolled growth of urban development of Akure has adversely affected its ecosystem which has potency to indirectly reflect on weather parameters with eventual local climate modification (Akinbode et al, 2007; Balogun et al, 2009).

Akure is the capital of Ondo State as well as the headquarters of Akure South Local Government Area. Between 1976 and present time, the city has experienced enormous growth and has developed independently of any spatial urban planning. This rapid growth became prominently noticed in the last two to three decades. As urbanized features extended farther from the central areas, lands populated by development are altered in significant ways. From the population figures of past national censuses, the population of Akure increased appreciably from approximately 71,106 in 1963 to 239,124 in 1991 and 360,268 in 2006 (NPC 1963, 1991 and 2006). Since 1976 when the town became the state capital, there have been remarkable changes in its growth and development. Several developmental projects that brought transformation to the physical landscape of the city are very prominent. Oyinloye

(2010 and 2013) specifically observed that the construction of Ilesha-Owo expressway opened up the area for further development. It links the city with the northern and eastern parts of the country. Presently, development and establishment of public facilities are concentrated along this route.

In other to mitigate the negative effects of the city's growth and expansion, there is need for adequate programs and policies that can foster its sustainable development. The essence of this is to encourage and monitor development in a way that it will not damage the environment for the incoming generations. This can only be achieved by taking appropriate inventory of the available resources and planning for their present and future uses. It is on this premise, therefore, that the study is set to investigate the influence of urban sprawl on land use changes in Akure and its surrounding communities.

MATERIALS AND METHODS

The Research Locale

The study centers on Akure city and its immediate environments. Akure is a notable city in the South-western Nigeria which became the capital of Ondo State on February 3rd, 1976. It is located between Latitudes 7^0 15^1 and 7^0 17^1 North of the Equator and between Longitudes 5^0 14^1 and 5^0 15^1 East of the Greenwich Meridian. It is about 204 km east of Ibadan, capital of Oyo state; 168 km west of Benin City, capital of Edo state; 311 km north-east of Lagos; and 323 km south-west of Abuja, the Federal Capital Territory of Nigeria. Akure town spreads over an area of about 15,500 km^2 in about 370m above the sea level. Its population figure by the National Population Census (NPC, 1963) was just 71,106. With the influx of public servants into the town consequent upon state creation in 1976, the population rose to 239,124 and 360,268 in 1991 and 2006 respectively (NPC, 1991 and 2006) with a projection of 476,159 to year 2014 (on 3.18 annual growth rate) when this study was carried out.

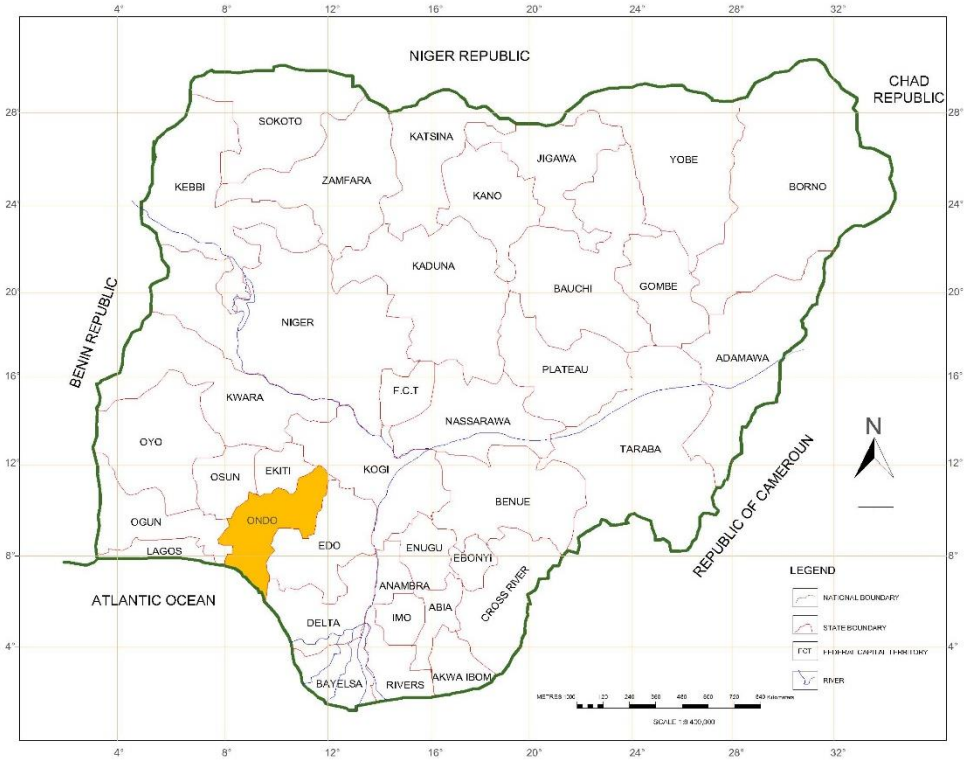


Figure 1: ONDO State in the National Setting.
Source: Dept. of Surveys, Federal Ministry of Works, Abuja (2014)

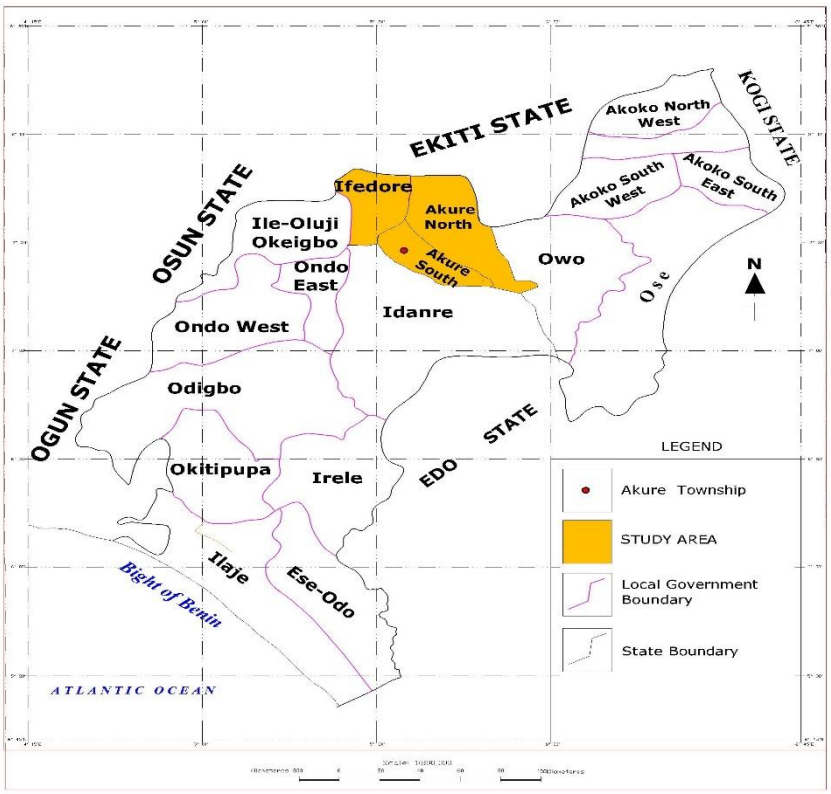


Figure 2: Ondo State and its Eighteen Local Govt. Areas

Source: Ondo State Ministry of Lands and Housing, Akure (2014)

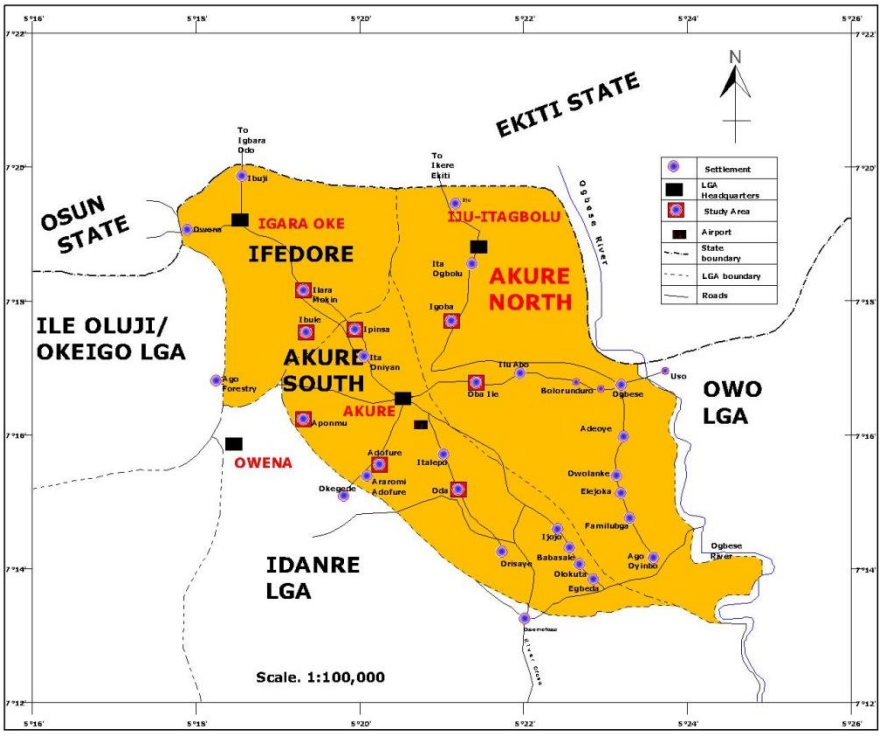


Figure 3: Locational Map of the Study Area in Regional Setting

Source: Ondo State Ministry of Lands and Survey, Akure (2014)

The Database

Data collection for this study was essentially through Aerial Imagery Overlay (AIO) with the aid of GIS, RS and personal observations. Other sources include government ministries and establishments for historical milieu of the area as well as base maps and population data used for the study. Internet facilities were equally explored for relevant information. The study area has a total (projected) population of 476,159 in 2014 with a total land expanse of 125,212 Hectares. The main approach used in this study was mainly post-classification comparison analysis of satellite imageries of Akure obtained at different decadal variations. This helps to show the direction and extent of growth in the study area from one period to the other. The studying period span through three decades and is divided as follows: 1985–1994, 1995–2004 and 2005–2014. The land use for the study area is classified into four categories, which include: the built-up area (involving residential, commercial, industrial, recreational and educational land uses); thick vegetation (forested land areas); light vegetation (cultivated land areas), and the water bodies (Rivers, streams, etc).

RESEARCH FINDINGS AND DISCUSSION

Analysis of Land Use Land Cover Classifications (LULCC) - 1986 to 2014

As shown in Figures 4-7; lager proportion (80,796 Hecht) of the study area were covered with thick vegetation in 1986 which accounted for 64.53% of the land area while 37,977 Hectares (30.33%) were cultivated and covered with light vegetation. Only about 5.1% were developed areas which are either residential, commercial, recreational, industrial or educational land uses, occuping just about 6384 Hectare land area. Just about 56 Hectares (0.04%) were covered by water. This situation express the low level of development as at 1986 with a small compact urban area.

In 2002, the percentage of built-up area had increased to 16.63% (20,885 Hecht), cultivated area (light vegetation) also increased to 68,940 Hectares (55.06%) while the area covered by thick vegetation reduced drastically to 32,978 Hectares (26.34%). This shows that much of the thick vegetation were cultivated while some gave way to further development and urban expansion through building constructions and provision of public utilities.

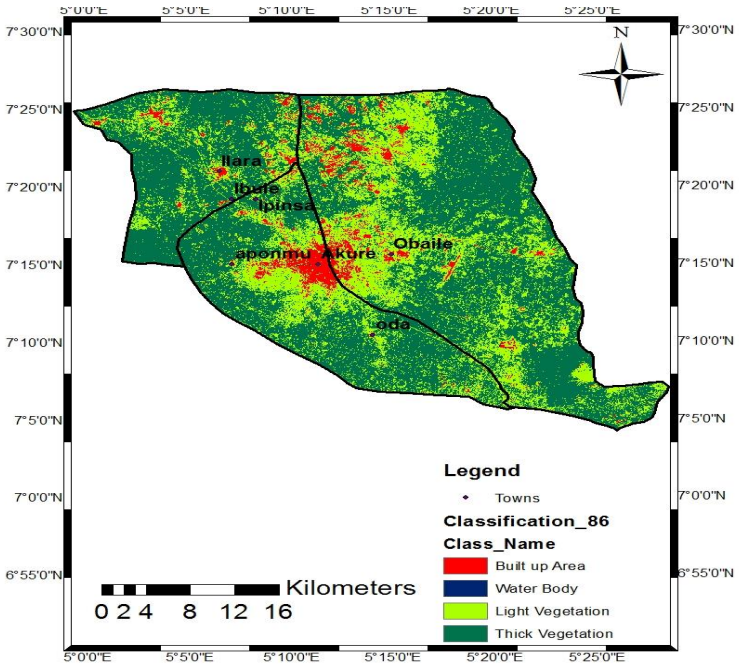


Figure 4: Land Use Classification of Akure as at 1986
Source: Landsat 4 Thematic Mapper (TM) Imagery (1986)

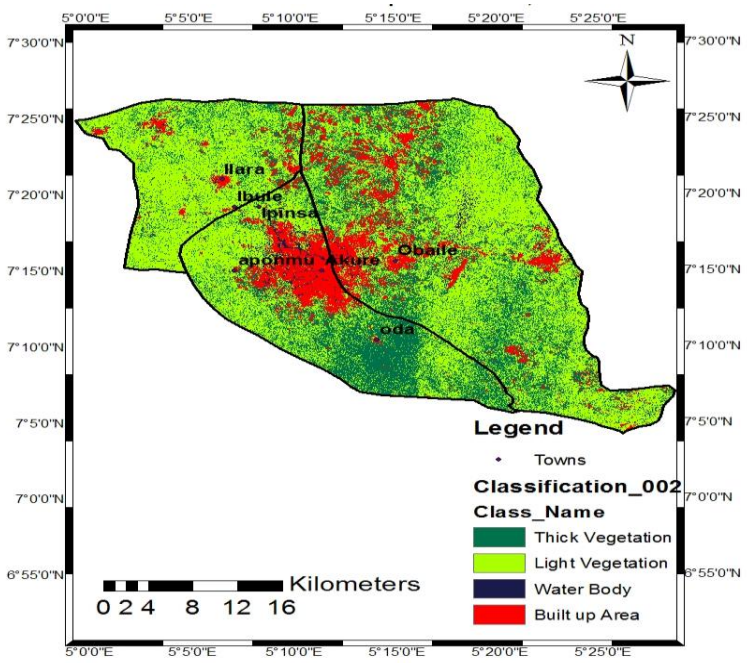


Figure 5: Land Use Classification of Akure as at 2002
Source: Landsat 7 Enhanced Thematic Mapper (ETM$^+$) Satellite Imagery (2002)

In 2007, the built-up area further increased to about 22,985 Hectares (18.36%), light vegetation cover occupied 82,415 Hectare (65.82%) while areas covered by thick vegetation and water body reduced to 19,002 Hectares (15.18%) and 811 Hectares (0.64%) respectively. The land use for the built-up area continue to increase till date while that of thick vegetation, light vegetation and area cover by water reduces.

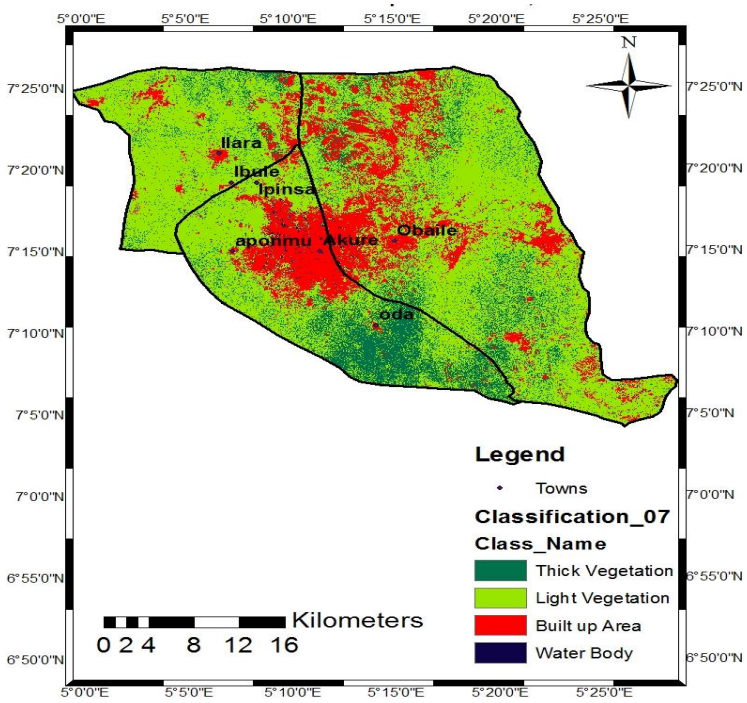


Figure 6: Land Use Classification of Akure as at 2007
Source: Landsat 7 Enhanced Thematic Mapper (ETM$^+$) Satellite Imagery (2007)

In 2014, land use for built-up area increased from 22,985 (in 2007) to 34,303 hectares (27.40%) while light vegetation (the cultivated area) reduced from 82,415 hectares (in 2007) to 72,675 hectares in 2014. The reason for this might be because of drastic reduction in

number of farmers since majority of people working on the farms had been taken over by civilization while some land areas meant for cultivation were acquired for provision of public utilities.

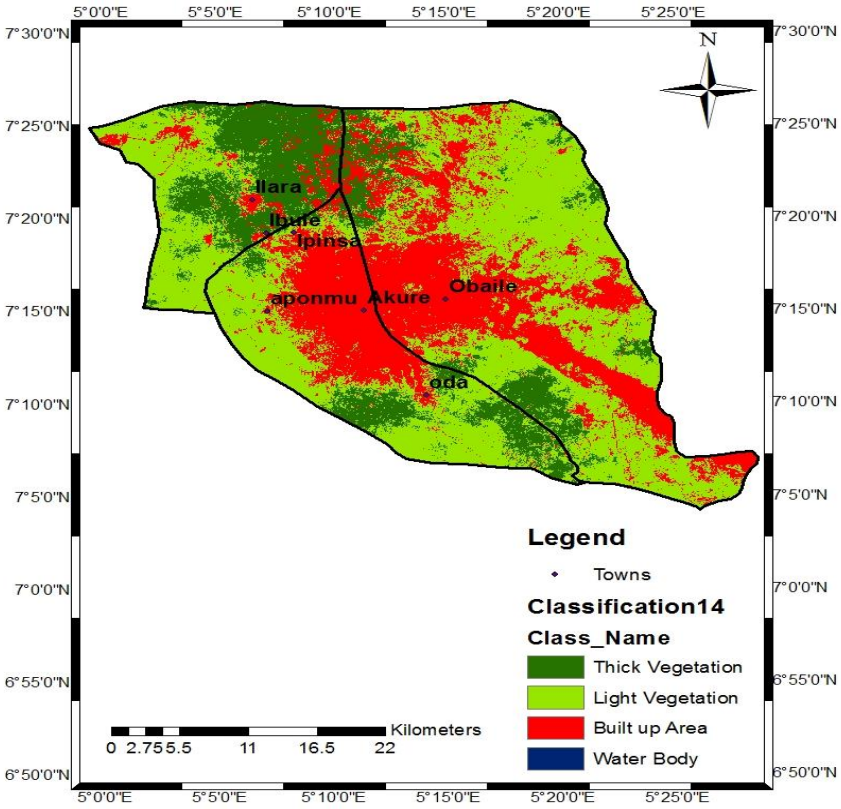


Figure 4.4 (a): Land Use Classification of Akure as at 2014
Source: Landsat Operational Land Imager (OLI) Satellite Imagery (2014)

The inference that can be deduced from this analysis is the rate of urban expansion as illustrated by the trend of increase in the built-up area and light vegetation (cultivated land areas). The drastic reduction in the percentage of area covered by thick vegetation shows there was a phenomenal growth within the studying period. For instance, the built-up area increased by 22.3% between 1986 and 2014 as well as light vegetation (cultivated land areas) by 27.71%. This is likely to be the result of much encroachment into the thick vegetation, rocky and undulating land areas for the purpose of building construction, quarry, blasting and mining activities. Besides, the economic situation in the state around the time (especially, the ealier years of the new millenium) was favourable for individuals, government and various establishments to embark on massive developments. For example, in 2002 (being the beginning of the millenium), various projects were embarked upon consequent upon the discovery that the state falls within the mineral endowed region, which accounted for the tremendous increase in the built-up areas, which result in massive physical expansion of the region. Again, Akure gained much influx of people seeking greener pastures being the state capital while the discovery of bitumen in the state attracted much investors and other immigrants within the studying period. Its administrative status and concentration of establishments like government ministries, several housing estates, Ondo State Oil Producing Area Development Commission (OSOPADEC) secretariat, Federal University of Technology, Akure (FUTA) and lot more were the centre of consideration for the attraction.

Land Use Land Cover Change Detection Analysis for the year 1986–2014

The LULCC of Akure and the change detection analysis for the 1986–2002, 2002–2007 and 2007-2014 are presented in Table 1 and Figure 8. From the table and figure, the percentage

increase of built-up area, light vegetation (cultivated land areas) and water body was higher between 1986 and 2002 than between 2002 and 2007. Percentage difference for built-up area was much more higher between 2007 and 2014 while other land classifications have negative index. Thick vegetation was rapidly depleted and taken over by light vegetation and built-up land uses as indicated by the negative index throughout the studying period. This is an evidence of consistent growth and rapid development witnessed in the city.

Table 1: LULC Change Detection Analysis in Akure for the year 1986-2014

	2002-1986		2007-2002		2014-2007	
The LULC	Difference in Area (Hecht)	Difference in Area (%)	Difference in Area (Hecht)	Difference in Area (%)	Difference in Area (Hecht)	Difference in Area (%)
Built-up	14441	11.53	2160	1.73	11318	9.04
Area	-47818	-38.19	-13976	-11.16	-1379	-1.11
Thick Veg.	30963	24.73	13475	10.76	-9740	-7.78
Light Veg.	2413	1.93	-1658	-1.33	-199	-0.15
Water Body						

Sources: Landsat Satellite Imageries (1986, 2002, 2007 and 2014)

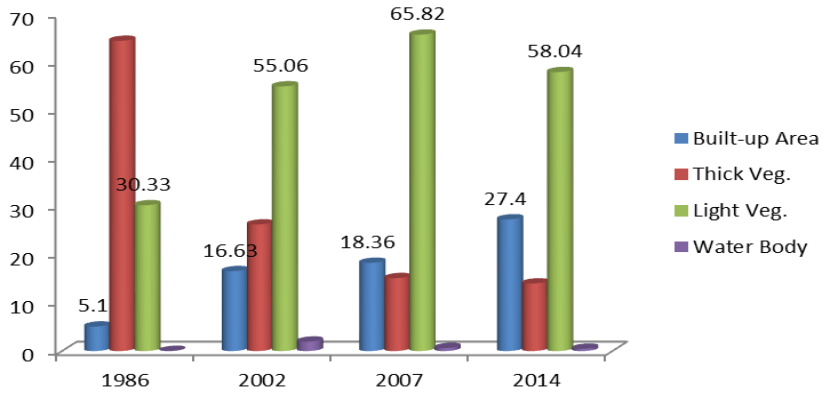


Figure 8: LULC Classification and Change Detection in Akure Urban Land Use (1986-2014)
Sources: Landsat Satellite Imageries (1986, 2002, 2007 and 2014)

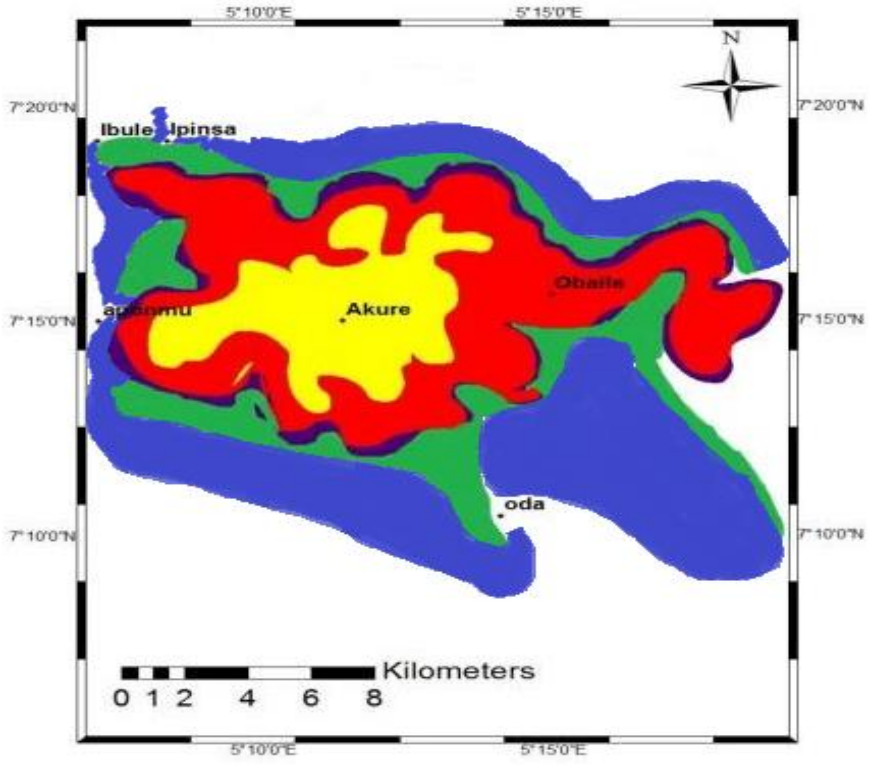
Urban Built-Up Change Detection Analysis and Predictive Model for Future Expansion

The spatial pattern of sprawling in Akure over a period of three decades (1985-2014), as shown in Figures 4-7, express the direction and extent of growth in the period examined. For instance; between 1985 and 2002, the growth navigates towards the northern and the eastern parts of the region more than any other direction. These areas were earmarked for the construction of Government Residential Areas (GRAs) and most of government parastatals and ministries. Besides, the area was the location of Ijapo estate, a notable residential estate in the city which attracted much influx into the area. The construction of Ilesha-Akure-Owo express route which passes through the north-eastern part of the city was another notable factor that play prominent role of attracting people to the area. But the direction of growth thereafter diffused to other directions, probably due to congestion in this area and availability of cheap lands and good topography that favours construction in other parts of the city.

The location of Federal University of Technology, Akure (FUTA) in the north-western part of the city has much influence in attracting huge population of people into the area. Most staff of the institution and students preffer to live close to it, thereby making the growth to be institutional attraction. Currently, the growth around this institution has almost captured Ipinsa and Ibule (the two nearest settlements) as high percentage of students of the institution find cheaper accommodation there as well as cheaper lands for staff and people from Akure to build houses and hostel accommodation for students. This and other important developments that parade the city revealed significant difference in stages of expansion and

land uses within the studying periods. The findings corroborate the work of Oyinloye (2010) and Balogun (2011 who observed significant difference in stages of development and growth in Akure since its inception as a state capital.

The use of GIS to predict future expansion of the study area and possible changes in land uses was modeled to guide policy makers in the management of land use activities in Akure and environs. Based on 3.6% growth rate adopted in Oyinloye (2010) for Akure, the predicting future expansion for the built-up area for a period of 20 years (2014 to 2034) is estimated at 68,793.41 hectares. The pictorial representation is shown in Figure 9. As seen in the figure; there is every possibility for Akure to become a full grown conurbation by 2034 when it would have subsumed many of its adjoining communities.



Legend: 1986 2002 2007 2014 2034

Year of Growth	Growth Area (ha.)	Cumulative Area (ha.)	Percentage Area
1986	6383.65	6383.65	5.10
2002	20825.33	27208.98	16.63
2007	22984.57	50193.55	18.36
2014	32969.15	83162.70	26.33
2034 Projected	66881.02	150043.72	53.41

Figure 9: Built-up Change Detection Analysis for Akure Urban Land Use (1985 – 2034)
Source: Field Survey, 2014

SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

The study gives a clear indication of unguided expansion in the growth of Akure which seriously affects the pattern of land uses in the city and its surrounding settlements. There were incompatible conversions of land uses and undue encroachment into green areas in the adjoining settlements due to favourable economic situation in the state around the period. In the early year of the millenium, Akure gained much influx of people being the state capital;

and most importantly, due to the discovery of bitumen in the state which attracted much investors and other immigrants in quest of greener pastures and job opportunities. Its administrative status and concentration of establishments were the key indices for this attraction. With this, the thick vegetation was massively encroached which consequently gave way to further developments and expansion from the city into various sorrounding communities. Also, the regional setting of Akure has naturally influenced the direction of the expansion. Findings revealed that the city spread out along the fairly flat areas of the north-western part of the city which appear to be more favourable to human settlements. Thus, the expansion first tend towards this direction before it began to diffuse to other areas.

Based on major findings in this study, it has become pertinent to put up some policy recommendations. In the first instance, the unguided nature of Akure urban development whose effects on land use pattern are well prominent in the study area needs adequate attention. The check on this should commence with land acquisition and allocation procedures for various uses so as to guide against incompatible land uses. It is therefore recommended that ministries in-charge of land management should employ resourceful control measures over private and public land uses through effective zoning strategy. In view of this, the Development Control Department (DCD) in the Ministry of Urban Development and Physical Planning should be reinforced with strong tools to carry out their duties, particularly in the area of effective monitoring for sustainable development.

The existing land use in the study area is more of residential, most of which are aged and dilapidated. In some parts of the city, especially at the urban core; most of the old buildings are being removed and changed over to new ones. In the course of changing some of these buildings, the usages are always at variance with compatibility standard. They constitute nuisance rather than complementing the planning and environmental standards. In this regard, it is recommended that adequate monitoring be made by DCD and other stakeholders in urban planning, right from plan approval stage to erection of structures so as to forestall such occurrences with a view to achieve a sustainable and virile livable environment. Besides, property rehabilitation strategy should be adopted on degraded landed properties rather than arbitrary removal and rambling replacements. This should involve improving the existing infrastructural facilities as well as providing new ones with a view to making their services functional and accessible to all and sundry. To reduce the level of encroachment into natural vegetation in the course of expansion, it is also suggested that vertical expansion should be encouraged in the form of story buildings, high scrappers, and the likes. It is believed that this will reduce the rate of land consumption and improve the structural quality as well as adding to the aesthetic value of the environment.

The administration of physical planning in Nigeria was not effective as far as promotion of orderly development of urban and rural communities is concern prior the enactment of Decree 88 of 1992 Nigerian Urban and Regional Planning Law (NURPL). Related programs on physical planning were carried out only on ad-hoc basis. However, the enactment of 1992 NURPL makes provision for improvement of urban area and city sustainability; essentially in part IV section 79-85 of the law. With this, it is expected that cities are to be in orderly shape and made sustainable for human living. But, in reality, this is not so. At local government level, planning is expected to be felt through various planning authorities since it is the closest tier of government to the people. But the authorities are almost become moribund since the mode of planning administration in Nigeria does not allow them to function. It is therefore recommended that the state of local government planning administration in Nigeria be reactivated and made functional.

The existing Master plan of Akure was produced in 1980 and has become inactive, old and superseded. There is need for a more comprehensive one as well as Regional Plan to guide the development and spatial growth of the region. These plans are to be administered by a constituted board which is to be saddled with responsibility to maintain an orderly and aesthetic environment in the region. The board is to be made responsible for the preparation and implementation of planning schemes as well as local, area and structural plans in conformity with the state and regional plans. This will go a long way to assist in regulating land uses for sustainable development in the area.

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Analysis of Land Use/Land Cover Changes in Damaturu, Nigeria: Using Satellite Images

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ABSTRACT

This study analyzes the land use/land cover changes in Damaturu metropolis and obtained the trend from 1986 to 2005. LandSat TM Images of 1986, 1999, and 2005 were used. Built-up lands, agric lands, water body and other lands (vacant) were created as themes in ILWIS 3.4 software. The images were displayed in False Colour Composite (FCC) for a better visualization and identification of the themes created. Training sample sets were collected based on the ground truth data during field checks. Statistical data were later extracted from the classified sample set. Area in hectares for each theme was calculated for each year and the result for each land use/land cover types for each study year was compared. From the result, it was found out that built-up areas have a considerable increase from 37.71 hectares in 1986 to 1062.72 in 2005. It has an annual increase rate of 0.34%. The results also reveal that there is a decrease of 5829.66 hectares of other lands (vacant lands) from 1986 to 2005.

Keywords: Land Use, Distribution, Analysis, Rate of Change

INTRODUCTION

Patterns of land use often lead to changes in land cover. Urban areas develop either through objectively planned areas, guided and regulated by deliberate regulation and control systems, or spontaneous growth through unplanned isolated constructions especially on the city fringes (Lawan, 2014). Human population dynamics largely affect the demand for land in any society. This dynamism leads to scarcity of land and land resources in communities (Isa, 2008).

Ideally, the growth that takes place around the urban areas should be channeled in an orderly manner that can produce an economically efficient, socially and personally satisfying living environment. The direct implication of such population growth is the change in the land use of the region.

Spatial patterns of urban growth over different time periods, can be systematically mapped, monitored and accurately assessed from the satellite data (remotely sensed data) along with conventional ground data (Lata *et al*., 2001). Modelling urban growth provides a "picture" of where this type of growth is occurring, helps to identify the environmental and natural resources threatened by such growth, and to suggest the likely future directions and patterns of the growth. This phenomenon comes with high level population increase in the urban areas as well as consistent decline in economic opportunities in rural areas (Gardner, 2001; UN-Habitat, 2004).

The aim of this study is to analyze the land use changes in Damaturu Metropolis from 1986 to 2005 using satellite images. This can be achieved through the following objectives:

i. Production of three land cover maps of the study area for the year *1986, 1999, and 2005*.
ii. Analyze the produced maps in order to obtain the extent of land use for each year.
iii. To obtain the trend of the land use using the raster approach.

Musa, L. & Zumo, I. M. (2016). Analysis of Land Use/Land Cover Changes in Damaturu, Nigeria: Using Satellite Images. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1518-1522

Statement of the Problem

The daily influx of people into the State Capital has put high demand on land, giving rise to high impacts of land use changes in Damaturu Metropolis. This has translated into socio-economic and political problems, thereby imposing great challenges to the urban planners, city administrators, and the general public.

Scope of the study

The study has focused on analyzing the land use changes in Damaturu Metropolis, Yobe state; and forecast for the future pattern of the land development in the study area.
Thus, the study has limited itself to the Damaturu Metropolis with the geographical location lying between latitude 11º 42'N and 11º 47'N, and longitude 11º 54'E and 12º 02'E.

METHODOLOGY

Data types and Sources: Table 2.1 shows the Data types and Sources.

Table 2.1; Data Source

S/N	DATA TYPE	DATE	SCALE/ RESOLUTION	SOURCE
1.	LandSat ETM+ Image	2005	30m	NASRDA
2.	LandSat ETM+ Image	1999	30m	GLCF(ESDI)
3.	LandSat TM Image	1986	30m	GLCF(ESDI)
4	Ground Control coordinates (GPS of some selected points)	2010		Field Work

Source; Global land cover facility 2009

Materials/Equipment used

The major equipments are used in this study are personal computers (PC) with 250 GB of hard disc space, 2.0 GB RAM with 1.66 GHZ speed; Hp DeskJet F2280 scanner and colour printer. Prominent software packages used for this Study were ILWIS 3.4, and Idrisi32.

Data preparation: LandSat images acquired, topographical maps, image map and the Land use plan of the Town were geo-referenced using the ground control points (GCPs). The root mean square (RMS) error of geo-referencing is approximate 0.5 pixels. The Root Mean Square (RMS) error represents the difference between the original control points and the new control point locations calculated by the transformation process (Isa, 2010). The transformation scale indicates how much the map being digitized will be scaled to match the real-world coordinates.

DATA ANALYSIS

Five themes were created. These are built up lands, forest lands, Water bodies, vegetation/Agriculture and Other lands. The images were displayed in False Colour Composite (FCC) for a better visualization and identification of the themes created. This determines the relative spectral between the bands to identify the different land cover types in the images. Training sample sets were collected based on the ground truth data during field checks. Statistical data were subsequently extracted from the classified sample set.

Calculation of the Area in hectares of the resulting land use/land cover types for each study year and subsequent comparison of the results

Table 4.1 shows the area in hectares and the percentage change for each year measured against each land cover type. Percentage change to determine the trend of change was then calculated by dividing the observed change by the sum of changes multiplied by 100

$$\text{(Trend) percentage change} = \frac{\text{observed change}}{\text{Sum of change}} * 100$$

To obtain annual rate of change, the percentage change was divided by 100 and multiplied by the number of the study year.

Identification of land use changes

From the classified images, the area under the built-up lands, other lands, vegetation – agriculture, and the water bodies were computed and tabulated accordingly, for further analyses.

Table 4.1; Land Use / Land Cover Distribution (1986, 1999, and 2005)

LANDUSE/LAND C CATEGORIES	A (H	A (%	A (H	A (%	A (H	A (%
BUILT-UP LANDS	27	1.	30	2.	13	1(
OTHER LANDS	94	6'	11	7{	53	3{
VEG. & AGRICULT	43	3(	25	1{	71	5(
WATER BODY	87	0.	1(	0.	25	2
TOTAL	**14**	**1(**	**14**	**1(**	**14**	**1(**

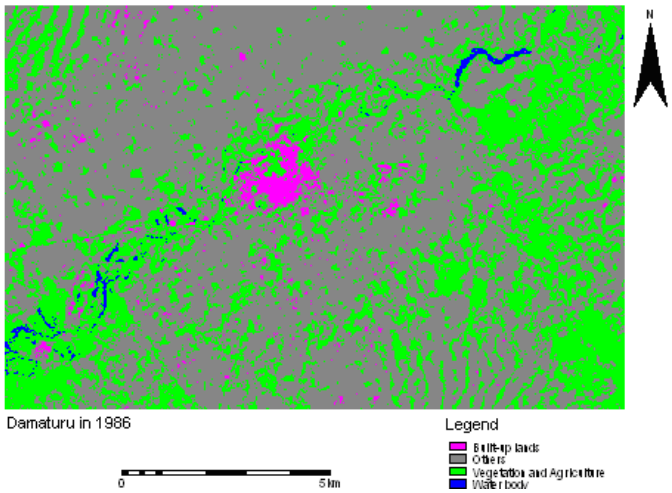

Figure 4.1 Classified image of Damaturu 1986
Source: Author's Laboratory work, 2013

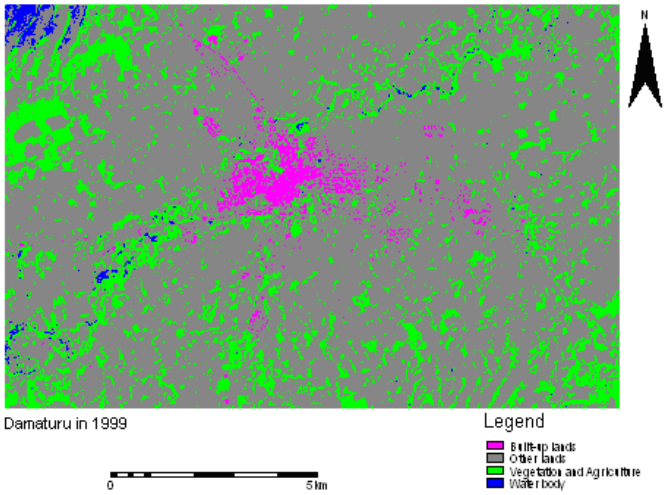

Figure 4.2 Classified image of Damaturu 1999
Source: Author's Laboratory work, 2013

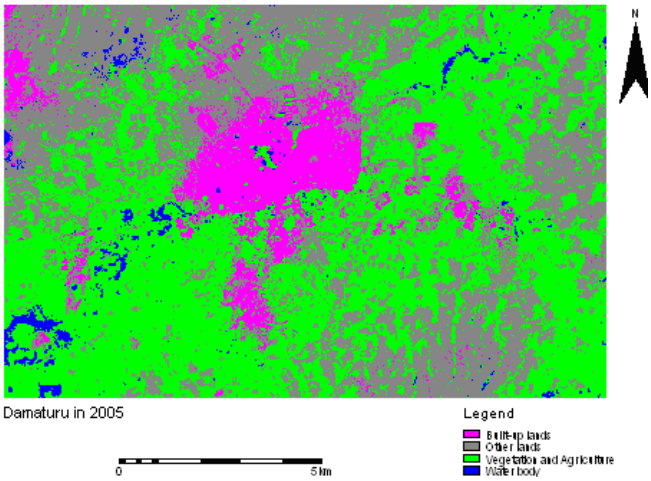

Figure 4.3 Classified image of Damaturu 2005
Source: Author's Laboratory work, 2013

Table 4.2 Land use / land cover change of Damaturu and its environs (1986, 1999 and 2005)

	1986 – 1999		1999 – 2005		ANNUAL RATE OF CHANGE	
LANDUSE/LAND COVER CATEGORIES	**AREA (Ha.)**	**PERCE TAGE CHANGE**	**AREA (Ha.)**	**PERCENT AGE CHA NGE**	**1986 - 99**	**99 – 2005**
	37.71	1	1062.72	9	0.13	0.54
BUILT-UP LAND	1694.34	48	-5829.66	-50	6.24	-3
OTHER LANDS	-1754.28	-50	4620.42	40	-6.5	2.4
VEG.& AGRIC	22.23	1	146.52	1	0.13	0.06
WATER BODY						

The percentage change in the built-up lands between the year 1999, and 2005 (9% as from the Table 4.2) was found to be very much higher than that of between the year 1986, and 1999 (1%). This may suggest that the rate at which the new lands were acquired for development after the state creation is high and this may also be the trend between the year 1999 and the 2005, as there seems to be development expanding towards the outskirts of the city. The following Figure 4.4 shows the gains and the losses in the built-up lands between the year 1999, and 2005 (9%) that indicate some significant differences. This implies that since there is an expansion of 9% from 1999 to 2005, this rate expansion will continue in the next few years and adequate planning towards increasing the distribution of facilities must be done in relation to the rate of growth.

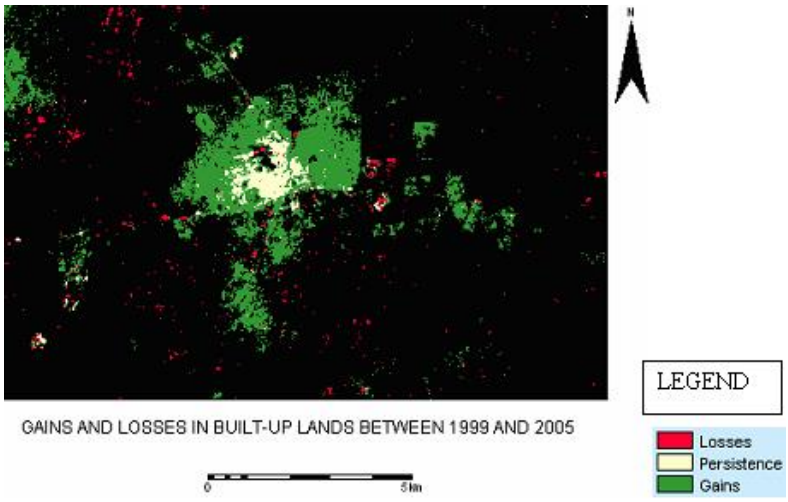

Figure 4.4; Gains and losses in built-up lands between year 1999 and 2005 derive from Idrisi software overly.
Source: Author's Laboratory work, 2013

CONCLUSION

This paper concludes that there is an increase in the usage of land from 1986 to 2005. It was found out that built-up areas have a considerable increase from 37.71 hectares in 1986 to 1062.72 in 2005. It has an annual increase rate of 0.34%. The results also reveal that there is a decrease of 5829.66 hectares of other lands (vacant lands) from 1986 to 2005.

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Characterising Peri-Urban Sprawl of a City in a Developing Country: Case Study of Ibadan, Nigeria

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ABSTRACT

Peri-urban areas, which may have become the most common type of living and working situation, as well as the dominant urban form and spatial planning challenge in the developing world in the twenty-first century, can be characterized as a heterogeneous mosaic of rural and urban features. Peri-urban areas have some mutually conflicting goals, including housing the neediest immigrants, attracting private capital and provision of un-serviced but affordable plots of land to a significant proportion of the people. It is often a zone of chaotic urbanization leading to sprawl. This study focuses on characterising the peri-urban areas and sprawl of Ibadan, Nigeria. Data for the study were collected through questionnaire administration, Focus Group Discussions, Key Informant Interviews, and direct observations. The following findings came from the data analysis: Ibadan recorded a sprawl of more than quadrupled over a 34-year period (1966-2004); the exponential growth of peri-urban areas in Ibadan was attributed partially to the increase in personal vehicle (cars) ownership by the people; the areas were highly populated by non-indigenes; commercial activities were predominant, although uncoordinated, unplanned and unregulated; and there were varied types of houses, predominantly bungalows, leading to the sprawl. Relevant recommendations sequel to findings include: curtailing the peri-urban sprawl by strengthening the existing Town Planning Authorities; encouraging the inhabitants to provide the necessary in-house infrastructural facilities and creation of enabling environment by the governments; and incorporating peri-urban areas into the ambit of planning and governance.

Keywords: Peri-Urban Areas, Peri-Urban Sprawl, Peri-Urbanization, and Urbanization

INTRODUCTION

Peri-urban areas are grey areas, overtly urban in terms of their economic function and, often, of their physical form; yet they are still rural, for lack of municipal facilities, among others (Storey and Overton, 2003). It can be characterized as a heterogeneous mosaic of rural and urban features. The area, perhaps, may become the most common type of living and working situation in the world in the twenty-first century, thus also becoming the dominant urban form and spatial planning challenge of the twenty-first century (Ravetz, Fertner and Nielsen, 2013). The reality of this is in the developing world (Nigeria inclusive) where peri-urban area is often a zone of chaotic urbanization leading to sprawl. Thus, there could be problems relating to increase poverty, inadequate services, poor housing and environmental degradation in the peri-urban areas, consequently leading to sprawl.

Sprawl, either urban or peri-urban, according to Batisani (2006), refers to a type of spreading suburban development with negative outcomes such as increased commuting time. Urban sprawl has been characterized as a distinct form of dispersed and inefficient urban growth, haphazard in configuration, and highly reliant on the automobile (Hasse and Lathrop, 2003). Peri-urban sprawl is the spreading out of a peri-urban area and its suburbs over more and more rural land at the periphery of the urban area. It usually involves the conversion of open space/rural land into built-up, developed land over a period of time in a rapid and not gradual form.

LITERATURE REVIEW

Urbanization and Peri-Urbanization

Mabogunje (1981, 1985) defines urbanization as a process of human agglomeration in multi-functional settlements of relatively substantial size. Stren (1992) also sees urbanization as a

Fasakin, J. O.; Dosumu, N. A. & Omole, F. K. (2016). Characterising Peri-Urban Sprawl of a City in a Developing Country: Case Study of Ibadan, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1523-1534

set of processes that transform nations through a transfer of production and population from rural to urban areas. According to Sudhira, Ramachandra, and Subrahmanya (2007) it is a form of metropolitan growth that is a response to often less understood implications of technological, economic, social, and political forces and to the physical geography of an area. Thus, urbanization is the process in which the number of people living in urban areas increases when compared to the number of people living in rural areas. A country is urbanized when over 50 percent of its population lives in urban areas. These definitions show that urbanization can only take place in cities or urban centers.

The definition of peri-urban areas, however, could be said to be situational, case specific, cloudy and nebulous at times, since spatially, peri-urban areas change over time. It shows that at times there is no clear divide between peri-urban and urban fringe. Nevertheless, peri-urban has been defined as an interface between the urban and rural spheres, in which activities traditionally classified as "urban" (e.g. industry) or "rural" (e.g. agriculture) co-exist. It has also been seen as the transition zone/area, or interaction zone/area between the urban and rural areas, where urban and rural activities are juxtaposed, and landscape features are subject to rapid modifications, induced by anthropogenic activity. It describes areas that are in transition from strictly rural to urban; the meeting of urban and rural areas (peri-urban interface) with interaction between three systems: urban, rural and natural (Parkinson and Tayler, 2003; Gregory, 2006; Mattingly and Gregory, 2006; SCOPE, 2007; Miljković, Crnčević and Maric, 2012). Peri-urban areas occupy changing spaces on the margins of towns and cities. They were once rural, but are gradually becoming urban due to outward expansion of cities. Therefore, today's rural will become tomorrow's peri-urban, while today's peri-urban will become tomorrow's urban.

While houses and other land uses are springing up daily in the peri-urban areas, with some of the residents taking advantage of these new income-generating opportunities, others who are the original rural dwellers are made poorer by this rural to urban transition (Mattingly and Gregory, 2006). Peri-urban challenges are complex and include spatial, service infrastructure, environmental, economic and social dimensions. Although the factors causing peri-urban growth could be said to be, by no means, confined to the spatially defined peri-urban areas, the complexities extend beyond the spatial manifestations of urban growth. Nevertheless, as cities develop, much of their growth is located in such areas leading to peri-urban intensification. Peri-urban intensification is associated with increases in the amount of activities that take place within the areas. Consequently, peri-urbanization affects a wide range of areas geographically, historically and morphologically. Regretably, these critical areas of land cover change, leading to transformations in the hydrological, ecological, geomorphological and socio-economic systems, are often neglected by both rural and urban administrations.

Peri-urbanization process, according to Rouge, Gay, Landrieve, Lefranc-Morin, and Nicolas (2013), is a combination of three factors:

i. a socio-cultural factor: collective appreciation of a habitat model based on the single-family house and proximity to resources combining the city and the country;
ii. a socio-technical factor: the spread of a new form of mobility, the automobile, which allows for a more marked separation between living spaces and workplaces; and
iii. a socio-economic factor: housing strategies that enable the acquisition of land and development of houses outside the city by a large segment of the population.

Characteristics of Peri-Urban Areas

Peri-urban settlements are usually characterized by high population densities coupled with agglomeration of different social and economic activities associated with inadequate or lack

of infrastructural facilities. Rapid population exacerbates due mainly to un-controlled migration from rural to urban areas leading to increase in economic activities and other changes in edges of urban areas by construction of buildings in hitherto agricultural land, which exert enormous pressure on resources and infrastructure in these areas (Mwesigwa, 1995; Ndezi and Wedgwood, 2001; Maseka, 2001; Bunting, 2002; Cohen, 2002).

Housing in the peri-urban area is characterised by various (mix) land uses, not because of planning strategies, but due to unregulated development. This is the reflection of the diversity of the social, cultural and economic activities that take place within the areas. Such uses include residential, commercial, religious (especially churches and mosques), and industrial, educational and agricultural uses. The benefits of such arrangements notwithstanding, peri-urban areas are characterised by low-income settlements, absences of infrastructure and services, insecure livelihoods with the associated problems of health, safety, noise and air pollution, and poor quality of life.

In Nigeria, like other developing countries, the unplanned growth of the peri-urban areas is aggravated by the absence of land use planning instruments, their execution and control. As a result, most of the peri-urban population live in areas without adequate access to basic infrastructure and social amenities. The dwellers live in sub-standard housing, without secure land tenure rights. Nevertheless, these areas provide opportunities for low and middle income earners to be accommodated and to be house owners.

Peri-Urban Sprawl

Ottensmann (1977) sees urban sprawl as the scattering of new developments on isolated tracts, separated from other areas by vacant land. Lee, Tian, Erickson, and Kulikowski (1998) argue that sprawl is the result of the development process of urbanization, sub, counter, and re-urbanization allowing for urban expansion into rural areas spreading outward in haphazard pattern and consuming more land than is necessary while creating unnecessarily high costs for basic community and social facilities and services. Batty, Xie and Sun (1999) perceives urban sprawl in relation to the contemporary urban growth consisting of three interrelated problems of spatial dynamics: the decline of central or core cities which usually mark the historical origins of growth; the emergence of edge cities which compete with and complement the functions of the core; and the rapid sub-urbanisation of the periphery of cities - core and edge - which represent the spatially most extensive indicator of such growth. Zhang (2001) defines urban sprawl as resulting from poorly planned, large scale new residential, commercial and industrial developments in areas previously not used for urban purposes. Sprawl has also been seen as the spread-out development that consumes significant amounts of natural and man-made resources, including land and public works infrastructure of various types (Transportation Research Board, 2002).

METHODOLOGY

Quantitative and qualitative data for this study came from both primary and secondary sources. The primary data were collected on the socio-economic characteristics of the inhabitants, availability of in-house infrastructural facilities, number of rooms in a house, household size, mode of travel and vehicle ownership, and distances to offices/places of work were also collected. The data were collected with the help of four (4) Field Assistants (FAs). Participatory Rapid Appraisal (PRA) techniques were used to collect the primary data. PRA is a bottom-up approach to development that enables stakeholders express themselves, share and analyze their knowledge. Existing documentations on peri-urban sprawl, housing/settlements, sustainable environment, accessibility to land, infrastructural facilities and their affordability in Nigeria peri-urban areas were reviewed. Tertiary Institutions, Research Institutes and International Bilateral, Multilateral and Development Agencies were

contacted to collect published and unpublished materials. Electronic materials were also sourced from the internet.

Table 1: Localities and Sampled Enumeration Areas in Lagelu LGA

S/N	Localities	Sampled Enumeration Areas
1.	Monatan	Alhaji Lasisi Adeniyi
2.	Agbon	Rising International School
3.	Abidi-Odan	Akinade (Baale)
4.	Akobo	M.O. Osanyin
		Shallom Villa
5.	Omolayo Avenue, Akobo	Mr. Kusanu O. Solomon
6.	Sawo	CAC Agbala Atorise
7.	Isokan	Felix Elegure
		Alhaji I. J. Salam
8.	Aba Alfa, Akobo	Elejigbo House
9.	Elewi Odo	Sariyu Buari house
10.	Kajola	Muriana Alagbe
11.	Ojurin Akobo	Pastor Akinbobola
12.	Onikokoro, Akobo	Baale Onikokoro
		Baba Aragbo House
		St. Peter Anglican Church
13.	Yawiri	Bamisaye Peters
	Total EAs	1,286
	Total Sampled EAs	17
	Total Population	148,133
	Total Sampled Population Size (%)	1.3

The Enumeration Areas (EAs) of the National Population Commission (NPC) were used and 1.3 per cent of these EAs was sampled. EAs are convenient areas subdivided by the NPC during the 2006 National Population Census. The research used simple random sampling technique to select the thirty-five (35) enumeration areas (EAs) in the two LGAs (Oluyole and Lagelu) that were studied. This gave all the 2,700 EAs equal chance of being selected. For the purpose of the household questionnaire administered, systematic random sampling was used in the selection of houses. The process of selection involved random selection of the first (1st) house, while others are systematically selected by a predetermined sampling interval (every fifth house on a street). This involves getting a list of population (N); determining sample size (n); calculating interval (N/n= k); and selecting every k interval after the first (1st) house. Thus, the procedure involved administering the questionnaire on the head of household in every fifth house on a street. The studied LGAs, localities and enumeration areas are shown in Tables 1 and 2.

FINDINGS AND DISCUSSIONS

In identifying the characteristics of the peri-urban areas, there is the need to measure the specific peri-urban areas, which can be done qualitatively and quantitatively. This study looks exclusively at the quantitative measure of the amount of sprawl – the actual square kilometres or hectares of land that are converted to peri-urban use as the city and its suburbs expand beyond their boundaries. Also, the socio-economic characteristics of inhabitants of the peri-urban areas in terms of education, marital status, religion, occupation, and income, among others, are discussed. Figures 1 – 3 show the maps of Ibadan and the two areas in time lapsed view of how the landscapes in and around the city of Ibadan and the two studied areas have changed as a result of development between 1966 and 2004. During these periods, there was rapid deforestation and other issues associated with sprawl, as trees were cut down, roads, businesses, and houses were built. According to the findings of this study, the total area of the

city in 1966 was 7,935 hectares, which grew by 36.58 percent within a 7-year period to 10,838 hectares in 1973. It means the city grew by 2,904 hectares within the period.

Table 2: Localities and Sampled Enumeration Areas in Oluyole LGA

S/N	Localities	Sampled Enumeration Areas
1.	Ifelodun Aba Alfa Olomi	Alhaji Alimi Opeyemi
2.	Opere	Life Guest Hotel
		Power Pentecostal Church
		Oblates of St. Joseph Formation
3.	Odo Ona Kekere	Yemtol Oil Ltd
		Soara Atere
		Alhaji Adebayo
4.	Ayedarade Agric	Baba Akowe
5.	Orule Odo	Adeleke Oke
		St. Martins Catholic Church
6.	Toll Gate/ British American Tobacco	British American Tobacco
7.	Idi Mangoro	Alhaji Lukman Olawore
8.	Papa Eleye	Jesse
		Christ the King Church
9.	Olorunkemi	Nurudin Islamic Model N/P School
10.	Aba Aboo	Ifenikoko Cooperative
11.	Ifelodun	Akintola Ona Ola Erutola
		Alkaja S. Ayoka
	Total EAs	1,414
	Total Sampled EAs	18
	Total Population	203,461
	Total Sampled Population Size (%)	1.3

However, the growth became phenomenal in the late 70s to early 80s (the oil boom years), increasing exponentially in 1982 to 18,868 hectares, which is 74.08 percent of that of 1973 (with a sprawled of 8,030 hectares over a 9-year period). By 1996, it sprawled with 10,533 hectares to increase to 29,402 hectares (55.8% of 1982 over a 14-year period). By 2004 the growth had reached 42,219 hectares, having sprawled 12,817 hectares (43.5% over a 8-year period). Figure 1 shows the rate of spatial growth of the peri-urban areas of Ibadan. In the 1980s, the Ibadan-Lagos expressway generated the greatest urban sprawl in Ibadan, closely followed by the Eleyele-Dugbe expressway

Rates of spatial growth of Oluyole and Lagelu peri-urban areas of Ibadan were not the same, as shown in Figures 2 and 3, respectively. While the extent of growth between 1966 and 1973 in Oluyole was at an average annual growth of 29 percent, it increased to 35.6 percent between 1973 and 1982. However, it was at its lowest ebb between 1982 and 1996, recording only 16.7 percent average annual growth rate. But between 1996 and 2004 the growth recorded its second highest annual rate of 35 percent (Figure 2).

In Lagelu, the trend differs. There was phenomenal growth between 1966 and 1973, recording more than triple annual growth rate. It increased drastically furthermore to more than quadrupled between 1973 and 1982, before plummeting to about double annual growth rate between 1982 and 1996 (Figure 3). It reduced drastically to 20.5 percent between 1996 and 2004. The growth rate was high immediately after independence simply because the area was highly rural before independence and people only started moving to the area in late 60s and early 70s, coupled with the fact that the period was the oil boom era in the country. The phenomena rate of sprawl witnessed between 1973 and 1982 could also be attributed to the

Lagos-Ibadan (Ojoo) expressway and the Ibadan (Iwo road)-Ile-Ife expressway, which were constructed during this period.

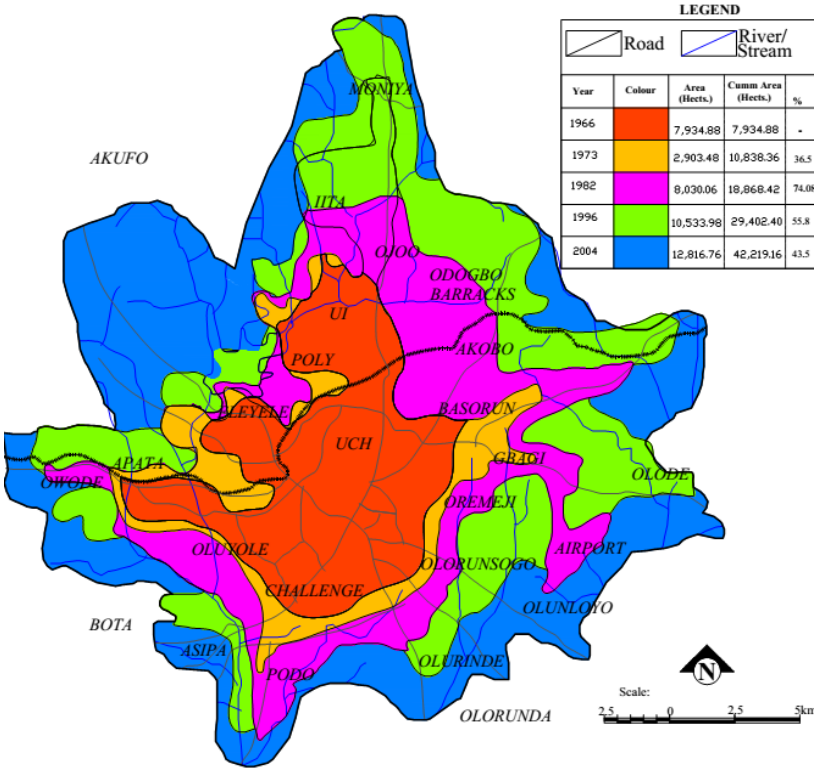

Fig. 1: The Extent of Growth of Ibadan Over a 38-Year Period (1966-2004)
Source: Compilation from Google Earth Timelapse Builder Analysis, 2010

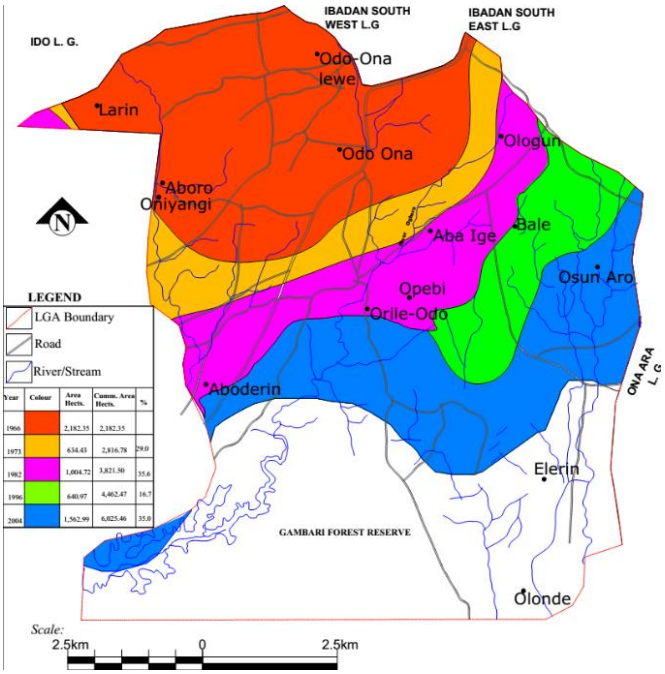

Fig. 2: The Extent of Growth of Oluyole LGA Over a 38-Year Period (1966-2004)
Source: Compilation from Google Earth Timelapse Builder Analysis, 2010

Thus, the trend shows that the population has been moving towards the peri-urban areas as a result of rapid urbanization of the urban area and industrialization of the peri-urban area where land is readily available for various uses. Improvement of public transport, especially road network enabled people to reside and activities to be located more easily outside the

town/city. Figure 4 shows the aerial view of a typical peri-urban sprawl in an enumeration area in Ibadan. From the figure one can see vividly lack of planning and disorganised road network, as well as comatose siting of buildings in the area.

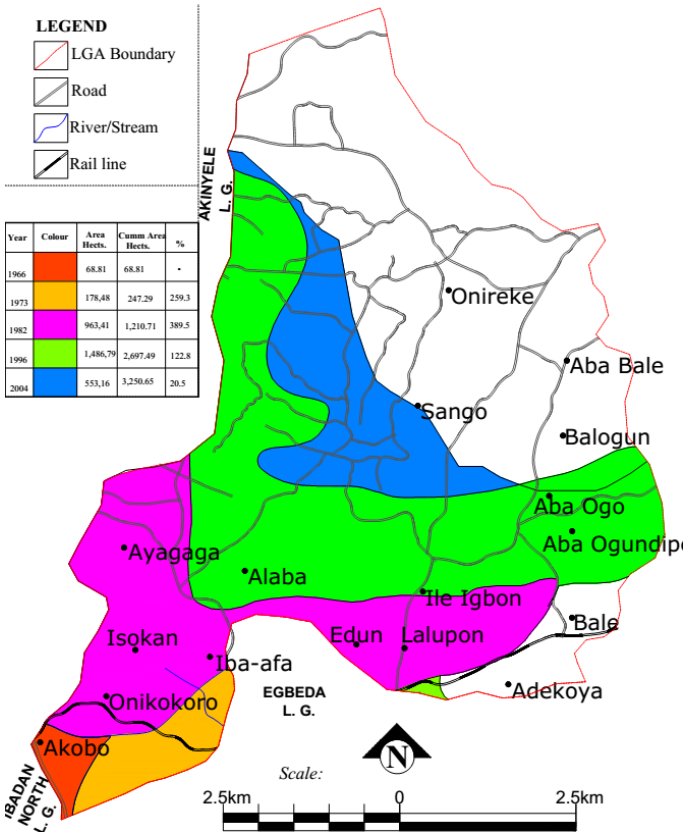

Fig. 3: The Extent of Growth of Lagelu LGA Over a 38-Year Period (1966-2004)
Source: Compilation from Google Earth Timelapse Builder Analysis, 2010

Fig. 4: Aerial View of Peri-Urban Sprawl of Isokan Enumeration Area in Lagelu LGA
Source: Google Earth, 2012

A significant proportion of the residents in the peri-urban areas of Ibadan were involved in either petty trading/small business (37.2%) or artisanal activities (26.4%), as shown in Table 3. There were pockets of retail and artisan shops, as well as commercial activities located sporadically within the areas. This confirms finding of other studies (Mabogunje, 1968; Areola, 1994; Onibokun and Faniran, 1995; Akerele, 1997; Fourchard, 2003) that there was

high level of informal economic sector activities in form of petty trading and petty craft activities in Ibadan.

Table 3: Occupation of Respondents

S/N	Occupation	Local Government Areas				Total	
		Lagelu		Oluyole			
		Frequency	%	Frequency	%	Frequency	%
1.	Farming	12	1.3	59	5.6	71	3.6
2.	Trading/Business	283	30.1	460	43.4	743	37.2
3.	Civil Service	197	21.0	121	11.4	318	15.9
4.	Professional	54	5.7	76	7.2	130	6.5
5.	Unemployed/Applicant	148	15.7	63	5.9	211	10.5
6.	Artisan	246	26.2	281	26.5	525	26.3
	Total	940	100	1,060	100	1,998	100

The people's involvement in petty trading and other small scale artisanal activities would have an effect on their level of income, which was low. About 43.5 percent of the respondents claimed to make a profit of less than ₦50,000.00 per annum, that is, about ₦4,166.67 per month, while 6.5 percent earned between ₦250,001 and ₦500,000, only 3.8 percent claimed to be earning over ₦1,000,000 per annum (Table 4). It shows that the peri-urban areas of Ibadan were inhabited predominantly by poor people who were leaving below the poverty line, since in the Nigerian context, the national minimum wage is ₦18,000.00 per month or ₦216,000.00 per annum, that is, US $1,309 per annum or US $109 per month or US $3.6day.

Table 4: Annual Income of Respondents

S/N	Income (₦)	Local Government Areas				Total	
		Lagelu		Oluyole			
		Frequency	%	Frequency	%	Frequency	%
1.	< 50,000	385	41.0	480	45.3	865	43.3
2.	50,0001- 100,000	160	17.0	180	17.0	340	17
3.	100,001 - 250,000	75	7.9	110	10.4	185	9.3
4.	250,0001- 500,000	60	6.4	70	6.6	130	6.5
5.	500,001 - 1,000,000	110	11.7	65	6.1	175	8.7
6.	> 1,000,000	60	6.4	15	1.4	75	3.7
7.	No Response	90	9.6	140	13.2	230	11.5
	Total	940	100	1,060	100	2,000	100

A significant proportion (28.4%) of the respondents had stayed in the areas for between 2 and 5 years and between 5.1 and 10 years (22.6%). While 21.3 percent had stayed for less than 2 years, 18.8 percent had stayed for over 15 years. This shows that most of the respondents should have a good understanding of the areas, having being staying there for long prior to the study. About 72.3 percent of the respondents were less than 10 years old as residents in the areas means most of the buildings were relatively new, less than 10 years old. Nevertheless, some of the buildings were not structurally sound. Family landholding was very prevalent in the peri-urban areas of Ibadan, resulting in the indigenous land owners (*omo-oniles*) to be highly influential. Most (45.8%) of the respondents acquired their land, which most often were without any registered title, from the *omo-oniles* and still believed a prospective land owner could acquire his/her land through the same source. Also, a

significant proportion (36.5%) of the respondents claimed to have at one time or the other received threat on their land from the *omo-oniles.*

The types of housing available in the peri-urban areas were bungalows (59.4%), rooming buildings (20.1%), storey buildings (14%), and duplexes (5.5%). Most of the houses being bungalows was adding to the spatial spread of the peri-urban areas of Ibadan, making the growth not to be smart and the entire areas not to be compact. Also, most of the buildings in the studied areas neither have a formal building plan, nor approval by the town planning authority. Such buildings lacked the necessary facilities and infrastructures, such as, toilet, bath, kitchen, as well as water, electricity, among other municipal facilities. Specifically, the finding shows that a significant proportion (36.5%) of the residents had low access to safe/adequate/improved sanitation; still using pit latrine, and practicing open defecation (in fields, bushes, or bodies of water) in the peri-urban areas of Ibadan. These people were putting themselves and others, especially children, in danger of deadly faecal-oral diseases like diarrhea, among others. It should be noted also that some of these houses were being developed installmentally, again, without the necessary in-house facilities. This is s system whereby the owner would complete one or two rooms, moved into the house, while the remaining parts are being developed.

Most of the buildings were rooming, with the modal class of the number of rooms per building being 6-10 (39.5%), closely followed by 4-5 rooms' class (29.5%), while 19.8 percent contained between 2-3 rooms. This frequency of high and varied rooms/building might be due to the varied housing designs or types of houses (bungalows and rooming) constructed within the peri-urban areas of Ibadan. The majority of number of rooms occupied by households in the buildings ranged from 1 to 5. The finding reveals that 41.5 percent of the households occupied 2-3 rooms, followed by 20.5 percent and 20.3 percent households occupying, respectively, less than 2 rooms, and between 4-5 rooms.

Majority of the households (38.8%) consisted of between 2-4 members (Table 5). Following this group were households of 5-7 members with 31.3 percent. While 11 percent were households of 8-10 members, only 9.8 percent had above 10 household members. The single person household recorded only 7.4 percent. The high frequency of low household size recorded in the peri-urban areas might be due to the fact that most of the houses consisted of relatively new and young family formation. Another factor that may be attributed to this is the immediate family structure that is being practiced by significant proportion of the residents of peri-urban areas.

Table 5: Household Size of Respondents

S/N	Household Size	Local Government Areas				Total	
		Lagelu		Oluyole			
		Frequency	%	Frequency	%	Frequency	%
1.	< 2	70	7.4	75	7.1	145	7.3
2.	2- 4	360	38.3	415	39.2	775	38.8
3.	5 – 7	325	34.6	300	28.3	625	31.3
4.	8 -10	105	11.2	115	10.8	220	11
5.	> 10	55	5.9	140	13.2	195	9.8
6.	No Response	25	2.6	15	1.4	40	2
	Total	940	100	1060	100	2,000	100

The exponential growth of peri-urban areas being attributed to the increased in personal vehicles (cars) ownership by the people within the last couple of years was confirmed by this study. Thus, vehicles ownership of the respondents were essentially cars (35.5%),

motorcycles (8.3%), buses (2.5%), and pick up vans (1.3%). Modes of travel for those without personal vehicles included commercial vehicles (49.2%), *okada* (46.7%), trekking (34.4%), and lift (26.3%). The heavy reliance of those without personal vehicles on motorcycles, popularly called *okada* shows the relevance and the growing importance of this mode of travel in the peri-urban areas. This can also be the impact of banning of *okadas* in some cities such as Lagos, Abeokuta and Abuja, which pushed the riders to Ibadan and especially the peri-urban areas of the city.

In providing answers to the question of the distance of the respondents' houses to the central market (Oja-Oba)/ the King's Palace, which was taken as the city (Ibadan) centre, 24 percent of the respondents stated that they lived within 15.6 - 17.5km; 21 - 23.6km (21.9%); 14.6 – 15.5km (21.1%); 11.6 – 14.5km (19.4%); and 17.6 - 20.99km (14.3%). Table 6 shows these distances to the city centre. Thus, it is striking to note that a substantial percentage of the residents had their offices/places of work within the peri-urban areas.

Table 6: Distance to Offices/Places of Work

Distance	Local Government Areas				Total	
	Lagelu		Oluyole			
	Frequency	%	Frequency	%	Frequency	%
< 2Km	435	46.3	570	53.7	1005	50.3
2 – 4Km	165	17.6	140	13.2	305	15.3
4 – 6Km	65	6.9	85	8.0	150	7.5
>6Km	180	19.1	175	16.5	355	17.7
No Response	95	10.1	90	8.5	185	9.3

While majority (55.4%) of the respondents had their offices/places of work located within less than 2kms to their residences (obviously because of the informal employment opportunities in such areas), 19.6 percent respondents' offices were located outside their neighborhoods (more than 6kms), 25.1 percent of the respondents were in between the two extremes, with 16.8 percent (2-4kms) and 8.3 percent (4-6kms), respectively. These distances had an effect on the time spent to travel to these places of work. Since most of the respondents had their offices within the areas, however, mostly they spent less time to travel to such places. Thus 37.7 percent of the respondents spent less than 10 minutes, 28.4 percent spent between 10-30 minutes, 15.2 percent spent between 20 minutes and 1 hour. However, 12.7 percent spent between 1-2 hours, while the remaining 6.1 percent spent over two hours. Those spending more time to travel to their places of work were those working outside the peri-urban areas.

These peri-urban areas lacked designated open spaces and other recreational facilities. Consequently, majority (68.3%) of the respondents claimed to be recreating at home (in form of relaxation), while 29.1 percent were recreating within the communities, in such places as beer parlours and centres for playing game board (ayo olopon) and checkers (draughts). These are traditional games being played at leisure time by the people as revealed through the PRA exercises.

CONCLUSION

In this study, the development of Ibadan, vis-à-vis the peri-urbanization of the city has been examined. The study found out that Ibadan recorded a sprawl of more than quadrupled over a 34-year period (1966-2004). Moreover, the rates of peri-urban sprawl of Oluyole and Lagelu LGAs of Ibadan were not the same. The exponential growth of peri-urban areas in Ibadan

was attributed partially to increase in personal vehicle (cars) ownership within the last couple of years. A significant proportion of adult residents in the areas were involved in either petty trading/small business or artisanal activities, resulting in pockets of retail and artisan shops, as well as commercial activities located sporadically within the areas. The commercial activities were uncoordinated, unplanned and located at irregular intervals within the residential areas. Also, majority of the inhabitants had their offices/places of work located within the areas, which were inhabited predominantly by relatively poor people. The distance of the inhabitants' houses to the city centre (Oja-Oba) ranged from 15.6 to 20.99km. There were varied housing designs or types of houses, with majorly bungalows, leading to the sprawl.

Considering the findings of the research, the following recommendations are necessary:

i. **Regulate the peri-urban sprawl.** Considering the challenge of regulating peri-urban sprawl through the existing weak and ineffective planning instruments, it is being recommended that there should be strengthening of the existing Local Town Planning Authorities through human capital development and procurement of the necessary equipment. This will address the issue of planlessness and uncoordinated growth of the peri-urban areas, thereby promoting smart and compact peri-urban growth.

ii. **Provision of in-house and neighborhood facilities.** The inhabitants of peri-urban areas should be encouraged to provide the necessary in-house facilities, such as safe water and sanitation facilities (toilet and bathroom), kitchen, among others, in the peri-urban areas. Moreover, the government should create the enabling environment for the provision of the essential neighborhood facilities, such as electricity, motorable roads, drainages, culverts, among others.

iii. **Regulate land allocation and acquisition process**. The family landholding system should be regulated and or the land use act of 1978 be reviewed to make land easily accessible to prospective house owners.

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Community Development Perspective of Rural Income Generating Activities in Nigeria: The Ijesa Region Example

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ABSTRACT

This study appraises the relationship of rural income generating activities with the prosecution of community development projects in Ijesa Region with the view to proposing a policy framework that can capitalise on the advantages of the connection to accelerate prosecution of community development projects in the region in particular and in Nigeria in general. The region is located in the south-western part of Nigeria and made up of six Local Government Areas (LGAs). This study focused on Atakunmosa East, Atakunmosa West, Obokun and Oriade LGAs which are the four rural/semi-urban LGAs in the region. Data were collected from primary and secondary sources and complemented with Focus Group Discussions (FGD) and physical observations. The research populations were the resident-population and community projects in the study area. The main research instrument used was two sets of structured questionnaire administered on heads of households and co-coordinators of community development projects in the study area respectively. The collected data were processed using the Statistical Package for Social Sciences (SPSS) computer software. The result shows a significant relationship between the people's level of involvement in income generating activities and their contributions to community development projects in the study area. It was revealed that funds for investment constitute a main constraint to the operations of income generating activities in the study area. This study affirmed that the more viable the people's income generating activities, the more their ability to contribute to community development projects. Improvement of access to credit facilities by operators of rural income generating activities through better funding from "sleeping funds" such as pension fund, among others, was recommended. Upliftment of the state of infrastructure, such as markets and roads was also recommended to aid the operations of income generating activities.

Keywords: Community Development, Entrepreneurship, Local Economic Development, Rural Income Generating Activity

INTRODUCTION

Community development is a term coined to denote initiatives and actions taken by members of a community to improve their standard of living. The United Nations defines it as a process where community members come together to take collective action to generate solutions to common problems (Wikipedia, 2015). This involves a set of approaches undertaken by individuals, groups and/or organisations to solve physical and socio-economic problems of their communities.

Significant contributions to community development highly revolve around the financial capabilities of the community members. This talks of level of economic vibrancy of the activities involved in income generation in the communities. Rural income generating activities, therefore, constitute a significant source of entrepreneurial revenue for rural population through rural livelihood diversification. These are assorted wage and non-wage entrepreneurial ventures that produce income in the rural areas for livelihood sustenance of the dwellers and socio-economic upliftment of the area (FAO, 1978).

The study set to resolve the question of whether rural income generating activities have been able to sufficiently empower the residents to contribute significantly to socio-economic and physical development of their respective communities or not. It also set to answer the question of how the level of participation, contributions and involvement of the community members contribute to the social, economic and physical upliftment of their communities.

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According to Oyetunji and Ajayi (2014), participatory development is highly essential towards enabling communities to help themselves in development projects in order to have livable communities.

Therefore, the aim of this study is to appraise the impact of the people's involvement in rural income generating activities on their contributions to community development projects in the study area with a view to recommending a policy framework that will strengthen rural income generating activities for community development. It further tested a hypothesis which states that:

H_0: Rural income generating activities do not significantly contribute to community development in Ijesa Region.

H_1: Rural income generating activities significantly contribute to community development in Ijesa Region.

LITERATURE REVIEW

Community Development

Community development reflects a grass-root or bottom-up approach to development; and this is in the purview of Local Economic Development (LED) concept. LED concept is a development approach whereby local endowment is utilised for the socio-economic upliftment of the area where they are endowed; believing that the aggregation of these localised developments will eventually result into a viable corporate regional development (Emmanuel, 2003). People's participation in community development refers to the active voluntary engagement of individuals and groups to change problematic conditions and influence policies and programmes that affect the quality of their lives and the lives of others. It builds strong and resilient communities through the process of identifying and addressing needs, assets and priority investment (Green, 2015). Community development activities may support infrastructure, economic development projects, installation of public facilities, community centres, housing rehabilitation, public services, clearance/acquisition, micro-enterprises, code-enforcement, home-ownership assistance and many other identified needs.

Carletto et al. (2007) affirm that issues about socio-economic development should consider the full range of rural income generating activities (both agricultural and non-agricultural) being carried out by the rural households. This allows for a proper understanding of the relationships between the various economic activities that take place in the physical space and of their implications for physical and socio-economic development of the communities.

Rural income generating activities as a strategic entrepreneurial force for community development

Rural income generating activities constitute the entrepreneurial pursuits of the rural dwellers for livelihood sustenance. According to Jhingan (2011), an entrepreneur is someone who possesses the ability to recognise opportunities for successful introduction of new commodities, new techniques and new sources of supply to run a business venture. Entrepreneurship mobilises other resources to meet unmet market demand (Jones and Sakong, 1980).

Entrepreneurship forms an economic force in rural development; as both have strong inter-link with each other. It is also a strategic development intervention that accelerates development. It provides enormous employment potentials and opportunities and constitutes a central force of economic growth and development; and without it, other factors of development are wasted and frittered away (Acs, et al., 2015). Food and Agriculture Organisation (FAO) arm of the United Nations considers entrepreneurial activities in rural areas as a vital issue in local (rural) and regional development. Local and regional

development cannot be separated from the full range of income generating activities being carried out by rural households. Rural income generating activities have implications for socio-economic growth and poverty reduction which, in turns, dictate the level of achievement of sustainable development.

As part of a community adaptation strategy, rural individuals and families are turning to non-farm income generating activities for subsistence (Jenson et al, 1995; Mencken & Maggard, 1999). Rural households are seizing business opportunities in order to improve their livelihood and create job opportunities for people around them. Many poor rural households maintain diversified set of activities to cope with life. Their activities, in many parts of the world, are the backbones of local economies and employment; producing about 70 per cent of goods for local, sub-regional, regional and national markets (Canzanelli, 2001). There is an increasing awareness in the developing nations of the necessity to strengthen local enterprises to provide answers to unemployment, economic survival and local (rural) and regional development (Emmanuel, 2003, Faseun, 2007).

Since human resource is paramount to local and regional development, the economic capability of people strongly influences people's ability to enhance local and regional development. The level of vibrancy of people's income generating activities has a strong bearing with the level of their contributions to socio-economic development at both local and regional level. Therefore, strengthening income generating activities is directly and indirectly analogous to enhancement of socio-economic development at all levels – be it grass-root, sub-regional, regional, supra-regional and national. It was on the above observation and premises that this study intends to find out whether the activities have significantly contributed to development in the region.

THE STUDY AREA AND RESEARCH METHODOLOGY

The Study Area: Ijesa Region

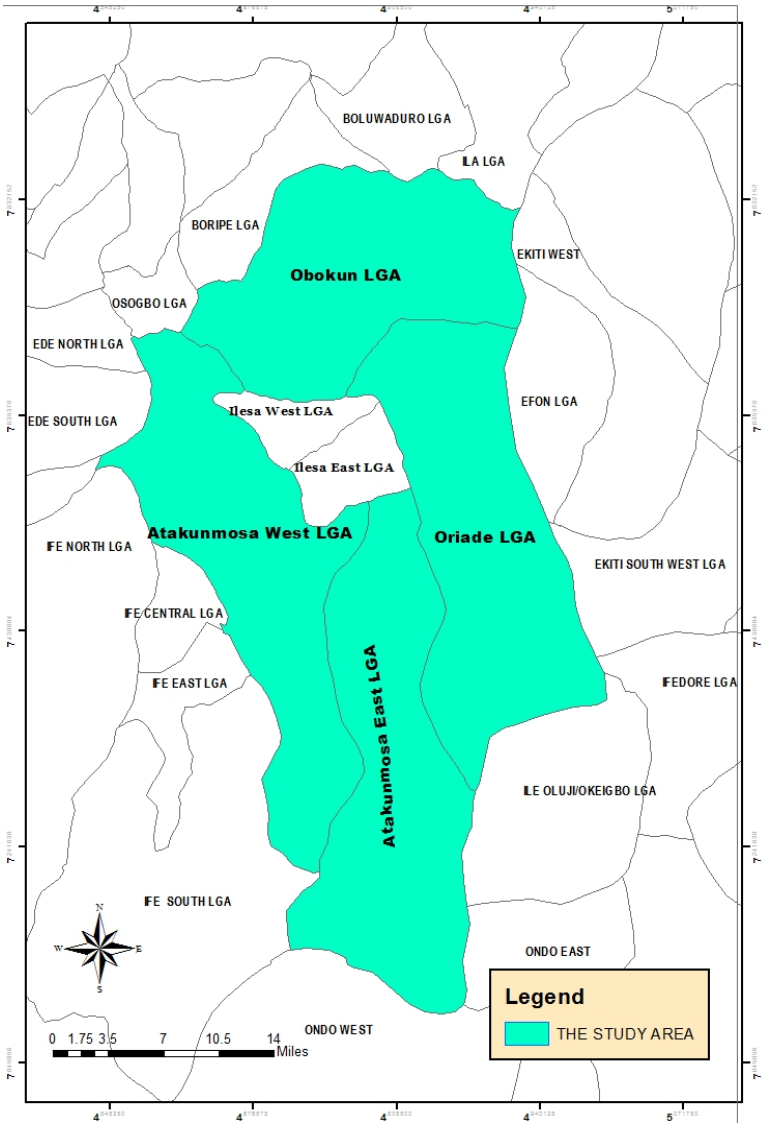
The study was conducted in Ijesa Region located in Osun State in the south-western geo-political zone of Nigeria. It lies between Latitudes 7° 17' North and 7° 50' North of the Equator and Longitudes 4^0 33' East and 5^0 10' East of the Greenwich Meridian. The region covers six of the 30 Local Government Areas (LGAs) and one Administrative Area political division of Osun State. Two of these LGAs are within Ijesa Metropolis while the remaining four are situated in the rural and semi.-urban areas of the region (Map 1).

The Ijesas are countrywide-acclaimed resourceful and ingenious traders and great farmers especially in tree crops, such as cocoa, kola-nut, palm-produce, plantain and fruits. Local crafts, like mat and cloth weaving, blacksmithing and pottery were popular in the region until the advent of new technologies for the production of such materials.

Research Methodology

The study employed survey method using questionnaire as the main survey instrument. The use of questionnaire was considered appropriate for the study because it allowed interaction with the resident-population in order to obtain their feelings, opinions and thoughts on the subject under study. Two sets of questionnaire were designed to obtain data from the resident-population on their income generating activities in relation to their involvement in community development projects in their respective communities and the CDA administrators respectively. Data were also sourced from primary and secondary sources complemented with Focus Group Discussions (FGD) and physical observations. The research populations were the rural resident-population, the leadership of Community Development Associations (CDAs) and community projects in the study area.

The 487 settlements in the study area were stratified into four Order-Centres (socio-economic activity-zones). Stratified random sampling method was used to determine the sample-size for the surveys across the LGAs and the Order-Centres; cutting through the various CDAs. In all, a total of 65,146 households and 198 functional Order-Centres were identified. Using stratified sampling technique, the household questionnaire was administered on 2 per cent of the households (i.e., 1,303 heads of household), and while the other set of questionnaire was administered on 100 CDAs spread across 10 per cent of the functional Order-Centres (i.e., 20 settlements). Data collected were complimented and supplemented with Focus Group Discussions and physical observations conducted across the region. The collected data were processed using the Statistical Package for Social Sciences (SPSS) computer software.



Map 1: Digitized Map of Ijesa Region Highlighting the Four Rural/Sub-urban Local Government Areas that Constitute the Study Area
Source: Osun State Ministry of Lands, Physical Planning and Urban Development, Osogbo. 2015

ANALYSIS AND DISCUSSIONS OF FINDINGS

Assessment of Level of Utilisation of Endowed Resources in the Study Area for Income Generation

Ijesa Region is endowed with many natural resources, such as high quality gold at Itagunmodi, an ancient town in Atakunmosa East LGA, forestry resources and agricultural

resources like cocoa, kolanuts and palm produce and food crops across all the LGAs. The utilisation of these resources provides opportunities for the highly resourceful resident-population to create employment for income generation. Except for exploitation of gold, which is under the control of Federal Government of Nigeria, people are free to legitimately utilise all other resources for income generation. There are evidences of illegal mining and selling of raw gold by families with gold deposit in their landed property.

The field survey, as depicted in Figure 1, shows that 1.8 per cent, 11.8 per cent and 21.2 per cent of the respondents are utilising the endowed solid minerals, forestry resources and farm resources respectively in their respective income generating activities. While 9.1 per cent of the respondents are utilising the combination of solid minerals and forest resources, 6.3 per cent are utilising mineral and farm resources. About 34.4 per cent utilise forest and farm resources and 18.6 per cent utilise all the three types of resources for income generation.

However, 9.1 per cent are utilising other resources sourced outside the study area for their income generating activities.

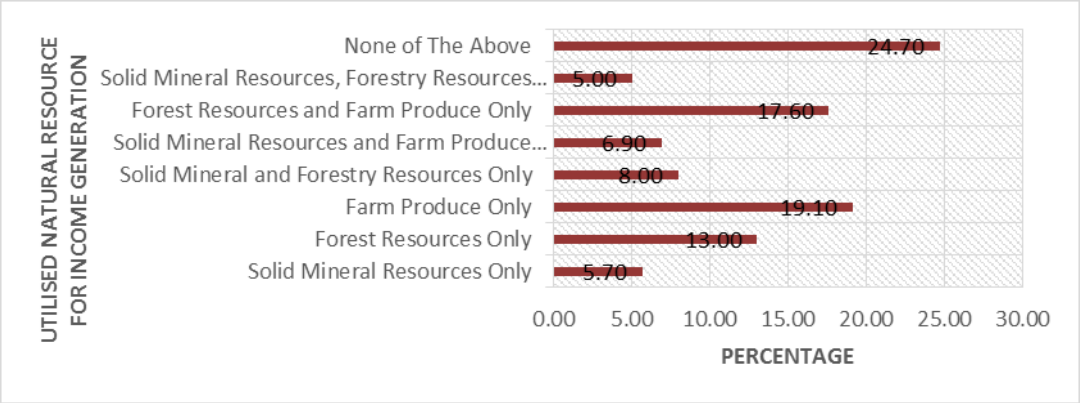


Figure 1: Level of Utilisation of the Endowed Natural Resources in the Study Area for Income Generation
Source: Authors' Fieldwork, 2012

The people are involved in merchandise of finished products such as electronics, cement, canned materials, among others. Some of them are involved in entertainment and hospitality services while others are artisans and craftsmen/women. Survey shows that 90.9 per cent of the respondents are utilising one, some or all of solid mineral, agricultural and forestry resources found in the area for their income generating activities. This shows rural income generating activities highly involve exploiting local resources as sources of employment and agents of local economic development in the study area. This enhances regional economic growth and development.

This implies that rural income generating activities have been able to encourage resource development in the region and assist the residents to make meaningful financial contributions to community development. Survey revealed that substantial numbers of income generating activities in Itagunmodi in Atakunmosa LGA substantially involve gold mining activities (though illegally), agricultural practice and exploitation of forest resources. This inspires and invigorates local and regional economy, growth and development.

A Chi-square test result on the utilisation of endowed natural resources for income generation in the region shows a Pearson Chi-Square value of 0.036 which is less than $\alpha = 0.05$; indicating significant utilisation of these resources for income generation in the region (Table 1).

Table 1: Result of Chi-Square Test on Utilisation of Endowed Natural Resources in the Study Area for Rural Income Generating Activities

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.067	21	0.036
Likelihood Ratio	36.948	21	0.017
Linear-by-Linear Association	8.052	1	0.005
N of Valid Cases	1303		

Source: Authors' Fieldwwork, 2012

Association between Population Traits and the People's Involvement in Rural Income Generating Activities in the Study Area

The significance of association between the population traits of the respondents and their involvement in either primary or secondary income generating activities was tested using Chi-Square Test of Significance as depicted in Table 2. Chi-square test of significance possesses the ability to provide insight into the strength of the influence of variables on each other.

As shown in the table, the X2-Calculated Value is greater than the X2-Table Value at 0.05 Level of Significance for all the Degrees of Freedom (df) for all the population traits. This indicates significant associations of population traits of gender, age, marital status, educational attainment, household-size, nativity, employment class and income with the involvement of the people in rural income generating activities as either their primary or secondary employment.

This interprets to mean that the population traits substantially influence the factors that determine the choice of rural income generating activities as primary or secondary employment in the study area. This possibly explains why there are more males in agricultural activities than females and more females in trading than males. This may also partially explain the reason behind the involvement of more males than females in vehicle driving and motor mechanic professions.

Table 2: Result of Chi-Square Test on the Association of Population Traits with the People's Involvement in Rural Income Generating Activities

Population Traits		Gender	Age	Marital Status	Educa-tional Status	House-hold Size	Settle-ment of Origin	Income
Activities as Primary	**X^2-Value (Calculated)**	50.90	190.14	93.22	346.01	78.96	146.81	200.31
	X^2-Value (Table Value)	5.99	15.51	15.51	21.03	12.60	12.60	15.51
	df	2	8	8	12	6	6	8
	Level of Significance	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Asymp. Sig.(2-tailed)	0 .000	0.000	0.000	0.000	0.000	0.000	0.000
	Comment	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
Activities as Secondary	**X^2-Value (Calculated)**	42.33	113.52	81.59	166.96	222.09	78.19	80.02
	X^2-Value (Table Value)	5.99	15.51	15.51	21.03	12.60	12.60	15.51
	df	2	8	8	12	6	6	8
	Level of Significance	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Comment	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.

Source: Authors' Field Survey, 2012

Relationship between the People's Involvement in Rural Income Generating Activities and Their Contributions to Community Development Projects in the Study Area

The study shows that 98.5% of the respondent-household-heads claimed that paucity of fund for their activities is their major problem. They complained of inadequate access to loan

facilities and financial grants that should have assisted their operations. This problem, invariably, reduces their contributions to their community development projects.

Due to the nominal nature of the variables, a Point Biserial Correlation test was carried out on the relationship between the people's involvement in rural income generating activities and their financial contributions to community development projects. The result shows that the p-values are less than $\alpha = 0.05$ and positive (0.021; 0.018) for both involvement in the activities as primary and secondary employment (Table 3). This means that there is a significant relationship between the people's involvement in rural income generating activities and their financial contributions to development projects in their communities. This indicates that the involvement of the people in rural income generating activities, either as primary or secondary source of income, is a potent and significant force that propels their contributions of the people to community development projects in the region. This implies that if rural income generating activities are better funded, there is a high possibility of better income for the operators of the activities; and subsequently, the enhancement of their contributions to community development projects.

Table 3: Point Biserial Correlation Test of Involvement in Rural Income Generating Activities and the People's Financial Contributions to Community Development Projects

		Involvement in Income Generating Activities as Primary Employment (RIGAPRY)	Involvement in Income Generating Activities as Secondary Employment (RIGASEC)
Financial Contributions to Community Development Projects (PROJECT-F)	***Pearson Corr.***	0.071	0.089
	Sig. (1-tailed)	0.021	0.018
	N	777	263

Source: *Authors' Fieldwork, 2012*

Test of Hypothesis

Phi-correlation was applied to test the hypothesis that states that:

H_0: Rural income generating activities do not significantly contribute to community development in the study area.

H_1: Rural income generating activities significantly contribute to community development in the study area.

The variables of rural income generating activities used for the test are the activities as primary employment (RIGAPRY) and as secondary employment (RIGASEC), scale of operation (RIGASCAL), types of activities in terms of agricultural, trading and craftsmanship activities (RIGATYPE) and who initiated the activities in terms of individual, group or community (INITIATE). Development was measured with references to the market spread for the products and services of the activities (MARKET) and modes of sales of the products in terms of wholesale and retail enterprises (SALEMODE).

The result of the test shows that all the p-values are less than $\alpha = 0.05$ (Table 4). Therefore, null hypothesis is rejected and the alternative accepted which states that rural income generating activities contribute significantly to community development in the region. All the contributions are positive; though at differing levels of contribution (Table 4).

These findings imply that if the rural income generating activities are enhanced, there will be a significant improvement in the socio-economic development of the region through the people's active involvement in and contributions to community development projects.

SUMMARY OF THE FINDINGS

The summary of the study is that the resident-population of the region is actively involved in income generation with many of them utilising the endowed resources in the area. This empowers them to contribute meaningfully to socio-economic development in their respective communities. This indicates that if the income generating activities are assisted to be more economically viable, the income of the resident-population will be substantially enhanced. The income enhancement will increase their financial capability to contribute significantly to community development projects in the region.

Table 4: Result of Phi-Coefficient Correlation Test on the Contribution of Rural Income Generating Activities to Development in the Study Area

	Phi Coefficient.	Approx. Significance.	Direction & Strength of the Contribution
RIGAPRY * MARKET	0.427	0.000	Positive & Moderate
RIGAPRY * SALEMODE	0.346	0.000	Positive & Moderate
RIGASEC * MARKET	0.525	0.000	Positive & Strong
RIGASEC * SALEMODE	0.286	0.000	Positive but Weak
RIGASCAL * MARKET	0.470	0.000	Positive & Moderate
RIGASCAL * SALEMODE	0.466	0.000	Positive & Moderate
RIGATYPE * MARKET	0.545	0.000	Positive & Strong
RIGATYPE * SALEMODE	0.209	0.000	Positive but Weak
INITIATE * MARKET	0.575	0.000	Positive & Strong
INITIATE * SALEMODE	0.195	0.000	Positive but Weak

Source: Authors' Fieldwork, 2012

RECOMMENDATIONS

Based on this, a policy framework that can capitalise on the advantages of vibrant rural income generating activities to enhance and accelerate initiation and prosecution of community development projects in the region is recommended. The framework should focus on the re-groupings of the weedy activity-groups presently based on individual articles of trade. This is to ensure effective control and management by government for better assistance. The income generating activities should, therefore, be formalised by organising them into registered workable groups based on distinct standard professional status with supervisory agencies at local and state government levels for effective monitoring.

To tackle the problem of paucity of fund, it is recommended that five per cent (5%) of some "national sleeping funds" such as pension funds with the various Pension Fund Administrators (PFAs) and Pension Custodians and "resting funds" in Nigerian Stock Exchange (NSE) should be set aside as loanable funds at a very low interest of maximum of 4% to boost small and medium-scale rural income generating activities.

Also, some high flying companies with a minimum of one billion Naira annual profit before tax should be compelled to be contributing one per cent (1%) of such profits to a special fund strictly meant to service rural income generating activities. Companies such as MTN, DSTV and big other service providers who are making a lot profit in Nigeria should be compelled through the Central Bank of Nigeria (CBN) to contribute to a special fund for the enhancement of rural income generating activities.

There should be reduction in the 20 – 25% interest rate being charged by microfinance banks to about 7%. The banks can do this by accessing resources at 3% interest rate from the earlier recommended specially set aside funds from the 'sleeping funds' and "resting funds".

Specifically, four more regional markets are recommended to be established across the region in addition to Owena-Ijesa Regional Market in Oriade LGA. The recommended locations for the markets are Osu and Okebode (in Atakunmosa West LGA), Itagunmodi (in Atakunmosa

East LGA) and Ijebu-jesa (in Oriade LGA). The new markets along with the existing Owena-Ijesa Regional Market will form a "Regional Market Ring" in the region (Figure 2).

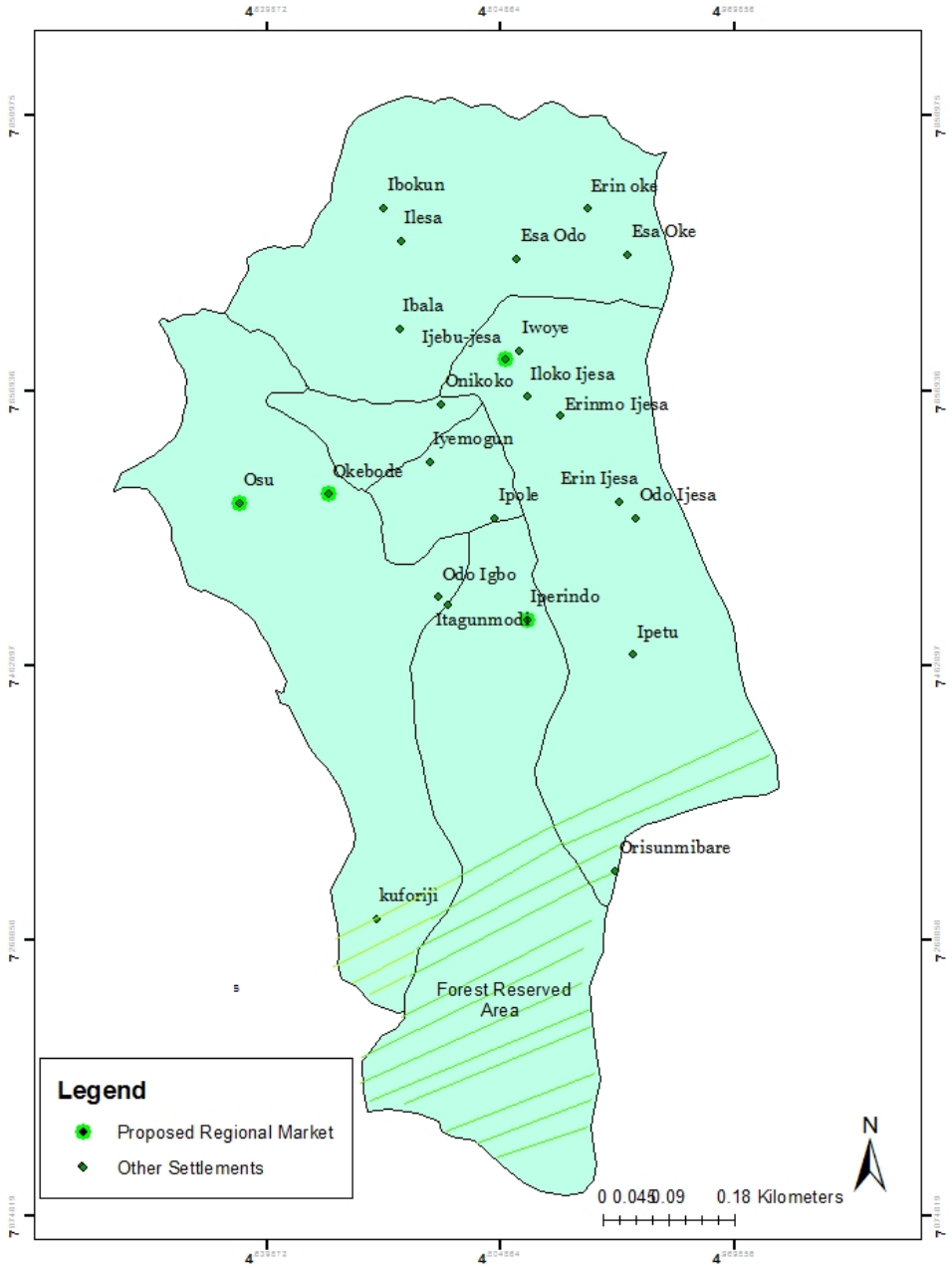


Figure 2: Map of Ijesa Region Highlighting the Locations of the Proposed Regional Markets in the Study Area

CONCLUSION

The level of vibrancy of rural income generating activities taking place in a community determines the propensity of the resident-population to contribute significantly to community socio-economic projects. Therefore, any policy framework that can invigorate the activities is a step towards encouraging the citizenry to be contributors and participants in community projects.

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Road Network Connectivity, Accessibility and Market Patronage in Benin Metropolis, Nigeria

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ABSTRACT

High quality road network increases national economic output by reducing trip times and costs, makes road corridor economically attractive and viable. As traffic becomes congested, drivers opt for alternative routes to reach destinations faster. This paper investigates road network connectivity, accessibility and market patronage in Benin metropolis, Nigeria. Stratified sampling technique, questionnaire, physical observation and graph theory analysis were employed for this study. Out of the twenty (20) markets in Benin metropolis, nine (9) of them were selected for the survey. Connectivity and accessibility matrices developed from the road network graph in the study area, reveal some nodal points (markets) and edges (routes). Fundamental properties of the transport network were measured to identify the growth within the network structure and change detection system. Gamma index value of 0.71 and Cyclomatic index (0.7) calculated show strong complexity and high degree connectivity. Yanga Market and Eki-Oba with index 10 were the most accessible nodal points and Eki-Uwa with index 21 as least accessible nodal point. Private cars (42.8 percent) and buses (41.5 percent) were most used transit modes. Market places contribute 90.7 percent to traffic congestion, 4.9 percent indicate that it 'rarely' occurs, while 4.4 percent respondents did not feel any impact of traffic congestion. These values positively influence traffic attraction and circulation with or without intervening opportunities to substitute the need and purpose of trips. The paper recommends identification of alternative routes for none-market destination, mass transit intervention, enactment and enforcement of traffic management laws.

Keywords: Road Network, Connectivity, Accessibility, Market Patronage, Benin Metropolis

INTRODUCTION

The quality of life and economy of any society depend on efficient, comprehensive and coordinated multimodal transport system that provides quick movement of goods and services (Okoko and Fasakin, 2007). Ikegbunam (2014) reports that, transportation system involves the flow of people, ideas, materials, goods and services from one location to another, resulting in spatial distribution of resources.

Transportation, movement and exchange of goods and services are obligatory features of modern life (Umoren et al, 2009) due to their multi-dimensional functions, imperatives of interaction, and its dynamic structure. Road has been described as the life-blood of human civilisation (Sarka, 2013) and social interaction. Economic prosperity in space has been shaped by road networks at intra and inter-regional levels. However, Oyesiku (2002) emphasizes that, the forms and pattern of distribution of structures to promote good health, accessibility, convenience and harmonious land use in an environment are a function of the rights and methods of dealing with land. Therefore, effective urban landuse control and the management of spatial activities in areas with rapid urban sprawl in Nigeria and Benin metropolis in particular, are crucial to tackling land use and transportation problems.

Human settlement is seen to be naturally heterogeneous, but a symbiotic system. One major part of the system is the market place, critically influenced by factors like; mode of transit, socio-economic characteristics of traders, distance, location and range of goods (Omole,

Fasakin, J. O. & Ayo-Odifiri, O. O. (2016). Road Network Connectivity, Accessibility and Market Patronage in Benin Metropolis, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1545-1555

2009). Urban landuses need adequate, convenient and efficient transportation system especially the commercial landuse such as market places. Market place serves as the hub of economic activities of a people and attraction especially from the residential landuse (Ojo, 1966). Therefore, initiating road connectivity to reduce traffic problems in these market areas would attract minimal cost and reduce man hours crucial to urban growth and development.

Availability of a convenient and acceptable location for trading activities as well as proximity to places of activity constitute significant factor in urban development. Adeagbo (2004) asserts that market provides daily reasons for people to meet one another. Similarly, Ratcliffe (1974) corroborates the view that apart from the economic advantages, markets also provide social function as a focus of the community, a meeting place, and generally contributing to the well-being of the society. Commercial activities such as buying and selling are major traffic attractors and circulators, which tend to concentrate more along road corridors for easy access.

Benin metropolis with its well-structured road network, experiences diverse transportation problems, especially easy and quick access to and through market locations. Some of these market places have historical and cultural significance in their locations, which contribute to the high traffic flow around them. The pattern of market distribution influences traffic flow in Benin metropolis, where many markets are located along road corridors. Nwafor (1982) and Eben-Saleh (1999) identify two basic classes of market places as daily and periodic markets. The periodicity (daily or weekly) of market exacerbates the existing traffic situation in the study area. Casual observation reveals that no meaningful attention may have been given to conflict and control of heavy vehicular and pedestrian traffic, especially at the various market locations in the study area.

With enormous traffic problems; uncoordinated traffic management, dwindling government resource allocation to transportation and market infrastructure, there is an urgent need to evolve proactive measures of maintaining free-flow of traffic within and around the market places in Benin City. The paper reveals the role of transportation management agencies and stakeholders, and market operators. Against this background, the paper seeks to investigate the degree of connectivity index of the routes linking the selected markets and also examine the level of accessibility of the selected market places in Benin City.

LITERATURE REVIEW

Road network as one of the oldest infrastructures of transportation, occupies a significant locality in modernisation, sustainable development, and daily activities in ancient and modern times (Al-dami, 2015). Rogers (2003) observes that road network of a high quality increases national economic output, reduces trip times and costs, and makes regions more economically attractive. Omole (2009) reports that market centres are fundamental to the economic, social, cultural, religious and political life of people. Despite poor recognition given to market place development in the post-independence periods, it promotes integration between production and consumption platforms of the economies on which they stand.

Socio-culturally, there is the belief that once information is given at the market place, it would be disseminated with ease to every part of the town by market patrons. Anthonia (1973) points out that, market places are social centres for activities like courtship, visits, exchange of ideas, drumming, and dancing, reuniting and festivities. They also advance economic, cultural and socio-political cohesion for societal development. Traditionally, many ancient Oba (King) palaces were located close to market places, because of the sacred identity attached to market places.

The religious roles of market places especially among the Binis cannot be overemphasized. Oral tradition has it that many market places in Bini were identified as sacred places used for all manner of sacrifices or rituals with associative traditional names. This is said to appease the gods of the land and spirits believed to meet and live on trees at the market centres. However, as orthodox Bini tradition recognises the importance of the market place, so also there the early Christian and Moslem missionaries used as a place for the propagation of the gospel because of her huge population. Olorunfemi (1999) upholds the oral tradition report that in Badagry Nigeria, the first church was built between two public markets, and in Akure, the central mosque is located opposite Oja-Oba. In the same vein, the central mosque in Auchi, Nigeria is sited at the premises of Ughiele market, and The Baptist convention (Church) is located beside Eki-Oliha in Benin City.

Traffic management measure used, organises movement, protects vulnerable road users, and makes best use of existing transportation facilities for safety, smooth traffic flow and re-route where necessary (Ndikom, 2010). On this basis, Litman and Fitzroy (2011) note that mobilizing management is a cost effective safety strategy, but decry that it is seldom implemented. In addition, they stress that, its objectives are to reduce traffic congestion, road and parking cost savings, energy conservation and emission reduction, and improved mobility options for non-drivers. Adeagbo (2004) in his assessment of accessibility opines that whether traditional or modern market, traffic and parking problems in urban markets are prominent in the economic and social development of settlement. The report notes that markets are so important that for any community to develop, availability of a convenient and acceptable location for buying and selling constitute significant factor as well as proximity to places of activity. This strategy Increases traffic flow rate and efficient interaction.

Okoko (2006) posits that Transportation System Management (TSM) concept is a short-term measure to make the most productive and cost effective use of existing transportation facilities, services and modes. TSM is a series of actions embarked upon deliberately to produce shifts in the supply-demand equilibrium of various transportation components. In addition, Fasakin (2000) emphasises that TSM protects pedestrians and encourages invariably the use of Para-transit modes (bicycles and motorcycles).

On the other hand, Transportation Demand Management (TDM) concept reduces traffic flows during peak hours; some of the techniques include car pooling, ride-sharing, and bus priority. IEA National Committee on Transport (1995) sees TDM as intervention to modify travel decisions for a more desirable transport, social, economic and environmentally friendly objectives to reduce adverse impacts of travel. Ohiaegbunem (2007) and Ndikom (2010) identify Contemporary transportation management options as road pricing, fuel taxes, ride sharing (mass transit), and traffic rules and regulations. Others are; traffic segregation, traffic restraint, bus priority, one-way scheme, parking management and landuse option. TDM is a reaction against continued large scale provision of road infrastructure to foster efficient mobility, environmental attractiveness, social equity, and effective utilisation of existing facilities.

STUDY AREA

Benin City is located between Latitude 06°19'N and 06°21'N, and Longitude 05°34'E and 05°44'E. It is situated in the south-south geo-political zone of Nigeria at an elevation of 77.8m above sea-level. Benin is a pre-colonial city, the capital of the defunct Mid-West and Bendel States, and the present Edo State. It is under laid by sedimentary formation of the Miocene-Pleistocene-age often referred to as the Benin formation (Odemerho, 1988). The city is located in the humid tropical rainforest belt of Nigeria with a population of 1,086,882 (NPC, 2006) and a projected population of 1,336,056 by 2012 at 3.5% growth rate.

Rainy season in Benin begins in March/April and ends in October/November. Rainfalls are of high intensity and usually double maxima with a dry little spell in August regularly referred to as 'August Break'. Apart from demographic transition, Benin City has witnessed, rapid territorial expansion due mainly to rapid rural-urban migration as well as tourist destination for bronze casting and the great Benin moat. Property developers have erected structures in different parts of the city and often without strict adherence to town planning regulations (Godwin et al, 2011).

The term "Edo" refers to place, dialect, language and people of Bini. Individuals from the Bini Kingdom call themselves "Oviedo" or "Ovioba". The Bini Kingdom was redefined (by the British) after the restoration of the monarchy in 1914 and limited to the new Benin Division (comprises of Binis).

METHODOLOGY

This paper focused on road network connectivity, accessibility and market place patronage in Benin metropolis. The scope therefore, demanded data set that requires variables on connectivity, accessibility, range of goods, mode of transit, and traffic impedance in Benin metropolis. Structured questionnaire was designed to elicit information from the target population who are traders (buyers and sellers) and households around the selected market places, road users (drivers) and government agencies.

Markets were selected for the study by stratified sampling technique based on the following criteria: geographical location, periodicity (daily or weekly) of the market, historical and cultural significance, Central Business District function (location within the CBD), and traffic confluence. Legal stall owners (sellers and buyers), and road users (private and public drivers) were interviewed. Others were the Nigerian Police; Edo State Traffic Management Agency (EDSTMA), and Oredo Local Government Council. Appendix 1 shows the road network map of the study area, and the selected market places identified by their traditional names. Inventories on road conditions, range of goods, and nature of traffic and patronage level were carried out. Models on connectivity, accessibility indices, and distances matrix were developed to explain the inter- and intra-markets linkages.

Precisely, out of the twenty (20) market places identified, nine (9) of them representing 45 percent were surveyed and questionnaire administered on market patrons. Data were collected at specific places and periods to meet targeted respondents. Questionnaires for traders and road users were administered in the afternoon, when many respondents had settled down for business, while Government agencies questionnaires were administered during office hours (8am to 4pm) on week days. Out of the Thirty-five (35) field assistants recruited, two (2) were assigned to each of the selected market place and road, nine (9) to EDSTMA, four (4) to the Nigerian Police and the other four (4) to Oredo Local Government Council.

Graph theoretic analysis was used to examine the road network and reveal the degree of connectivity and accessibility of nodes (market places) within the network of roads in the study area. The road map was converted to linear graph regardless of the width, standard and quality of the roads. Each market was rated according to its level of connectivity and accessibility using the shimbel index matrix, and the number of routes required to connect a market with other markets in the network through the shortest path was identified.

RESULTS AND DISCUSSION

Findings from the study are discussed under subheadings which include market location and range of goods and services, mode of transit, traffic congestion, and traffic impedance. Others

are road connectivity and degree of market patronage, and accessibility and level of market patronage.

Market Location and range of goods and services

Omole (2005) reports that the range of goods and services is average maximum distance a prospective consumer is willing to cover in order to consume a good or a service. Computation of the distances between the selected market places was done using Shimbel connectivity matrix shown in Table 1. At the ring road (Oba Ovoranmwen square/king's square) where the Oba palace is located, Eki-Oba and Yanga market, which are closest to market patrons are located 189m apart.

The study revealed that, the location and shape of Yanga market and Eki-Oba places conform to Walter Christellar's hexagonal principle that says, each market place serves six other markets (Figure 4) of the same number of smaller centres (central place theory) respectively. The remaining seven (7) out of the selected nine (9) markets do not conform, because of the intervening market centres that break the hierarchical principles among the market places.

Market Location and Modes of Transit

Safety and timely arrival at one's destination are factors of an effective transportation system. Inefficient transport mode and paucity of infrastructural facilities affect the sustainability and patronage of market places. Where these challenges abound, traffic congestion is likely to set-in, especially, when the carriage-capacity of the dominant operational transport mode is low. Figure 1 shows that 42.8 percent of the respondents used private cars to and from the market, while mini-buses and taxi accounted for 41.5 percent and 9.8 percent. About 2.5 percent of the respondents used foot and keke-NAPEP (National Poverty Eradication Programme) to market respectively, while 0.9 percent said they used trucks. The number of private cars used was quite high, considering the occupancy capacity of private and taxi cars with not more than four (4) passengers on board, whereas a bus would conveniently carry between eight (8) to eighteen (18) passengers on a trip. This implies that the traffic problem experienced in the study area is exacerbated by increased use of private cars and taxi cars.

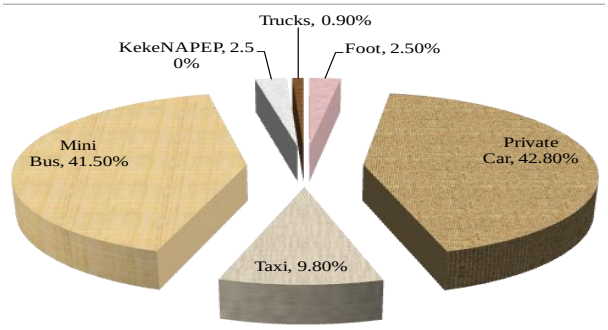

Figure 1. Modes of Transit of Respondents to Mark
Source: Fieldwork, 2013

Market Location and Traffic Congestion

On the possible influence of market location on traffic congestion in Benin metropolis the respondents were of the view that, the location of market was responsible for 38.3 percent of daily traffic congestion experienced in Benin metropolis, while 34.9 percent believed it was responsible for traffic congestion six (6) days of the week. Other respondents observed that, traffic is witnessed once a week (14.4 percent), 4.9 percent indicate that it 'rarely' occurs, while 4.4 percent respondents did not feel any impact of traffic congestion (Figure 2). These responses confirmed the contribution of market location to traffic congestion in the study area. The divergent views of respondents are perhaps based on the periodicity of the selected market and nature of markets (types of goods sold in the market), especially, for the 17.4

percent who observed that, traffic congestion is experienced once a week. Similarly, a negligible 4.4 percent do not feel the impact of traffic congestion, whereas a total of 95.6 percent established the presence of traffic congestion at one time or the other in Benin metropolis in terms of traffic intensity and duration.

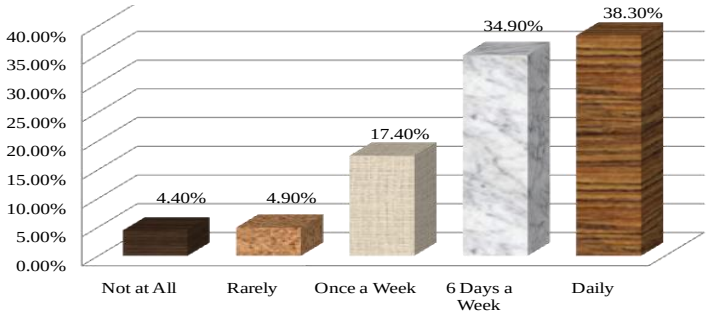

Figure 2: Market Location as a Source of Traffic Congestion in the Study Area
Source: Fieldwork, 2013

Market Location and Traffic Impedance

Figure 3.1 (a&b) showed the traffic situation along Television (T.V) road (between Eki-Oliha and Eki-Uwa). Two markets are located on this route; Eki-Oliha is a daily market known for the sales of traditional items and other commodities and Eki-Uwa (a specialized daily market) is known for the sales of bush meat. Street parking and trading, and alms begging impede free flow of traffic on this route. Potholes, absence of designated motor parks, and open drains were other factors inhibiting traffic flow along this road.

Figure 3.1 (a): Television (T.V) road

Figure 3.1 (b): Television (T.V) road

Figure 3.2 (a&b) reveals the condition of traffic along Oba (Eki-Oba) market road. Eki-Oba and Yanga markets located around the city centre (Ring road) are held daily; all manner of goods are sold in Eki-Oba, and fresh sea-foods are sold in Yanga market about 189m away. Indiscriminate street trading and parking, abandonment of motor parks, activities of revenue collectors and uncontrolled human interference with vehicular traffic were visible impediments to traffic flow on this road. Others include poor traffic management measures and solid waste deposits on walkways encroaching drive ways.

Figure 3.2 (a): Oba market road

Figure 3.2 (b): Oba market road

Road Connectivity and Degree of Market Patronage

Table 1. Shimbel Binary Connectivity Matrix (One Step or Direct Link)

Edges Nodes	1	2	3	4	5	6	7	8	9	Total Index
1. Eki-Uwa	0	1	-	-	-	-	-	-	-	1
2. Eki-Oliha	1	0	1	1	-	-	-	-	-	3
3.Yanga Market	-	1	0	1	1	-	1	1	1	**6***
4. Eki-Oba	-	1	1	0	1	-	1	1	1	**6***
5. Eki-Osa	-	-	1	1	0	1	1	-	-	4
6. Eki-Ogiso	-	-	-	-	1	0	1	-	-	2
7. Eki-Edo	-	-	1	1	1	1	0	-	-	4
8. Eki-Agbado	-	-	1	1	-	-	-	0	-	2
9. Vegetable Market	-	-	1	1	-	-	-	-	0	2

Sum = 18 *Source: Author's Fieldwork, 2013*

A connectivity matrix developed from the road network graph (Figure 4) shows the number of other nodal points (markets) to which a particular node (market) is directly linked; the node with highest number of points is said to be most connected. From Table 1, the most connected markets were Yanga market and Eki-Oba with index of six (6) each. This means that each of the markets have direct link with six (6) other markets. This is followed by Eki-Osa and Eki-Edo with four (4) direct links each to other markets. Similarly, Eki-Oliha has direct links to other three (3) markets. In addition, Eki-Ogiso, Eki-Agbado and Vegetable market have two (2) direct links respectively to other markets, while Eki-Uwa has only a direct link with Eki-Oliha.

The diagonal was coded zero (0), because it represents single origin-destination trips thereby making origin-destination trips redundant. The matrix is rarely concerned with the number of ways a location is connected to itself; no trip along the diagonal is coded one (1) since it takes at least two (2) steps to return to the origin. The non-diagonals zero cells are coded as null in the matrix because one represents one step or direct connection.

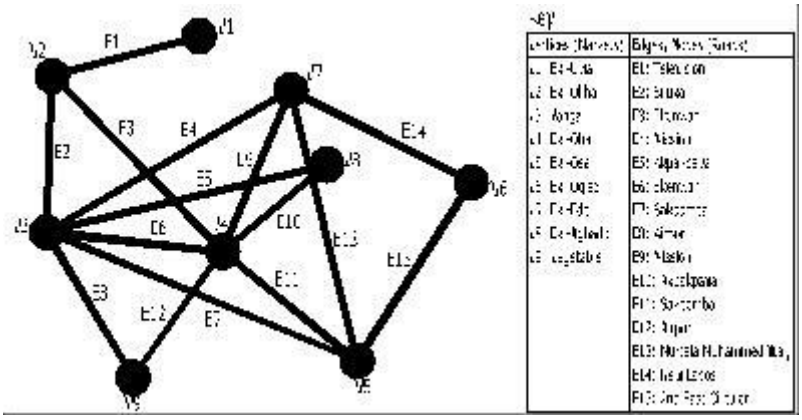

Figure 4: Road Network Graph Analysis of the Selected Markets
Source: Fieldwork Analysis, 2013

Nagne et al (2013) and Al-dami (2015) postulate that, the fundamental properties of a transport network are measured by Alpha index, Beta index, and/or Gamma index. For extraction of connectivity index, it requires a road network (edge) and junction (vertex). These indices are useful to identify the growth within the network structure and also for change detection system.

Figure 4 shows the graph connection irrespective of road grade linking the selected markets under investigation in the study area. Thus, given the number of selected markets in the study

area as nine (9), it is therefore possible to study the affected markets graphically. Nine (9) vertices (**v**)/nodes, and fifteen (15) edges (**e**)/routes/links were found in the study area. To estimate the degree of connectivity, Gamma index (γ) was adopted and the completeness of the network verified with Cyclomatic Index (μ).

Gamma index (γ) is a ratio of actual number of edges to the maximum possible number of node in the network (Al-dami, 2015), but the value is greater where the network is well connected (Nagne et al, 2013). Its value ranges from 0.0 (showing no connection between nodes) to 1.0 (maximum number of connections with direct link to all nodes).

$$\text{Gamma index } (\gamma) = \frac{e}{3(v-2)} \quad (1)$$

γ = Gamma index, e = number of edges (links/routes), v = number of vertices (nodes)

Given that; γ =?, e = 15, v = 9; Substituting into equation (1)

$$\gamma = \frac{e}{3(v-2)}$$
$$= \frac{15}{3(9-2)}$$
$$= \frac{15}{21}$$
$$= 0.71$$

From the Gamma index (γ) analysis, a value of 0.71 (71 percent) was calculated. This value implies that the road networks are considered to have a strong complexity and high degree of connectivity in the study area. This therefore, positively influences traffic attraction and circulation with or without the substitute of intervening opportunities for the purpose of trips.

The completeness of the connectivity network of the selected markets in the study area was evaluated using the Cyclomatic index (μ), given as;

$$\mu = e - v + 1 \quad (2)$$

Where; μ= Cyclomatic index, e = number of edges, v = number of vertices

μ =? e = 15, v = 9; Substituting the values into equation (2); μ = e - v + 1, μ = 15 - 9 + 1, **μ =**

The implication of equation (2) analysis is that, the network is highly developed with short route connectivity. This is because, 70 percent of the selected markets network have developed itself to have shortest possible routes in relation to other markets with 30% in the study area.

Accessibility and Level of Market Patronage

Table 2. Accessibility Matrix Representing Shortest Route in Number of Steps

Edges Nodes	1	2	3	4	5	6	7	8	9	Nodes Index
1. Eki-Uwa	0	1	2	3	3	4	3	3	3	21
2. Eki-Oliha	1	0	1	1	2	3	2	2	2	14
3.Yanga Market	2	1	0	1	1	2	1	1	1	**10***
4. Eki-Oba	2	1	1	0	1	2	1	1	1	**10***
5. Eki-Osa	3	2	1	1	0	1	1	2	2	13
6. Eki-Ogiso	4	3	2	2	1	0	1	3	3	19
7. Eki-Edo	3	2	1	1	1	1	0	2	2	13
8. Eki-Agbado	3	2	1	1	2	3	2	0	2	16
9. Vegetable Market	3	2	1	1	2	3	2	2	0	16

Sum = 168 *Source: Author's Fieldwork, 2013*

The accessibility index matrix (Table 2) reveals that nine (9) nodes (markets) are in the network of roads in the study area. This measure represents the arrangement of links between the markets (Figure 4) and the number of steps taken from one market to another. From the matrix, a cell value indicates the number of inter-nodal link, while zero (0) represents no link. However, the distance between pairs of nodes (markets) is expressed as the number of intervening links along the shortest path that connects them.

From Table 2, the most accessible nodal points are Yanga Market and Eki-Oba with index of ten (10) each. This means that each of the markets requires ten (10) intervening links (steps) from other markets in the network. Yanga Market and Eki-Oba located (189m apart) at the core of the central business district (King Square) are most accessed, patronized and populated with human and vehicular traffic. The index value is a measure of accessibility in terms of the total number of shortest links (steps).

Eki-Osa and Eki-Edo have index of thirteen (13), Eki-Oliha has index of fourteen (14), while Eki-Agbado and Vegetable Market have index of sixteen (16). Similarly, Eki-Ogiso (New Market) had an index of nineteen (19), and the least accessible market is Eki-Uwa with the highest index of twenty-one (21). This implies that, the lower the index value, the higher the accessibility; and the higher the accessibility, the higher the level of patronage (human and vehicular traffic), with the tendency to impede traffic flow as well as generate congestion in the study area.

SUMMARY AND CONCLUSION

This study highlighted the challenges of road network connectivity and accessibility, and their implications on market patronage in Benin metropolis. It has identified high rate of traffic congestion repeatedly caused by incomplete road connectivity, poor accessibility, eroded road surfaces, and street parking and trading. Others included activities of revenue collectors and EDSTMA staff, and poor enforcement of traffic regulation mechanism as critical issues in the study area. Graph theory, physical observation, and structured questionnaire were adopted to elicit information for this study. Also used was stratified sampling technique based on criteria of geographical location, market periodicity (daily or weekly), historical and cultural significance, Central Business District function (location within the CBD), and traffic confluence.

The results of the graph theory-base study showed that, although good road network connectivity existed among the selected market places, it was 30 percent incomplete. Eki-Oba and Yanga market were found to be most accessible and patronised because of locational advantage at the city centre (Kings'/Oba Ovoranmwen Square). Private cars and mini-buses were the most used mode of transit, while trucks were lowest.

RECOMMENDATION ON POLICY GUIDELINES

This study advances some recommendations in the light of the findings for sustainable traffic management system (STMS). All the access routes should be rehabilitated as possible alternative to bye-pass market places for none-market trips; Television road where Eki-Oliha and Eki-Uwa are situated and 2nd East Circular road where Eki-Ogiso and Eki-Osa are located should be reconstructed. Provision of traffic signals, street graphics and furniture along the market roads; motor parks for private and public vehicles should be provided in all the markets to prevent street parking.

Vertical and horizontal expansion of the market stalls using planning techniques and architectural design scheme is highly necessary to accommodate traders who display their wares on walkways. Pedestrian bridge should be constructed between Eki-Oba and Yanga

market which are 189m apart, within the city core which are most connected, accessed and patronised. Legislative empowerment for the enforcement of traffic management laws and measures would breed discipline among road users and facilitate high traffic flow rate. Effective planning of the market place as a city node and development centres should be taken seriously prior to its physical development, in order to prevent slum and blight in the built environment where these markets are situated.

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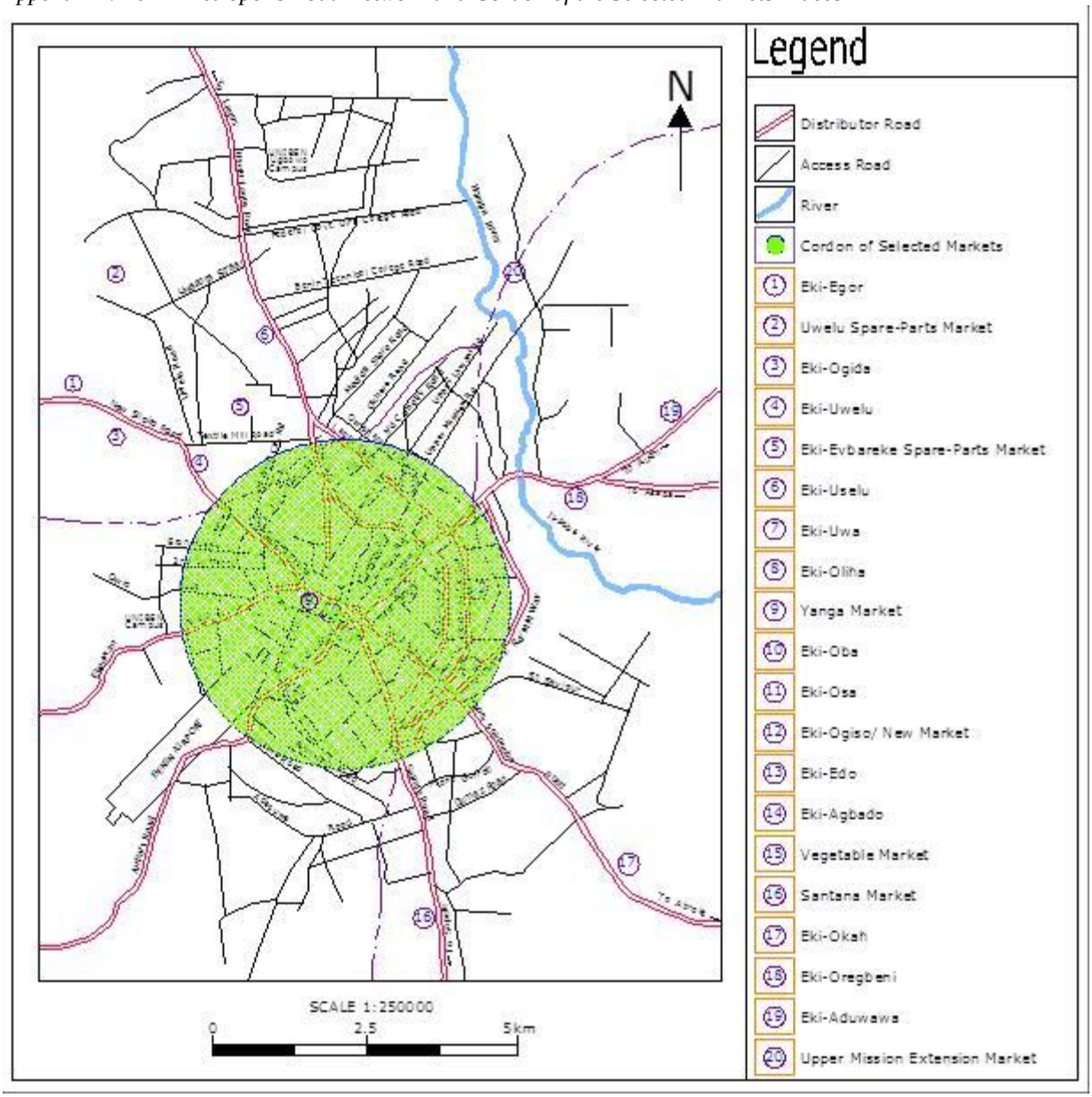
Appendix 1. Benin Metropolis Road Network and Cordon of the Selected Markets Places



Source: Edo State Ministry of Lands and Survey, Benin City

Assessment of Local Government Council and Community-Based Development Associations in the Provision and Maintenance of Educational Facilities in Ilawe-Ekiti, Nigeria

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ABSTRACT

The quality of education delivered and achievement by school is dependent on the facilities provided for students to develop their full potentials. The purpose of the study was to assess the provision and maintenance of educational facilities by the Local Government Council and Community-Based Development Associations with a view to ensuring adequacy of education facilities in Ilawe-Ekiti. This study adopts the survey research method and used three different sets of questionnaire to collect research data from the authority of the Ekiti South-West Local Government Council officials, Community Development Unit of the Local Government Council and the 61 (CBDAs) officials available in the study area.Findings among others revealed that majority of the secondary schools were privately-owned, while the primary and nursery/primary schools were Community-owned. There were 8 secondary schools; 9 primary schools; and 25 nursery/primary schools in the study area. The maintenance carried out on school facilities was inadequate for majority of the facilities to provide high quality education. In view of the findings, there were need to improve the educational facilities through additional provision and maintenance of the existing schools; encourage people's participation in the conceptualization and implementation of new proposal to develop the town. Finally the paper calls on the three tiers of governments and other stakeholders to provide and inculcate good maintenance culture on our educational facilities for effective management with the intension of promoting high quality education in the study area.

Keywords: Community-Based Development Association, Educational facilities, Local Government Council, Maintenance, Provision

INTRODUCTION

Education facilities are material or resources that enhance teaching and learning. Educational facilities can be defined as the entire school plant which school administrators, teachers and students harness, allocate and utilize for the smooth and efficient management of any educational institution (Asiyai, 2013). Educational facilities serve as pillars of support for effective teaching; as well as the physical and spatial enablers of learning. According to Adedokun (2011) educational facilities are physical resources that facilitate effective learning. They include blocks of classrooms, blackboard, laboratories, workshops, libraries, equipment, consumables, electricity, water, visual and audio-visual aids, tables, desks, chairs, play ground, storage space and toilets. These promote and increase the production of results. Most governments in the third world countries like Nigeria face strong financial problems in providing educational facilities like school bus, laboratories, workshops, libraries, equipment, in the urban/rural setting. In Nigeria, provision of schools/education continued to increase without a corresponding increase in facilities which has to meet the needs of rapidly increasing users for effective teaching and learning. One of the main problems of education in Nigeria is underfunding, this has resulted in the depleting conditions of educational facilities in the country (Nigerian). These are of great concern to the government i.e. Local Government Council Authorities, Community-Based Development Associations, and other agencies in encouraging the provision and proper maintenance of schools and existing educational facilities.

The role of provision and maintenance of educational facilities in grassroots development and poverty reduction cannot be over-emphasize both in urban and rural environments. Provision

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in this paper means an item of goods provided/suppy and obtained for future use. The word maintenance, according to Eti *et al.* (2006) means preserving and keeping in good order as near as possible in their original state. By implication, maintenance means keeping in good order and shape all projects of development that are of benefit to the people. However, the attitude of people towards the maintenance of educational facilities is that the government property does not belong to anybody. To this extent educational facilities that were meant to benefit the masses are just rotting away, without being put to any good use as people are not interested in making such facilities sustainable. Governments have come to term with the LG for the need to be involved in grassroots development. However, the establishment of LGCs in Nigeria which aimed among others to facilitate rural and urban development through infrastructure development and delivery in which schools (i.e educational facilities) provision and maintenance is inclusive. The LGC is statutorily empowered to construct and maintain schools and other public facilities (FGN, 1999). The recognition and importance of this process is to tackle local socio-economic problems and to manage grassroots development. Despite these provisions, educational services in both urban and rural areas in Nigeria in inadequate. Sehinde (2008) maintained that in Nigeria, the overriding impression is that LGCs are weak in responding to the challenges posed by infrastructural development. This has led to self-help programmes through which private sector is now involved in educational facilities development. The CBDAs form one of the main actors of the Local Economic Development (LED) process. They have been responsible for the provision of communal facilities such as schools, markets, water supply, and town halls. Akinsolu (2004) asserted that educational curriculum cannot be sound and well operated with poor and badly managed school facilities.

The aim of Education for the 21st Century "is to enable every person to attain all-round development in the domains of ethics, intellect, physique, social skills and aesthetics according to his/her own attributes so that he/she is capable of life-long learning, critical and exploratory thinking, innovating and adapting to change; filled with self confidence and a team spirit; willing to put forward continuing effort for the prosperity, progress, freedom and democracy of their society, and contribute to the future well-being of the nation and the world at large. " *Hong Kong* Education Commission, 2000)", as stated by Edewor *et al.* (2003) the Nigeria people must be given good education to ensure improvement in their health condition so as to enhance their economic empowerment and help in decision making that will liberate them. In the education sector, it is common to see dilapidated school buildings with collapsed roofs without ceiling occupied by students, thus, making learning environment very unsuitable especially in hot seasons. All of these point to the fact that educational facilities as a social service are not adequately maintained. Norris (1997) defined LGC as the government of urban areas or rural areas subordinate having an independent legal existence. The functions of a LGC in Nigeria include provision and maintenance of primary, adult and vocational education. While CBDAs is regarded as an association that provides forum for people to articulate their views, aspirations and needs. The associations aim at helping people within a local community to identify their social need, and work towards achieving them.

Purpose of the Study

The purpose of this study is to assess the contributions of LG Council and Community-Based Development Associations in the provision and maintenance of educational facilities in Ilawe-Ekiti with a view to enhancing the performance of educational institutions in the study area.

The study objectives are to;

i. classify the existing educational facilities (i.e schools) according to ownership and conditions in the study area;

ii. highlight the involvements of the Local Government Council in the development of educational facilities in Ilawe-Ekiti ; and
iii. assess the performance of the Local Government Council and Community-Based Development Associations in the development of Educational Facilities

LITERATURE REVIEW

The importance of school in the education process has necessitated the need for the provision, management and maintenance of those facilities in the school system. According to Olutola, (1998) the operational input resources in education industry are referred to as school facilities, the provision, management and maintenance of these facilities have been found to be significantly related to school performance. In the study of Olutola's (1998) schools with good faculties recorded greater achievement in WASC examination than schools with poor educational facilities. Educational facilities provision and maintenance is a powerful instrument of development, especially among developing nations like Nigeria has led to the evolution of educational programmes such as the Universal Basic Education in Nigeria (Abdulkareen, 1999). Nigeria school system is witnessing expansion in school enrolment and school programmes. This has necessitate a great demand for more provision of schools, and the need to maintain the facilities, such like classrooms, libraries, laboratories, multipurpose rooms/halls, toilets and school fields for the teeming school population. Adedokun (2011) also stated that, in spilt of government hugh financial allocation to education in its annual budget, school facilities are still grossly inadequate in Nigeria. Consequently there is a called for the need to explore strategies in sustaining the school system. Over the years government and non-governmental agencies (i.e CBDAs) and individuals have been concerned about the management of education, the crucial aspect of this management is the provision and maintenance of educational facilities.

The provision and maintenance of educational facilities and services is essential for the promotion of efficient operations of any country, state, or town in enhancing the general standard of living. As stated by Okwakpam (2010), human needs are insatiable and the government alone cannot meet them. In recent times, various efforts have been made by government. One of the strategies employed to enhance development is through grassroots participation. Government has come to terms with the need to partner with the LGC and CBDAs as agents (or institutions of development) in addressing shortage in infrastructural facilities, including schools. Ilawe-Ekiti is faced with inadequate and poor state of the existing schools. Provision and maintenance in this paper is used to indicate the extent to which educational facilities such like school buildings/walls, classrooms, sports field and library in the Nigerian communities are affected so as to bring about better living conditions, (economic, social and cultural developments).

In this study the researchers observed that; most of the school compounds were bushy, majority of the signboards, gates and walls of the schools were defaced, coupled with dilapidated buildings and leaking roofs; (some of which have been blown off), rough floors and windows without louvers, poor illumination in some cases, broken chairs and desks. It appears adequate management and maintenance is not provided in the available schools/educational facilities. Educational facilities are supposed to be kept in good and proper condition near their original state by the school educational administrators. Based on our causal observation, it appears that owners of school are neglecting the role of educational facilities provision, management and maintenance. The question now is could this observation be the same for all nursery, primary and secondary schools in Ekiti State? It's against this background that this study was carried out.

RESEARCH METHODOLOGY

The survey research method was adopted for this study. The target populations were classified into four (4) groups; Ekiti South West LGC Caretaker Chairman, Community Development Unit in-charge of Community Development Projects in the Ekiti South West LGC office, Community/Quarters-Heads in Ilawe-Ekiti and CBDAs in Ilawe-Ekiti. A Non-probability sampling approach was employed for use in this study; it is carried out when particularly the researcher is not concerned about the representativeness of sample. A total census (i.e 100% coverage) survey was also conducted on all the 61 (CBDAs). Only the President/Chairman/Secretary of the CBDAs were interviewed. Only one questionaire was administered on the Ekiti-South West LGC Caretaker Chairman and also one questionaire was administered on the official in-charge of the Community Development Project Unit in the LGC office. Data were collected with the aid of structured-multiple choice questionnaire. It consists of sixty-one (61) questions which were set to elicit specific information from the respondents.

This study employed the use of four sets of questionnaire for data collection. In this study, the researchers in conjunction with the seven (7) Field Assistants administered the questionnaires. Students from the Department of Urban and Regional Planning, Crown Polytechnic Odo, Ado-Ekiti, were used. The data collected from the field were collated and proceed using the Statistical Package for Social Sciences (SPSS) version 19.

RESULT AND DISCUSSIONS

The discussions of the data were based on the research objectives generated for the study.

The Existing Ownership of Schools in Ilawe-Ekiti

Schools in Ilawe-Ekiti were mostly built by the government, Private individual and the community. Majority (i.e 56%) of the schools in the town were built by the community i.e the Faith Based Organizations (FBOs) this were owned by the church Missionary Society and (2.4%) were built by the Muslim Islamic Society. Through community participation efforts, the Faith Based Organizations (FBOs) built nursery, primary and secondary schools in the town. Some individual built schools (private schools), while few schools were built by the government in Ilawe-Ekiti. Findings reveals that (49.5%) of the secondary schools in Ilawe-Ekiti were Privately-owned, followed by Government-owned (38.0%) and Community-owned (12.5%). Majority (88.9%) of the primary schools in Ilawe-Ekiti were Community-owned while the remaining (11.1%) of the primary schools were Privately-owned. Furthermore (56.0%) of the nursery/primary schools in Ilawe-Ekiti were Community-owned, (40.0%) were Privately-owned, while (4.0%) were Government-owned nursery/primary schools.

The Existing Ownership of Secondary Schools in Ilawe-Ekiti, 2015

There are eight secondary schools in Ilawe-Ekiti; those include Oniwe Grammer School at Aaye, Glorify God Secondary School at Aaye, Victory College at Irorin, Oniwe Comprehensive High School at Irorin, Ejire Secondary School at Irorin, Solid Foundation at Okebedo, Corpus Christi College at Adin and United High School at Oke-Emo. Those secondary schools were mostly built by the private individual, private-owned secondary schools in Ilawe-Ekiti constituted (50.0%) of the total secondary schools, while (37.5%) were Government-owned secondary schools, Community-owned secondary schools represented (12.5%). However (75.0%) of the secondary schools in the town are in fair conditions, while (25%) are in good conditions. Secondary schools in Ilawe-Ekiti were built by government, Private individual and the community. Corpus Christi College is the first major secondary school in the town, built in 1967 at Adin by the community. Findings reveal that the involvement of private schools in the town has helps in improving the standard and quality of

education in Ilawe-Ekiti. (75.0%) of the secondary schools in the town are in fair conditions, while (25%) are in good conditions.

The Existing Ownership of Nursery/Primary in Ilawe-Ekiti

Table 1 shows the 25 names of nursery/primary schools in the wards in Ilawe-Ekiti. Majority (65.0%) of the nursery/primary schools in the town were owned by the community i.e the Faith Based Organizations, (29.0%) consist of individuals' private-owned nursery/primary. While the government owned nursery/primary schools in the town constituted (6.0%). Findings reveals that majority of the nursery/primary schools were established more than 22 years again and most of them are unkempt, the signboards and walls of the schools are defaced, as they are engulfed by weeds. Further findings revealed that the community-owned nursery/primary schools in the town were later handed over to the government. The criteria used in assessing the conditions of those schools in Ilawe-Ekiti, was carried out with the aid of rank size relationship. The ranking relationship shows the condition of nursery/primary schools in wards of Ilawe-Ekiti. Marks assigned to each ranking are as follow: Very good-5, Good-4; Fair-3; Poor-2; and bad-1. Having summed up the total percentage score of all the nursery/primary primary schools, the number of school facilities that scored certain marks was multiplied by 100 to calculate the percentage score. The result from the ranking relationship shows that condition of nursery/primary schools in wards of Ilawe-Ekiti is in fair state, which consists of 16 (47.0%). Number of good are 14 (41.0%), Poor are 4 (12.0%). The percentage of very good and bad nursery/primary schools cumulated to 0%. Like the foundation of a house, nursery/primary school education forms the bedrock of the educational system of any country.

Involvement of the Local Government Council in the Provision and Maintenance of Educational Facilities in Ilawe-Ekiti

The Community Development Unit of the LG Council is in-charge of Community development project undertaken by the LG Council. Provision and maintenance of educational facilities were embarked upon by the LG Council, Community-Based Development Associations and private individuals in the study area. Findings reveal that the participation of the people in educational development is satisfactory. However the problem of finance and human factor were of the hindrances in the provision and maintenance of educational facilities in the area. The community development unit of the LG Council only provides the available detail information's from year 2010 - 2015 on the cost of project, status of project and the nature of projects executed in Ilawe-Ekiti. However the educational facilities projects are discussed as follow:

E**ducational Facilities Provision and Maintenance Projects by the LG Council and CBDAs in Ilawe-Ekiti**

Educational facilities embarked upon by the LGC. Those include construction of 3 class rooms and office each in St Augustine's catholic nursery/primary school at Irorin, Ilawe Grammar School at Okebedo, and St. Stephen at Adin. The LG Council was responsible for the renovation of schools such as Ilupeju nursery/primary school at Aaye, Holy Trinity at Adin, and Irowelede primary school at Okebedo.

The educational facilities executed by the CBDAs include those embarked upon by the social clubs; the school clubs provided books and awarded scholarship to indigenes of the town, they provided boarding school facilities for the male and female hostel in Corpus Christi College at Adin, renovated classrooms, repairs toilets, roads and equipped the library at Adin, Faith Based Organization (FBOs) provided tables, chairs and books in Corpus Christi College at Adin. The CBDAs supports on educational facilities were on materials; this was very instrumental to the improvement of educational facilities in the town. The CBDAs are good

examples of grassroots development. Findings reveal that all the educational facilities projects of the LGC and CBDAs were completed; only the scholarship grants for students are currently on. The results showed that maintenance of the school facilities were inadequate. Renovation and construction was the most prevalent practice of the LGC and CBDAs in the town while students in the community and Government schools were responsible in maintenance of most of the school fields.

Table 1: The Existing Nursery/Primary Schools in Ilawe-Ekiti, 2015

S/N	Names	Wards/ Location	Ownership	Year of Establishment	Condition
1	Oke-Osun	Aaye	Community	2001	Fair
2	Ilupeju Nur/Pry School	Aaye	Community	-	Fair
3	St Michael's Primary School	-	Community	1955	Fair
4	St. Michallan Catholic Nur/Pry School	-	Private individual	1989	Fair
5	Victory Nur/Pry School	Irorin	Private individual	2002	Fair
6	St Augustine's Catholic Nur/Pry School	-	Community	-	Fair
7	Irowolede	Okebedo	Community	2013	Good
8	Heritage Nur/Pry School	Okebedo	Private individual	-	Fair
9	Afuremu Community Primary School	Okebedo	Community	1977	Poor
10	Ifemayowa Model Nur/Pry School	Okebedo	Private individual	2014	Good
11	Olorunsugo Primary School	Okebedo	Community	-	Fair
12	Holy Trinity Anglican Nur/Pry School	Okebedo	Community	1916	Good
13	Solid Foundation Nur/Pry School	Okebedo	Private individual	-	Fair
14	Subeb Model Primary School	Okebedo	Government	-	Good
15	Precious Seed Nur/Pry School	Okebedo	Private individual	2015	Poor
16	Apex Nur/Pry School	Okebedo	Private individual	-	Good
17	Holy Trinity	Adin	Community	1912	Fair
18	St. Mary	Adin	Community	-	Fair
19	St. Peter	Adin	Community	-	Fair
20	St. Louis Catholic Nur/Pry School	Adin	Community	1993	Good
21	St. Stephen	Adin	Community	-	Fair
22	L.A Pilot Nur/Pry School	Oke-Emo	Government	1955	Good
23	St. Patrick's Catholic Nur/Pry School	Oke-Emo	Community	1955	Poor
24	Blessed Assurance Nur/Pry School	Oke-Emo	Private individual	-	Fair
25	Methodist Primary School	Oke-Emo	Community	1993	Good
26	St. Johns	Okeloye/Iro/Okepa	Community	1936	Good
27	Ejire Nur/Pry School	-	Private individual	2015	Fair
28	St. Angela's Catholic Primary School	Okeloye/Iro/Okepa	Community	1956	Poor
29	St. Anthony's Catholic Primary School	Okeloye/Iro/Okepa	Community	1993	Good
30	Glorify God Nur/Pry School	Okeloye/Iro/Okepa	Private individual	-	Good
31	St. Rapheal	Okeloye/Iro/Okepa	Community	-	Good
32	Araromi	Okeloye/Iro/Okepa	Community	2012	Good
33	C.A.M.C	Okeloye/Iro/Okepa	Community	-	Good
34	St. James Primary School	Okeloye/Iro/Okepa	Community	1993	Fair

Source: Author's Fieldwork, 2015

RECOMMENDATIONS

Encouragement of maintenance culture among target population is inevitable. There is the need to promote maintenance culture in Ilawe-Ekiti. The school owners, administrators, teachers and students should develop and inculcate good educational facilities maintenance

culture that will prolong their durability and efficiency; People's participations and involvement in the formulation and implementation of policies on educational delivery is needed, because people's participation is one of the ingredients of good governance; More money should be disbursed to the LGC, in order to improve educational facilities through additional provision and maintenance of the existing schools; Finally, the three tiers of governments and other stakeholders should provide and inculcate good maintenance culture on our educational facilities for effective management and constantly organize seminars and conferences to sensitize people on maintenance culture from time to time with the intension of promoting high quality education in the study area. This will also help to improve and ensure sustainable provision and maintenance of educational facilities and develop capacity of LGC and communities in the area.

CONCLUSION

The LGC and CBDAs participation programmes have helped in developing Ilawe town /communities to some extent. The CBDAs have been responsible for the provisions and maintenance of educational facilities in the study area due to the government failure to do this. However the present monthly allocation from Federal Government to LGCs is grossly inadequate; and it is not enough to embark on provision and maintenance of educational facilities. The two tiers of government (local and state) particularly the LG that is close to the grass root should endeavor to identify these CBDAs, streamline their activities and provide adequate supervision, motivation, monitoring and evaluation of their projects through appropriate government personnel to support development in the study area.

AREAS FOR FURTHER RESEARCH

Impact of Local Government Council and Community involvement in the provision and maintenance of educational facilities on residents of Ilawe-Ekiti; Nigeria.

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Analysis of Some Attributes of Street Begging in Akure, Nigeria

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ABSTRACT

This paper analyses some characteristics of street begging in Akure city, Nigeria. The scope of the study focused on Akure city where an extensive field survey was conducted on the incidence of street begging. The study made use of both primary and secondary data. Using multistage sampling technique, a total of two hundred and forty (240) street beggars were sampled, constituting 12.5% of total 1,908 beggars in Akure. Data obtained from the questionnaires were processed and analyzed using Statistical Package for Social Sciences (SPSS) version 21. The research findings were presented in form of tables, percentages and charts as appropriate. Findings show that a large population of beggars in Akure took to street begging as a result of poverty and this accounts for almost half the total sampled population, that is, 49.6%. The next factor in order of magnitude is physical disability 32.9%, followed by those that attributed their activities to cultural beliefs 10.4%, and religious inclination 7.1%. The study recommends the building of rehabilitation centres in the study area, social welfare for poor beggars, and evacuation of beggars from the streets, sustainable landscaping, and poverty alleviation programmes among others.

Keywords: Beggars, Characteristics, Poverty, Rehabilitation, Social welfare

INTRODUCTION

Begging is simply defined as asking passers - by for money in public places (Kennedy and Fitzpatrick, 2001). The appearance of beggars who seem to spend most of their time on the streets and public spaces in many urban areas of Nigeria and in cities of some developing countries is in plain sight. This situation is a reflection of urban complexities worldwide and has become a very common and familiar experience for a long time. The population of beggars on Nigerian streets is growing rapidly. Today, their presence is a serious problem that requires remedy and rehabilitation (Gabriel, 2013).

However, not only have their numbers grown over the years, their lifestyles and the display of overtly aggressive behaviour make them the subjects of suspicion and hostility by the public at large and the law enforcement agencies in particular. The menace of street begging as a potential threat to the environmental, economic and social survival of humanity societal fabric is evident (Aliyu, 2006 and Ogunkan 2009). People who engage in begging even recognize the act to be a 'problem'. To them, it is harsh, humiliating, demeaning, degrading and frustrating (Lynch, 2005).

It is obvious that begging has become a global phenomenon which threatens the environment, economic and social survival of humanity. This is true of Nigeria where different categories of beggars are conspicuously found in motor parks, religious worship areas, markets, road intersections, venues of ceremonies among other public places, begging for alms (Jelili, 2006). Scholars have attributed the problem of begging to a number of factors such as poverty (Adedibu, 1989; Jelili, 2006), religion (Hanchao, 1999), physical disability (Adedibu, 1989; Jelili, 2006) and culture (Adedibu, 1989, Jelili, 2006).

The aim of this paper is to examine some attributes of street begging in Akure, Nigeria. Prominent indices of investigation include the factors of begging, categories of beggars, methods of begging, reasons for begging and body physique of beggars among others. It is imperative to state that the increasing incidence of beggars in Nigerian cities is not only due

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to poverty and physical disability but also to the fact that majority of the beggars are satisfied with the "job" (Jelili, 2006). The presence of fake beggars and criminals has not helped the situation and may be dangerous to the society. Despite the evil posed by begging in Nigerian urban centres like Akure, it is curious that much research works have not been directed towards the investigation of the incidence of street begging and rehabilitation in Nigerian urban centres (Gabriel, 2013).

Statement of the Problem

Street begging is a serious issue, in the sense that its intensity and magnitude are increasing at an alarming rate in our society. The negative impacts of begging on social and physical environments are obvious in the tendency of beggars to delay and obstruct free flow of human and vehicular traffic and their high propensity to generate dirty materials either as waste or as parts of their belonging (Jelili, 2006).

A street beggar is known to be an individual such as children, elderly, disabled people, and families who normally beg in public spaces such as shopping areas, banks, public offices, churches, mosques, busy streets, among others (Adugna, 2006). Although, the problem of begging is a worldwide phenomenon, it is more pronounced in the third world countries (Adedibu, 1989; Ogunkan 2009). This is true of many urban areas of Nigeria where different categories of beggars are conspicuously found in streets, motor parks, religious worship centres, markets, road junctions, venue of ceremonies among other public places begging for alms.

Begging is recognized as a 'problem' by diverse stakeholders, including the media, politicians, retailers and traders, law enforcement officers and agencies, welfare and social service providers, the general public, and planners. Each of these stakeholders has a common interest in reducing the incidence of begging. The continued relevance of begging as both a political and a public policy problem is evidenced by extensive media coverage of the issue in recent years, together with governmental consideration of the regulation and governance of begging (Lynch, 2005; Petro and Kombe, 2010).

Although, the problem of begging is a worldwide phenomenon, it is more pronounced in the developing countries (Adedibu, 1989). Akure, a city in a developing country is presently faced with the menace, hence, the need for action. Moreover, in Nigeria, some government authorities have made various efforts to tackle the problem of street begging such as sending them back to their homes but without setting strategies on how to make street beggars attain their basic necessities of life. As a result, many urban authorities have been striving to control the influx of street beggars in the city without success. A quick examination of these efforts indicates that most of them are focused more on the symptoms rather than on prevention or eradication of the deeper structural causes of the problem (Petro and Kombe, 2010). Despite the problems of begging to the environment and socio-economic development of Nigerian urban centres, Akure as a case study, it is unfortunate that much research works have not been directed towards the rehabilitation of beggars. This signals the need for more to be done to contain the situation in a comprehensive and sustainable way.

The problems were investigated in this study based on the fact that, in Akure the Ondo State capital city, an increasing population of beggars is visible on the streets impacting environmental, social and economic discomfort in the city. There is no rehabilitation centre. There is no social welfare, vocational training programs for the beggars and poor landscaping among others. This study, therefore, is focused on investigating some attributes of street begging in Akure.

STUDY AREA

Akure is a traditional Nigerian city and like other traditional Yoruba towns in the country, it has been in existence long before the advent of British colonial rule in the country. The city is located within Ondo State in the south western part of Nigeria. Ondo State is one of the 36 states of Nigeria. It lies approximately on latitudes 7^0 5^1 and 8° 00^1 North of the Equator and longitude 5^0 45^1 East and longitude 6° 00^1 East of the Greenwich Meridian at an altitude of 370m above sea level. Akure is a medium-sized urban centre and became the provincial headquarter of Ondo State province in 1939. It also became the capital city of Ondo State and a Local Government Headquarters in 1979. These dual political roles of Akure have since acted as impetus to the influx of people into the city (Olujimi and Olamiju, 2011).

Akure is located approximately 700 kilometers South West of Abuja, the Federal Capital of Nigeria and about 350 kilometers to Lagos the former capital of Nigeria. It is located within the tropical rain forest region of Nigeria where rainfall is high throughout the year. The increased relative political influence of Akure as a state capital since 1976 has greatly promoted its rapid growth and increased socio-economic activities resulting in its spatial expansion from an area of about 16 square kilometers in 1980 to about 30 square kilometers in 2000 (Ministry of Works, Lands and Housing, 2000) the population of the city grew from 38,852 in 1952 to 71,106 in 1963. Its population was estimated to be 112,850 in 1980 (DHV, 1985); and 157,947 in 1990 (Ondo State of Nigeria, 1990). The 1991 national population census however, puts the population of Akure at 239,124 and its population in 2006 was 353,211 (NPC, 2006). In 2014, using a growth rate of 3.18 percent, the city is estimated to have 453,731 people using a formula for projection, $Pt = Po\ (1+r)^n$ (Gabriel, 2014).

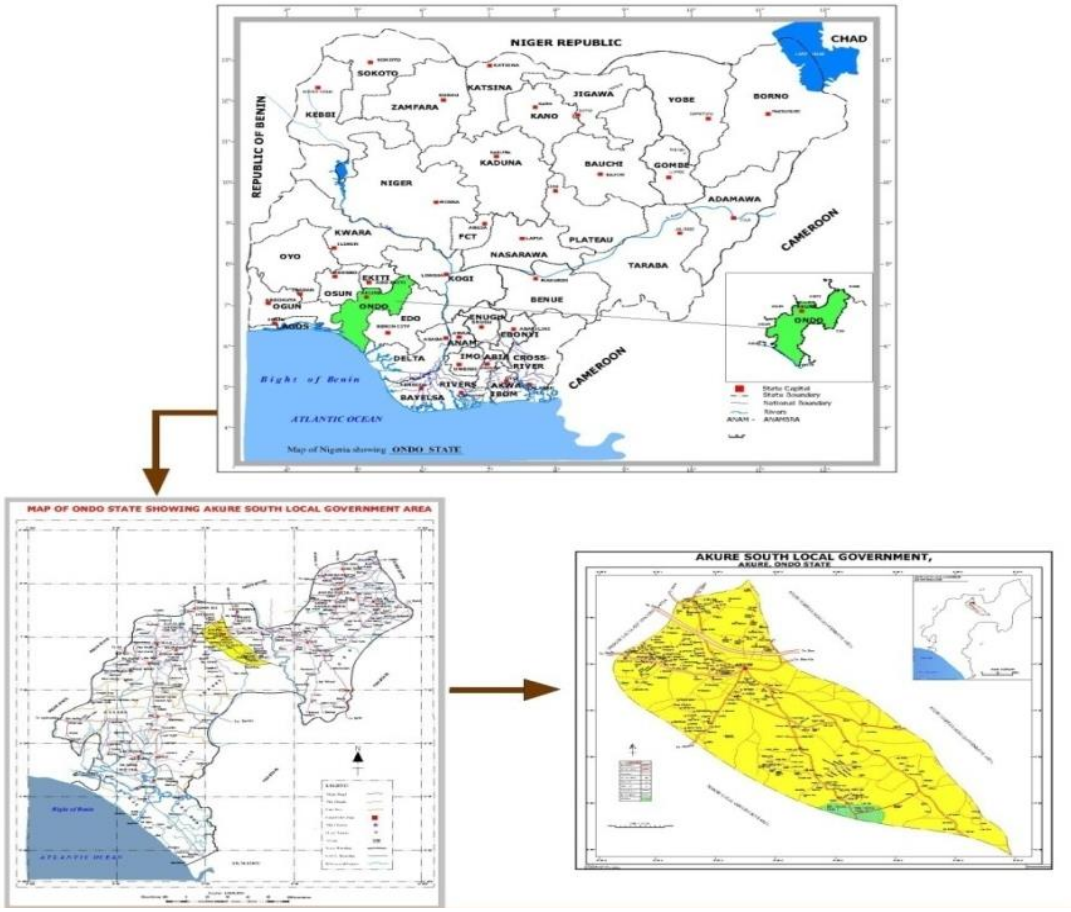

Figure. 1: Map of Nigeria showing the study area in its national, regional and local settings. Source: Ondo State Ministry of Lands and Survey, Akure (2014).

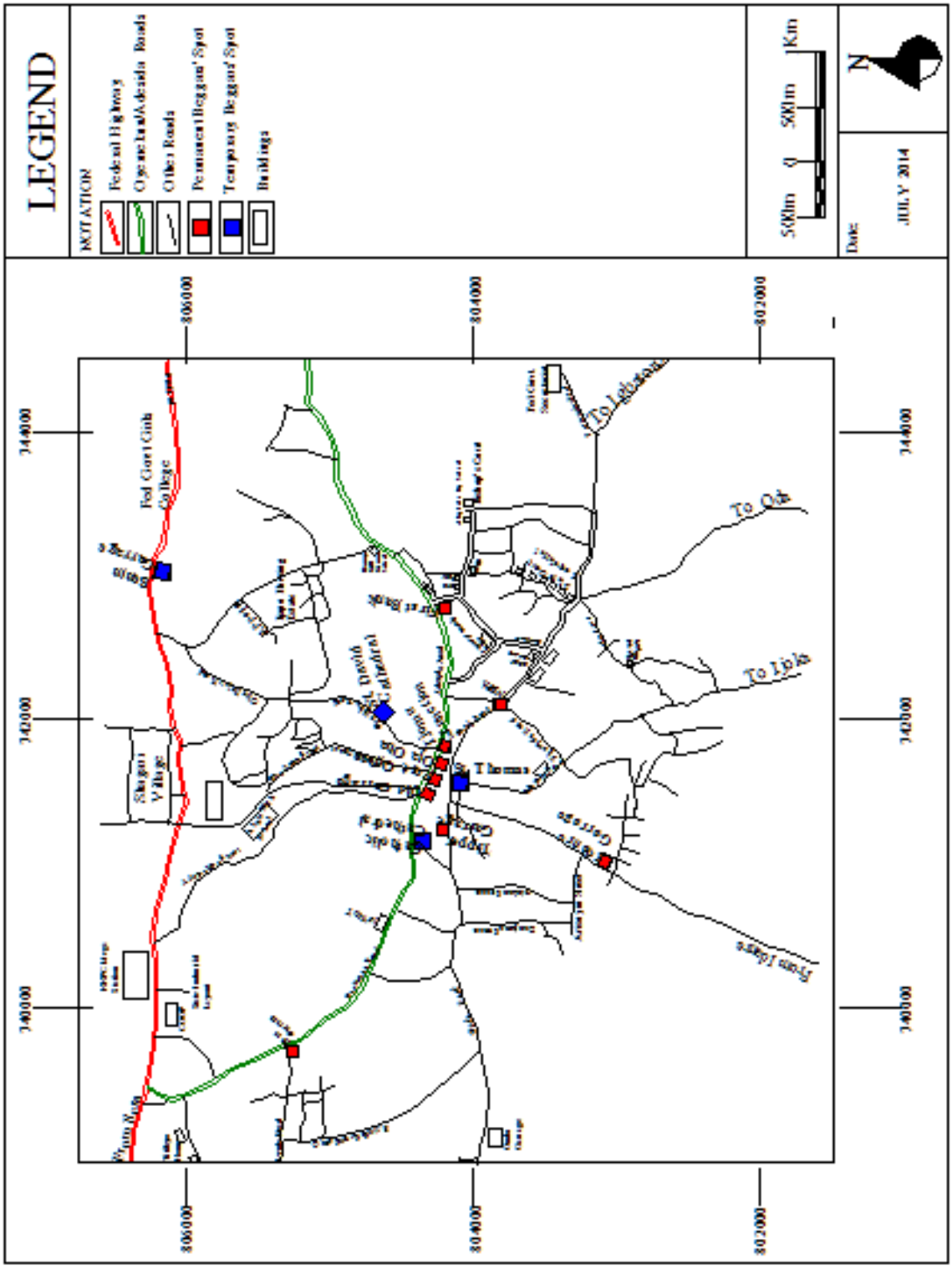

Figure. 2: Major begging spots in Akure
Source: Ministry of Lands and Survey, Akure Ondo State (2014); Authors Field Work, 2014

METHODOLOGY

Primary data for the study were generated from the administration of structured questionnaires that focused on characteristics of street beggars. The questionnaires probed among other issues; the incidence of street begging, socio-economic and cultural characteristics of beggars. Secondary data were obtained from relevant institutions to this research work, such as, Ministry of Women Affairs and Social Development Akure Ondo State, Ministry of Lands and Survey Abuja, Ministry of Town Planning Akure, Ondo State, Ministry of Lands and Survey Akure, Ondo State among others. Since the street beggars keep moving, it was very difficult to prepare any sampling frame to select the desired sampling size. Therefore, purposive sampling technique was employed. Using multistage sampling technique, a total of two hundred and forty (240) street beggars were sampled, that is, 12.5% of the total, 1,908 beggars in the study area.

Further relevant information for the study were collected from in-situ observations, photographs, informal interviews and discussions with the beggars, especially the key informants who are the leaders among the beggars. Data obtained from the questionnaires were processed and analysed using Statistical Package for Social Sciences (SPSS) version 16. The research findings were presented in form of tables, percentages, maps and charts as appropriate.

RESULTS AND DISCUSSION

Analysis of Attributes of Street Begging

This section examines the analysis of some characteristics of the street begging in the selected land uses and streets within Akure city. The results are presented as shown in the following charts and tables.

Factors of begging

From figure 3 the findings showed that a large population of beggars in Akure took to street begging as a result of poverty and this accounted for almost half of the total sampled population 49.6%. The next factor in order of magnitude is physical disability 32.9%, those that attributed their factor to cultural beliefs 10.4%, and religious inclination 7.1%. The findings revealed that the menace of street begging in the study area is as a result of the compounded problems in the society. It ranges from abject poverty, homelessness, varying forms of destitution among others.

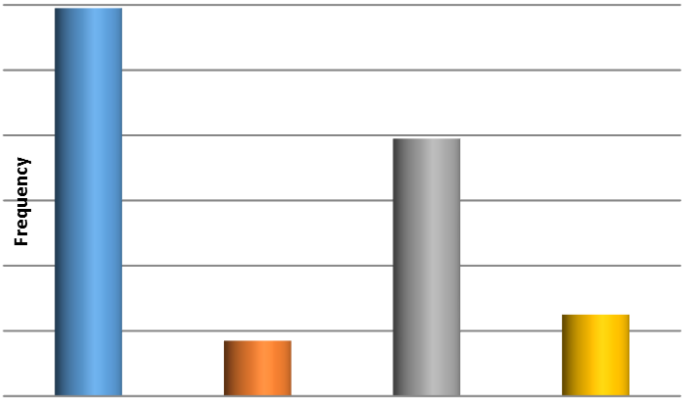

Figure 3: Shows factors of Begging.
Source: field survey, 2014.

Categories of street beggars

Table 1 showed the distribution of the types of street beggars within the study area. About 54.2% were destitute beggars, 13.8% were homeless or wanderers, that is, those without a place of abode in Akure, 05.4% were neglected female beggars, 11.7 % were children involved in begging and 15.0 % were aged beggars.

Table 1: Categories of Beggars

Category	No. of Respondents	Percentage (%)
Destitute / jobless beggar	130	54.2
Wanderer / professional beggar	33	13.8
Unskilled, uncaterred for female beggar	13	5.4
Old age beggar	36	15.0
Child beggar	28	11.7
Total	240	100.0

Source: field survey, 2014

Methods of begging

Figure 4 revealed the methods of begging among the beggars in Akure city. Out of 240 sampled beggars, 60% represents those that fall into the category of beggars whose method of begging is stationary, that is, those that beg at a spot. This finding revealed that most `stationary beggars` are found in such land uses as motor parks, religious worship centres and around banks in Akure. While the `wandering beggars` 40.0%, were roving beggars seen in such areas as markets, main junctions and filling station.

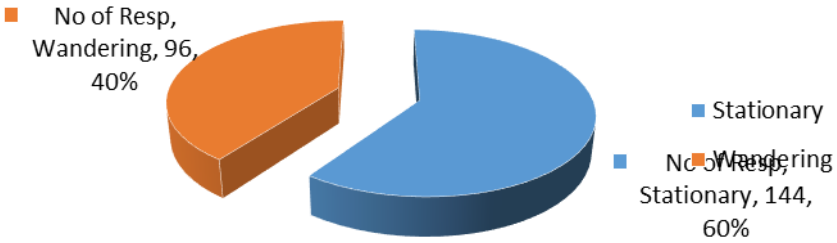

Figure 4: Shows factors of Begging
Source: field survey, 2014

Reasons for begging

Table 2 revealed the reasons for begging in Akure. From the sampled beggars, 45.4% were engaged in street begging because of the quest for money/materials, peer group or family influence 7.1%, physical disability 30.4%, lack of care/neglect 4.2% and unemployment/human capital deficit 12.9%. From the findings of this research it was revealed that, most of the beggars were engaged in street begging because of quest for money and material things which is in a way ascribed to prevailing poverty in the society.

Table 2: Beggars` Reasons for Begging

Reason	No. of Respondents	Percentage (%)
Quest for Money/Materials	109	45.4
Peer Group/Family Influence	17	7.1
Physical Disability	73	30.4
Lack of Care/Neglect	10	4.2
Unemployment/ Human Capital Deficit	31	12.9
Total	240	100.0

Source: field survey, 2014

Body physique of street beggars

Figure 5 showed the distribution of beggars in Akure by body physique. Findings indicated that majority of all sampled beggars were physically impaired (legs and hands/arms) which accounted for 31.3%, old aged beggars 15% normal, that is, beggars without any form of impairment 14.5%, leprous beggars 13.3%, visually impaired 12.5%, children involved in

street begging 11.7% and hearing 1.7%. These findings suggest that body physique of some of the beggars compels them to engage in street begging as they do lack alternatives or supports to sustain their livelihood as some of them find themselves in circumstances beyond their capacity and capability.

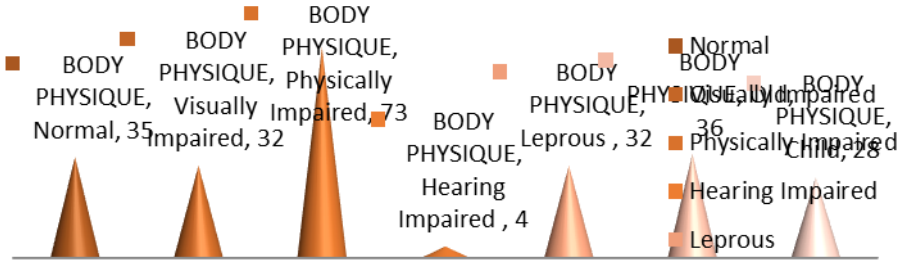

Figure 5: Shows factors of Begging
Source: field survey, 2014

CONCLUSION AND RECOMMENDATIONS

Analysis of characteristics of street begging is burdensome, because of the social, economic and cultural behavior of the street beggars. The study established that street begging is carried out by diversity of people regardless of factors and reasons for begging. The researcher is fully convinced that if rehabilitation centres are put in place and in good condition, social welfare fund for the poor beggars, vocational training; skill acquisition and entrepreneurial assistance to the inmates who are deprived beggars and other related measures are introduced in the study area and in some cities nationwide, street begging will be a thing of history. In line with the findings of this research work the following measures are recommended:

The Government should build rehabilitation centre(s) in the study area and some selected towns in the nation. For the mere fact that this promises to be good strategies of keeping beggars off the street, they should be provided with basic necessities of life such as water and electricity so that inmates will feel comfortable. The rehabilitation centres should also be offering skill acquisition and entrepreneurial assistance to the inmates who are deprived beggars. On the social welfare fund for the poor beggars; there is the need for Ondo State Government to develop a policy of giving Survival Monthly Allowance to the inmates and the needy. Evacuation of beggars from the street and deployment to their states of origin should be a continual and consistent process in the study area and by extension throughout the entire state. A census of beggars for planning and welfare purposes should be regular and consistent among others.

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An Appraisal of Social Housing and Urban Poor in Nigeria: A Case Study of Ado Ekiti

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ABSTRACT

Housing as a complex and expensive commodity is equally considered to be one of the major components of social policy along with health, education, social security and personal social services. In order to meet the challenges of housing the deprived people, particularly the urban poor of developed Nations as well as the low income class of developing countries many policy documents have been designed over time . This paper therefore takes a look of the reality of National Housing Policy towards social housing of the urban poor in Ado Ekiti. Relevant data were collected through questionnaires from randomly sampled public housing estates in the city. The results were subjected to both descriptive and inferential statistical analysis The result of the findings revealed that provision of social housing are not only short in supply but equally not within the reach of the poor in term of income qualification and employment opportunities due to poor governance. The paper concludes among other things, suggestion for use the local building materials, private developer participation of housing delivery and adequate financial empowerment of the urban poor populates.

Keywords: Urbanisation Urban poor; Social housing, Private developer and Governance

INTRODUCTION

Housing has been universally accepted as one of the most essential needs for human survival simply because in all ramifications, housing is more than mere shelter as it includes access to much of social infrastructure that enhances livability indices such as education, health and open- spaces.(Ezenagu (2000), Wahab (2003) and Alser (2007),) It also includes access to physical infrastructure such as road, water, electricity and telecommunication. However, these indices do not only make housing to be expensive products but as a complex good that support social and urban externalities of which those with high income take the best, leaving the worst accommodation for the least well off in society.

As a matter of fact, the categories of the worst off in the society are mostly the urban poor. These groups are generally regarded as the low income earners who are equally engaged in the informal sectors of the urban economy. According to Ajakaiye (1999), the urban poor are self employed people of petty jobs such as hawking, barbing, repairing and local maintenance. They are also the unskilled labours who are employed to work in industries and construction site or those as result of unemployment take to casual work which includes the Taxi drivers and the popular Okada riders in our towns.

It is important to know that these groups of people formed the majority that are well pronounced in developing countries, particularly in Nigeria where the rapid rate of urbanization and the population growth do not correspond with the economic development. This no doubt, has contributed a lot to the manifestation of high level of inequality and poverty that make many urban poor to be homeless while many live in urban decay of slum and substandard housing environment.

The worrisome situation has made public intervention in housing delivery in term of social housing to be inevitable tools that provides accommodation for those who cannot compete in the housing market. This type of housing which was tenure for the very poor and housed low-waged working families was equally designed to provide for rent, part rent/ part buy at less than full market cost by a socially responsible agency.

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However, in developing countries particularly in Nigeria public housing intervention popularly known as Low income housing or affordable housing is very limited. At the same time, poor people invariably have no access even when a low cost housing scheme is put in place purposely for the poor because the well to do are the ones who eventually benefit.

In view of this fact, this paper appraises the poor and the public housing in Ado Ekiti, Nigeria.

THEORETICAL FRAMEWORK AND REVIEW

This paper is based on State intervention which is an offshoot of Marxist Theory of conflict where differential social class does not only form the dimension of social contradictions but equally leads to social inequality that relates with the problems created by injustice to collective consumption system of ensemble of social groups. In fact, the struggle results in state policies which serve the interest of the dominant class while the subordinate class sometimes win and wrest certain concessions.

Available records reveal that the world is not only experiencing rapid population growth, but equally witnessing high rate of urbanization that undergoing urban growth. According to UN (2012) in 2011 the global population reached the 7 billion mark and it is projected to climb over 9 billion by 2050. Hence, the population of the world that took thousands of years to reach 1 billion only took 200 years or so to make it sevenfold Likewise, the UN (2007) also pointed out that the proportion of the world population living in the urban was only 3 percent in 1800 and at 1900 almost 14 percent were urbanites with 12 cities of 1 million or more inhabitants while in 1950 about 30 percent of the world population resided in urban centers where numbers of cities of million people grown to 83. In fact, Fadare (2008) revealed that in 1950 about 733 million people or 29 percent of world population lived in urban areas and by 2005 the people reached about 3.172 billion or 49 percent of the world population and projected to hit 4.9 billion or 61 percent by 2030. Shehu (2003) also noted that within the last forty years, the numbers of urban areas in Nigeria increased from 329 to 1650 while the population of towns with 20,000 people and above increased from 3.2million to 32million.

The failure to prepare for this unprecedented and inevitable urban explosion carries serious implications on global security and poverty. For instance, environmental degradation makes the urban poor vulnerable to the spread of disease while one-third of the world's urban population live in slums of overcrowding without access to adequate shelter, clean water, and basic sanitation. According to Ravallion (2007), global poverty has become an urban phenomenon of which in the year 2002, 746 million people in urban areas were living on less than $2.00 a day. The absolute number of urban poor also increased within the last fifteen to twenty years at a rate faster than the rate in rural areas, particularly in Asia with the largest share of the world's slum dwellers, whereas, nowhere is the threat of urbanizing poverty is more grievous than in Africa with the fastest rate of urban growth and the highest incidence of slums in the world (Halfani 2007). As a matter of fact, the rapid rate of urbanization in Africa has been decoupled from economic development of which in the last fifteen years the number of slum dwellers has almost doubled in sub-Saharan Africa, where 72% of the urban population lives in slums (UN-HABITAT 2006). Likewise, in Nigeria about 18.4 million people who were living below poverty line in1980 aggravated to 125 million (78 %) in 2000 of which more than half of the people are living in urban centre (Ajakaiye 1999). This is simply because the more the increase in population of towns and cities, the more the urban poor.

History revealed that the antecedent of poverty in term of overcrowding, poor hygienic conditions, disease and other misery became more evident during the industrial revolution

and the aftermath of World War I; therefore making social housing to become a central tool for combating the menace by the enactment of acts. According to Claire (2008), Belgium with its 1889 Act, was the first in the world to start the social housing; Britain came second in 1890 with the passage of the Housing of the Working Class Act while France came third with the Loi Siegfried act of 1894. Similarly, the genesis of public housing in developing countries of Asia, Latin America and Africa has much to do with the colonial and post colonial style of governance (Wakely 2014). For instance, the unfortunate outbreak of bubonic plaque of 1928 in Lagos led to the establishment of the Lagos Executive Development Board (LEDB) to signify the ushering of Nigerian public housing programmes intervention, (Onibokun 1990 and Aribigbola 2000). According to Bustani, and Kabir (2010) the establishment of the Nigerian Building Society (NBS) after the Second World War provided housing for selected people in term of staff quarters for expatriate and Armed forces as well as construction of housing estates to serve the senior civil servant in the capital city of Lagos and regional headquarters like Kaduna, Ibadan and Enugu.

The social housing over the years has witnessed many changes globally of which Housing experts often ask whether social housing could be seen as the problem rather than the solution. According to Claire (2007) almost all those parameters which originally made housing as a social project, and which contributed to collective well-being and social cohesion have changed; particularly the population living in social housing and their social milieus as well as the standards, needs and conceptions of good housing. Malpass (2008) equally pointed out that social housing has changed from a broadly based tenure, accommodating a range of income groups, to an increasingly residual sector for the poor. This made the pattern of ownership and management of social housing in Britain to transform from local authorities to individual ownership through the sale of council houses under the right to buy in 1980, and the transfer of council housing to housing associations in 1988.

Nigeria over the years also witnessed a wind of change in the public housing provision. For instance, the first major changes occurred between 1970s and 1980s when NBS metamorphosed to Federal Mortgage Bank of Nigeria (FMBN) through federal government effort in providing affordable housing to Nigerians citizens on long term mortgage repayment arrangement and the national low income housing programme embarked by the government in all the States of the Federation, popularly known as Shagari low cost.

However, the failure of the programme led to National Housing Policy of 1991 with a slogan of Housing for All by the Year 2000A.D. Aribigbola (2008) explained that the policy has a vision of providing about 700000 housing units every year to meet the 8million housing deficit and provide sites and services scheme for all income groups, with special emphasis on low income groups in the major cities of the country through National Housing Fund of which both workers and government were to contribute 2.5% of their annual income and revenue respectively while insurance company, commercial and merchant banks were made to contribute between 10% and 40% of what they generated to the fund.

Unfortunately, the inability of the policy to achieve its target led to 2006 housing policy with the aim at removing the impediments to the realization of housing goal of the nation. The strategies adopted by the policy included among others the disengagement and encouragement of private developers into housing provision, the use of certified locally produced building materials as a means of reducing construction cost, making land for housing development easily accessible and affordable, ensure the use of relevant and fully registered Nigerian professionals to provide appropriate designs and management in housing delivery and promote a national housing market. According to Wakely (2014), in developing countries site and services schemes which was considered as a means to the housing

provision toward the end of the twentieth century became in relevant and abandoned by the end of 1990s and therefore seeking support for private participation in housing provision.

MATERIAL AND METHODS

The Study Area

The study area is in Ado Ekiti the capital of Ekiti State and focuses on the public housing schemes. The city which is located on latitude 7°4' north of the Equator and 5°15′ east of the Greenwich Meridian does not only witness progressive population growth but equally experience spatial expansion. As a matter of fact the population of the town that was less than 200,000 before the creation of state is now about 400,000 while the spatial expansion increased from 19.6 km^2 in 1996 to 36.7 km^2 in 2006

The city has also witnessed more physical developments, particularly in housing since inception as a state capital. For instance, the estimated total housing stocks of the city which were less than 2500 when the state was created were estimated through satellite imagery to be around 4000 units. Initially there were two housing estates in the city namely Ekiti State Housing Estate and the Federal Housing Estate which are located along Afao road. However, the town can now boast of eight housing schemes at different locations,

Methodology

The study is purely based on both descriptive and inferential statistics of which data were obtained from both primary and secondary source. The various Journals, text books and internet services remain the source of secondary data while structure interview and questionnaire serve as source of primary data A well structure oral interview was conducted with officials of both Ekiti State Housing corporation and the Federal Ministry of Housing and Urban development to get relevant information on their housing properties in term of total number of developed properties, types, location and the cost implications At the same time, administrative questionnaire was designed to collect information on housing characteristics as well as social economic of the prospective owners. These involved administration of about 196 questionnaires that were randomly distributed to sample 20 percent in various type of housing stocks located at each housing estate. The collected data were presented in tabular format and properly analysed by multiple regression method to determine the influence of socio economic factors of households on their housing tenure. The model of the regression which has the housing tenure as dependent variable and education status, income age and employment status as independent variables is specified as

$LnY = a + b1X1 + b2X2 + b3X3 + b4X4 + e$ where Y stands for the nature of housing stocks, X1 for education status, X2 for income, X3 for age X4 for employment status and e as error term.

RESULTS AND DISCUSSION

Descriptive Analysis

There are three categories of estates in the study area namely, the Federal government, the State government and the private developer. The Federal government has three estates with 396 housing units, the State government controls four estates of 380 housing units while private developer has one estate of 250 housing units, see table 1. The table clearly showed that the Federal government (Shagari) low cost housing estate contained one bedroom and three bedrooms flats while most of the recent housing estates have two bedrooms flat, three bedrooms flat, three bedroom flat special, four bedrooms flat and manson. Apart from Shagari low cost housing which had purchasing values of 10,000 and 18,000 Naira, others have purchasing values that ranged between 2million and 5million Naira.

Table1: The General Information about the Estates

Name of Estate	Developers	Year	Type	Unit	Cost in N
Federal Housing	Fed. Govt (PB)	1981	1 Bedroom	157	10000
			2 Bedrooms	10	18000
Bawa	State Govt (PB)	1997	2 Bedroom		
GRA	Fed Govt (PB)		2Bedroom	16	2.5million
			3Bedroom	20	3.5million
			4 Bedroom	24	4.5million
Shelter View	Private developer	2007	2Bedroom	30	3million
			3Bedroom	170	4million
			4Bedroom	50	5million
Obasanjo	Fed Govt/Home Agenda (PB/PR)	2006	2Bedroom	24	3million
			3Bedroom	96	3.5million
			3Bedroom (S)	22	4million
Fayose	(PB/PR)	2006	2Bedroom	50	3million
Irewolede	State Govt/Wema Housing	2009	2Bedroom	16	3.5million
			3Bedroom	204	4.6million
			3Bedroom (S)	9	5.4million
			4Bedroom (M)	23	11million

Source author compilation 2014
Note PB stands for Public while PR stands for Private

Plate 1:A view of Obasanjo Housing Estate

The table below indicates that majority of home ownership that represents 62.9 percent secured their properties with 10 percent fixed deposit and installment payment while those with outright purchase are 8.6 percent. At the same time, the 10-20 years period of payment has the highest percentage of 68.3. The table also noted that co-operative loan formed the major financial assistant with 45.7 percent

Table 4: The Housing Financial Information

		Bawa	Shagari	GRA	Irewolede	Obasanjo	Shelter	Fayose	Total	%
Mode of Payment	Full	3		5	3	4	1	16	8.6	
	10%+Istal	14	10	37	16	33	7	117	62.9	
	>10%+Istal	19	2	8	9	13	2	53	28.5	
Period of Payment	0Yr	3		5	3	4	1	16	8.6	
	0-10 Yrs	9	2	7	9	15	1	43	23.1	
	10-20Yrs	24	10	38	16	31	8	127	68.3	
Source of Payment	Self/advance	10	3	7	7	9	2	38	20.4	
	Co-op	17	5	23	11	24	5	85	45.7	
	Bank	9	3	16	7	13	2	50	26.9	
	Mortg	-	1	4	3	4	1	13	7	

Source Author Fieldwork (2014)

It is generally noted that majority of those who owned houses in these estates were between the bracket age of 25 and 50 years with 55.1 percent while none is below the age 25 years, see data below. The data also revealed that 87.2 percent of the house ownership is male while 89.8 percent are married with divorce of 1.5 percent as the least percentage.

Table 2: The Social Background of Respondents

		Bawa	Shagari	GRA	Irewolede	Obasanjo	Shelter	Fayose	Total	%
Age	< 25 yrs									
	25-50	4	12	8	34	18	26	6	108	55.1
	>50 yrs	6	24	4	16	10	24	4	88	44.9
Sex	Male	8	30	10	44	27	45	9		87.2
	Female	2	6	2	6	1	5	1	25	12.8
Marital Status	Single				2		2	1	5	2.6
	Married	8	32	11	43	27	46	9	176	89.8
	Divorce		1		2				3	1.5
	Widow	2	3	1	3	1	2		12	6.1

Source author fieldwork (2014)

The economic background of the house owners in these estates are 68.4 percent publicly employed while the retirees came second with 22.4 percent, see table the below. From the table as well, those that earned above 1.5million constituted the majority of the house ownership with 49.5 percent while those that earned between 1.0 and 1.5 millions also came second with 25.5 percent. The table equally showed that those with tertiary education background formed the highest percentage of 72.5 percent.

Table 3: The Economic Background of Respondents

		Bawa	Shagari	GRA	Irewolede	Obasanjo	Shelter	Fayose	Total	%
Education	Pry	1	2				1		4	2
	Post Pry	2	10	3	9	7	15	4	50	25.5
	Tertiary	6	24	9	41	21	34	6	142	72.5
Employm	Self		2		1				3	1.5
ent	Public	3	5	7	35	23	45	9	134	68.4
	Private		4	2	6	4			15	7.6
	Retiree	7	25	3	8	1	5	1	44	22.4
Income	,<.5m	6	23						29	14.8
	(0.5-1.0)m	3	10		4		3		20	10.2
	(1.0-1.5)m	1	3	4	14	7	13	8	50	25.5
	>1.5m			8	32	21	34	2	97	49.5

Source author fieldwork (2014)

The Inferential Analysis: The result of the model summary which is presented in Table 4 with R as 0.712, clearly indicates a strong relationship among the variables while the (R^2) with value 0.50.7 implies that the regression has 50.7% of fitness

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.712[a]	.507	.342	.83753

a. Predictors: (Constant), employment, income, age, education

The Anova table with Ho hypothesis that all the independent variables has no effect on the housing tenure is rejected when the p value <0.05. This implies that the variables have significant effect with 0.058greater than the p value of 0.05

Table 5: ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8.641	4	2.160	3.080	.058[a]
	Residual	8.417	12	.701		
	Total	17.059	16			

a. Predictors: (Constant), employment, income, age, education

b. Dependent Variable: location

The coefficient table also revealed that individual variable has significant influence the housing tenure with income taking the lion share while age has the least significant. The equation formed with the unstandardised coefficient b as indicated below is normally used to predict the trend of change in the variables

$$LnY = a + b1X1 + b2X2 + b3X3 + b4X4 + e = 3.018 + 0.130 + 0.015 - 0.084 - 0.055$$

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.018	.296		10.201	.000
	education	.130	.090	4.056	1.449	.173
	Income	.015	.026	.592	.574	.577
	Age	-.084	.046	-2.408	-1.852	.089
	Employment	-.055	.044	-2.390	-1.264	.230

a. Dependent Variable tenure:

Discussion

The Shagari government massive low cost housing programme made Ado Ekiti to receive 156 one bedroom flat and 10 three bedrooms flat. However, the fact that the government was able to delivered 47000 housing units out of the projected target of 120000 as pointed out by Waziri and Roosli (2013) is an evidence of shortage of housing expectation of the city. The involvement of private participation in housing delivery has contained in 2006 National Housing Policy actually contributed to the rapid growth rate of housing supply in the State. This is because the Federal and the State government that delivered only 225 housing stocks between 1980 and 2000 delivered 760 housing stocks between 2007 and 2010 when public/private participation (PPP) was introduced. This is actually more than thrice the quantity produced between two decades.

It is obvious that using the average household size of 4 persons with the average of 2 households per housing unit to divide the 308621 population census of Ado Ekiti in 2006 made the housing requirement to be 38578 as against the existing housing stocks of 3600 in 2009. Therefore, in spite of the tremendous improvement in public housing delivery, the city still has acute shortage of housing to accommodate the teeming population particularly the urban poor that are not less than 60 percent.

The situation where the low cost housing of Shagari regime in 1980 were placed at price between 10000 and 18000 Naira when the minimum monthly wage was 100 Naira while the two bedroom flat in public housing of 2007and above have the price value of 2.5million Naira when the least paid public worker receives the monthly salary of 18000 Naira coupled with low patronage of mortgage facilities and bank loan actually made public housing to be too expensive and practically impossible for the common poor to access with their low income. . It required more than a life-time for middle and low income earners to save such amount. So they simply ignored the buildings only for the high income earners and very senior civil servants to acquire and rent to them (those that could pay the rent), while most of them patronized slums

The location of those housing estates developed by the Federal and State government in the early 1980s and late 1990s as well as those recently developed through PPP were over two kilometer away from the fringe of the city. The situation made these poor people who cannot afford the means of transport to the city centre for essential facilities as well as their places of work not to bother to apply. Hence, Filani (1987) observation that in addition to the main problem of the houses not being affordable, the National Low Cost Housing (NLCH) programmes were located at the periphery of the city thereby creating higher cost of transportation to and from work for the occupants who are workers in the cities justified. He

further explained that in some cases infrastructural facilities like water, electricity and good roads were not provided thereby creating a lot hardship and misery to occupants. For these reasons the worker will prefer to squat with friends and relatives inside the city or live in slums

CONCLUSION AND RECOMMENDATIONS

Majority of the world population are poor and mostly live in urban area without access to proper housing the situation is the same in Ado Ekiti where there is a problem of huge housing deficit for the poor The little available public housing in the city are not only too expensive for the poor but equally located at a distant place for the poor accessibility. The paper also noted the effort of both the State and Federal governments in the housing provision to perceive that private sector is far more efficient provider of societal goods and services than the government.

As a way of recommendation, there is need to improve on the existing policies as follows:

The strategy of 'cooperative housing 'as a concept that has emerged as an increasingly important vehicle for the provision and maintenance of low- income housing in the National Housing Policy of Nigeria should be encouraged and supported with wide publicity and enlightenment. This will encourage the society, members to contribute, manage fund, and decide on housing programmes and implementation with joint effort

An innovative public – private partnership approach to housing is, therefore, required to make the kind of progress that is needed. This will synergize the technical and organizational expertise of the private sector with the regulatory functions of the public sector to improve the housing delivery

In order to make the cost of housing affordable to the poor citizen, government must not only make it a mere policy to use local building materials but must come out with workshop and training to enlighten and encourage housing developers of using the local materials.

There must be proper and intensified enlightenment campaign through media to explain the importance of mortgage and also ensure enough provision of facilities that can make mortgage housing fund accessible to all citizens.

Government must make it a policy to give tax rebate to housing developers and for those who are on housing loan through mortgage or any other bank loan.

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Public Infrastructural Facilities and Urban Fringe Development in Developing Nations: A Focus on Ibulesoro, Ondo State, Nigeria

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ABSTRACT

Urban fringes are receiving more attention, given the transformational changes in both urban and rural areas plus the fact that both are becoming increasingly interwoven. The quantity and quality of public infrastructural facilities are guiding forces for the development of urban fringes in both developed and developing nations of the world. In developing nations, the focus of policy makers, planners and development professionals is on the welfare of urban centres at the expense of urban fringes. Consequently, this study examines the level and quality of public infrastructural facilities in Ibulesoro (an urban fringe of Akure) vis-à-vis its effects on sustainable physical and human development in the community. The study utilized the simple random sampling technique to select 20% of buildings (70) out of 350 in the community for homogenous characteristics. The eldest household head was interviewed in each building using the instrumentality of a structured questionnaire. Empirical analysis shows that: a higher proportion of respondents indicate high level of poverty with low level of productive capacity due to inadequate public infrastructural facilities both in quantity and quality; over 70% of respondents show that available infrastructural facilities are provided and maintained through individual and communal efforts; a higher percentage of respondents also revealed that educational, health and other social facilities and services are at their low ebb. Based on the findings, an integrated land use Master Plan for Akure with particular emphasis on infrastructure facility development for Ibulesoro and other fringe communities around Akure is canvassed.

Keywords: Developing Nations, Ibulesoro, Infrastructural Facilities. Poverty, Urban Fringe

INTRODUCTION

Urban fringe is synonymous with peri-urban, urban periphery, rural commuting zone, or the inner rural. It is an area around the urban settlement where urban and rural development processes meet, mix and interact at the edge of the city (Adell, 1999). It is therefore the edge of the city which combines both urban and rural characteristics. It is a borderline between the rural and the urban - a narrow zone with various widths outside the political boundaries of an urban area which is neither rural nor urban. It is often defined as a conflict zone at the interface between urban and rural landscape. The urban fringe as an area of very special characteristics, unusual dynamism and transition (Vries, Haccoû, Bruijn & Stortelder, 2012), requires research, policy and action in its own right; its planning and development is therefore crucial to sustainable development of the parent city.

It is pertinent to note that urban fringes which had been the medium for raw material production and agricultural practice have been neglected by the various levels of government in Nigeria (Chardwick, 1995). Amao and Ilesanmi (2013) note that, the urban fringe constitutes the habitat of a diversity of populations, including lower income groups who are particularly vulnerable to negative externalities of both rural and urban systems. These include; risks to health, life and physical hazards related to the occupation of unsuitable sites, lack of access to clean water and basic sanitation and poor housing conditions.

In developing nations, urban fringes are not usually given recognition by formal governments especially in the area of infrastructure provision and management. Infrastructure is synonymous with development, and the lack of infrastructure services signals barriers to growth and overall development (Olamiju and Fasakin, 2015). ADB (2012) notes that the

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provision of infrastructure systems demand public sector involvement because of having some aspects of public good, which inhibit private firms from supplying them efficiently; entail a long project cycle and huge costs that private enterprises in developing countries often cannot afford; and the need for appropriate public sector policies and regulations. Hence, Olamiju and Fasakin (2015) conclude that without government involvement, provision of inclusive infrastructure is illusive.

Ibulesoro, the focus of this study is one of the numerous communities in Ondo state without access to good infrastructural facilities (ODSG, 2005). This paper therefore studies the effort of government in the provision of infrastructural facilities in Ibulesoro; the strategies adopted and the impact of this on the social and economic wellbeing of the people.

REVIEW OF EMPIRICAL LITERATURE

The first definition linked to urban fringe dated back to the World War II period. It was defined as "areas of transition between well recognized urban land uses and the area devoted to agriculture" (Wehrwein 1942). Many authors define the urban fringe from two points of views – the economic and distance from the urban centre. From the economic point of view, the urban fringe is defined as: "…the frontier in space where the returns to land from traditional and customary urban land uses are roughly equal to the returns from traditional and customary rural land uses. In theory, such a frontier should always exist, although its exact location on the ground may not be easily fixed (Hite,1998). From the urban-centric point of view, Chicoine (1981) defines urban fringe as areas that "generally include those areas bordering central cities, surrounding close-in suburbs and non contiguous nearby towns, and extending into the adjacent, open countryside." Based on this view, Webster (2002), considered the urban fringe as areas starting just beyond the contiguous built-up urban area and extends as far as 150 km from the core city center.

Several factors suggest the importance of the urban fringe as deserving greater attention on the part of policy makers. For instance, in most developed countries, increases in: household incomes; urban subdivision codes; infrastructure investment patterns; open space undervaluation; and commuting under-pricing, among other factors, translate into urban expansion on the urban fringe. In addition, the urban fringe is frequently the dumping ground for industrial enterprises forced out from the city centers either through laws and regulations or due to economic factors such as rising land prices (World Bank, 2007). In developing nations especially in Nigeria, the available public infrastructure in urban fringes are poor if not totally absent. Poor infrastructural facilities or complete absence of it in any community is an invitation to poverty. Around the world more than 1 billion people lack access to roads, 1.2 billion do not have safe drinking water, 2.3 billion have no reliable sources of energy, 2.4 billion lack sanitation facilities and 4 billion are without modern communication service (The Global Poverty Project, 2013).

Ayeni (1990) opines that one of the most pressing problems faced by towns and cities all over the world (especially in developing nations) is that of infrastructure ability. The issues of infrastructure and facilities involve not only the inabilities of cities to stimulate urban production by creating a constantly expanding market for agricultural production but also their inability to adequately provide the amenities and essential facilities both within the city and their fringes. Most fringe communities in developing countries experience spontaneous developmental pattern rather than planned growth as they fall outside the jurisdictional boundaries of the governing bodies of the urban area. The local governments and those of urban areas often act separately in terms of overall planning; this has made integrated fringe development the largest single hurdle to overcome (Masum, 2009).

Most urban fringes suffer deprivation due to absence or total lack of public infrastructural facilities and other social amenities. Urban fringe deprivation is well documented in literature (William, Steven and Eduardo, 1993; UN Habitat, 2003; Ogundipe, 2003; Eziyi, 2009; Fasakin, 2009; Olamiju, 2014; Dosumu, 2015). Inequalities in the spatial distribution of infrastructure and social amenities between the urban centres and the fringes can be responsible for deprivation in the latter. Olamiju (2014) notes that the provision of infrastructural facilities in Akure is concentrated at the city centre at the expense of peri-urban communities whose residents had to travel long distances to get access to these facilities. This trend shows that residents of urban fringes in Akure are deprived of basic amenities such as good roads, electricity and piped water supply among others.

Fox (1994) opines that infrastructure include those social services derived from a set of public works traditionally provided by the public sector, to enhance private sector production and household consumption; these include services like hospitals, water supply, electricity, roads, drainages, sewerage and etcetera. The adequacy of infrastructure helps to determine a country's success or failure in diversifying production, coping with population growth, reducing poverty, improving environmental conditions, etc. Also, it has been noted that infrastructural capacity grows step for step with economic output. For example, a one per cent increase in the stock of infrastructure is associated with one percent Gross Domestic Product (GDP) (World Bank, 2007)

Synoptically, infrastructural facilities are very essential in an environment for economic growth, and to enhance the quality of life. Ayodele (1996) suggests that there is both an economic and social dimension to infrastructure. The social dimension relates to social services which cover health, information and education among others; while the economic aspect relates to utilities such as energy, power, transportation, water and communication services. In conclusion, most of these services and facilities are concentrated in the urban centres at the expense of the urban fringes (Olamiju, 2014).

METHODOLOGY

Research Locale

Ibulesoro locates in Ifedore Local Government Area with its headquarters in Igbara-Oke, Ondo State Nigeria (Figures 1 and 2). A Yoruba speaking community in South West Nigeria, Ibulesoro falls on latitude $7^{0}15^{1}$ North and longitude 5^{0} 20^{1} East. The community is bounded in the North by Ijare; in the East and North by Akure Township; and in the West by Ipogun (see Figures 1 and 2 for the location of study area in its national, regional and local settings).

The topography is generally undulating but relatively plain. Historically, the paramount ruler of Akureland is a mentor to the Olubule (the paramount ruler of Ibulesoro) signifying the level of contiguity and socio-cultural relationship between the two communities. A prominent tourist centre in Ibulesoro is the Bobado River which is traditionally forbidden to albinos for historical and cultural reasons.

Ibulesoro enjoys warm, humid tropical climate with an average rainfall of about 1500mm per annum. The people of Ibulesoro engage in farming and petty trading. According to 1991 population census, the population of Ibulesoro is 3,003. Presently, the community has an average of 750 households (Olafiaji, 2010). With an average of 7 persons per household (Fasakin, 2000), the estimated population of the study area stands at 5,250 people. Observation reveals that, this community is not accessible to good water supply, electricity, health services, educational facilities and other basic amenities which make them to rely on Akure Township for survival.

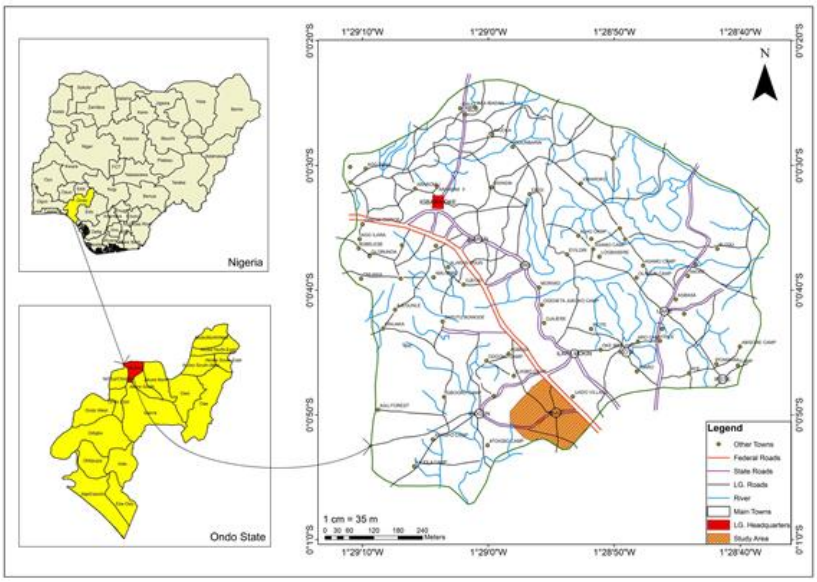

Figure1: Ibulesoro in its National, Regional and Local Settings
Source: Federal Surveys, Abuja, Nigeria (Digitized by the authors in Arc View)

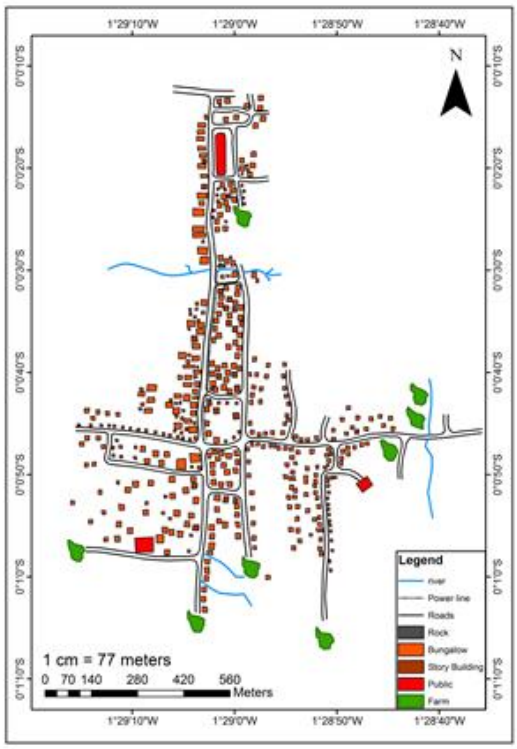

Figure 2: Street-Guide Map of Ibulesoro (Source: Authors' Fieldwork, 2010)

Database Description

In a survey carried out in October, 2010; "the building population of Ibulesoro was 350 with about 752 households" (Olafiaji, 2010). Twenty Percent (20%) of buildings were sampled for homogenous characteristics; and the most senior household head was interviewed in each building using the instrumentality of a structured questionnaire. The questionnaire investigated 39 variables covering the socio-economic and public infrastructure components of the community. The variables were designed as questions with pre-coded alternatives specified. Trained research assistants, read and interpreted the questions to the respondents and administered the questionnaires on one-on-one basis for two weeks. They were instructed to read and interpret the questions in Yoruba (the local language in Ondo State) in case the respondents could not speak English language. Variables which bordered on socio-economic

characteristics of respondents and level of infrastructure development in the community were engaged in the analysis.

FINDINGS AND DISCUSSION OF RESULTS:

Finding on the socio-economic characteristics of respondents show that 40.3% were male while 59.7% were female. This trend shows that majority of deprived people in the study area is gender sensitive. The age composition of respondents shows that 40.3% are youths between the age of 18 and 30 years; 45.7% are middle-age adults between the age of 31 and 50 years; while40.0% are adults of 51years and above. This age composition shows that it is the vibrant, youthful and matured proportion of the population (especially females) that are mostly deprived of good infrastructure for development. This trend is against the Goals 5 and 9 of Agenda 2030 for sustainable development which is expected to achieve gender equality and empower all women and girls; and build resilient infrastructure respectively.

The marital status of respondents shows that 35.7% were single, 51.4% were married, 7.2% were widow/widower while 5.7% were divorcees. Since more than half of the population are married, the rate of procreation is likely to increase over the years more than the rate of infrastructure provision. The respondents are highly literate as about 46.8% of them had primary education, 37.1%, secondary education while, 6.5% had tertiary education and 9.7% had no formal education. Generally, the respondents engage in trading and farming as about 35.7% are traders and 34.3% are farmers with 5.7% as civil servants while 17.2% are artisans (who were self-employed). About 7.1% of respondents are unemployed. Consequently, most of the respondents are poor as over 51.0% of them earn below N10,000 per month. With this amount, an average respondent earns about N300 ($1.30) per day (see Table 1). This amount is very close to the international community average earning of $1.25 for extreme poverty; as nearly half of the population in the developing regions lived on less than $1.25 a day.(MDG, 2015). Olaseni and Alade (2012) confirmed that about 55 per cent of the Nigerian population lives on less than $1 per day, which is one of the highest poverty rates in sub-Saharan Africa.

Findings show that the main source of power supply in the community is the Electricity Distribution Board (EDB). As a result of poor/irregular supply, over 40% of households use generators as alternative source of power supply. When electricity is irregular, businesses suffer and the use of generators exposes residents to exhausts that are detrimental to their health. One important new innovation in power supply in Ibulesoro is the installation of a Biogas Digester by the West Africa Agricultural Productivity Programme (WAAPP) in partnership with the Federal College of Agriculture, Akure, Nigeria (FECA). The biogas digester converts animal dung into combustible biogas. This produces methane gas which can be piped into residences to supply energy for cooking, heating, and other tasks. The Nation (2015) note that this facility would not only reduce greenhouse gas emissions, it would create a potential business opportunities for entrepreneurs to supply biogas digesters to people who want to generate electricity at affordable cost. Respondents confirmed the training of local residents on the construction of the facility. This is a good development that must not be allowed to waste; if only the digester machine could be made readily available to the people at affordable cost. It is recommended that the local and state governments invest in the biogas facility project to ease the problem of irregular power supply in the community in particular and Nigeria as a whole. Plates 1 and 2 show the biogas facility and a beneficiary cooking with the Biogas Digester respectively

Table 1: Some Socio-economic Characteristics of Respondents

Occupational Status		
Occupation	**Freq.**	**%age**
Farming	24	34.3
Trading	25	35.7
Civil Service	4	5.7
Artisanal	12	17.2
Unemployed	5	7.1
Total	**70**	**100**

Marital Status		
Income (₦)	**Freq.**	**%**
1-10,000	36	51.4
10,001-20,000	10	14.3
20,001-30,000	9	12.9
30,001-40,000	5	7.1
40,001-50,000	7	10.0
Above 50,000	3	4.3
Total	**70**	**100.0**

Age Group		
Group	**Freq.**	**%age**
18-30 years	10	14.3
31-50 years	32	45.7
Above 50 years	28	40.0
Total	**70**	**100**

Marital Status		
Status	**Freq.**	**%**
Single	25	35.7
Married	36	51.4
Widow/Widower	5	7.2
Divorced	4	5.7
Total	**70**	**100**

Plate 1: Cooking: Powered by a Biogas Digester Facility
Source: The Nation (2015)

Plate 2: A beneficiary of the Biogas Digester cooking with the facility at Ibulesoro
Source: The Nation (2015)

It is pertinent to note that the people of Ibulesoro do not enjoy piped water supply in their homes. The only solar-powered borehole in the community is not networked, but rather a point source where residents queue for water. The chief source of water supply in the study area is the well as over 61.4% of respondents get water from this source while about 27.1 % uses the borehole. About 11.5% of respondents fetch water from streams and rivers (see Plates 3 and 4; Table 2). The predominance of well in Akure area generally may not be unconnected to the fact that it is cheaper and easier to construct than borehole and pipe borne water (Lawal and Basorun, 2015). Observation shows that most of the wells are earthed and not covered while residents use the rivers and streams as toilets. This trend shows the level of health hazard the people could be exposed to due to environmental pollution.

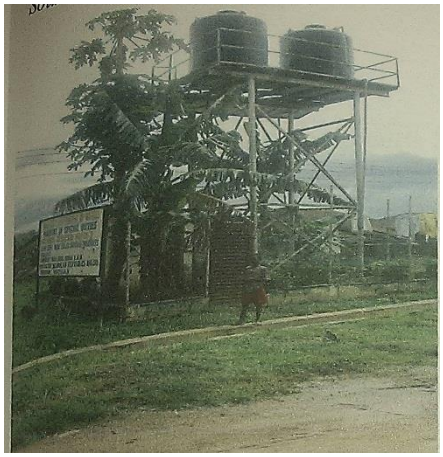

Plate 3: Public Solar-Powered Borehole with Overhead Water Tank in Ibulesoro

Table 2: Sources of Water Supply

Source	**Freq.**	**%age**
Piped Water	0	0.0
Borehole	19	27.1
Well	43	61.4
Stream/River	8	11.5
Total	**70**	**100**

Table 3: Nearness to Sources of Water Supply

Distance	**Freq.**	**%age**
Below 100m	14	20.0
100m-500m	9	12.9
501m-1Km	35	50.0
Above 1Km	12	17.1
Total	**70**	**100**

Nearness of respondents to sources of water supply was accessed (see Table 3). About 20.0% of respondents walk less than 100 meters distance from source of portable water supply to their homes; while about 12.2.0% walk between 100m-500m distance to sources of water supply. A cumulative 67.1% of respondents walk more than 500m distance from home to sources of water supply. This trend is above the minimum 500m approved walking distance to sources of portable water by WHO/UNICEF (Olajuyigbe, 2008). In addition, as a result of the long distance covered before getting to improved source of water, a lot of time that could have been used for other benefits is wasted.

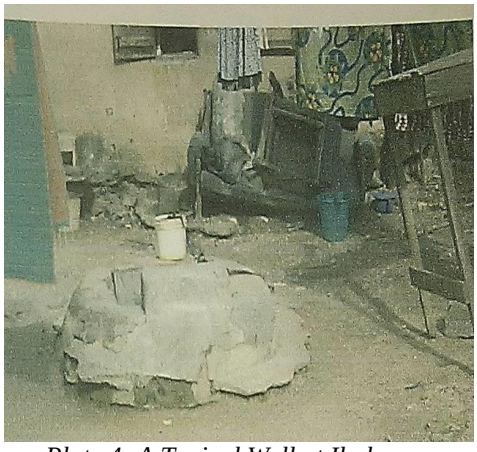

Plate 4: A Typical Well at Ibulesoro

For example Alaci and Alehegn (2009) observed that average households in urban fringe communities of Kogi State of Nigeria spends an average of 65 minutes per day, 455 minutes (8 hours) per week, 1820 minutes (30 hours and 33 minutes) per month and 21840 minutes (364 hours) yearly to fetch water. Olaseni and Alade (2012) conclude that water and sanitation infrastructure in the country is grossly inadequate and has implications for wealth creation and economic development. It is the responsibility of government of any nation to provide adequate quality of portable water for its citizenry (Ajibade et.al, 2012). It is therefore obvious that the failure of governments (be it local, state or federal) to provide adequate infrastructure facilities for her citizenry, degenerates their social and economic life.

Generally, 11.3% of respondents ranked the health facilities in the community as good while 88.7% ranked them as poor. This finding is a reflection of the state of health facility in Ibulesoro in particular and Nigeria as a whole. Observation and personal interview of individuals reveal that there is only one health centre in the community, which is without adequate facilities, hence residents seek medical care in Akure metropolis. This trend was reported by the National Bureau of Statistics (2008) in Olaseni and Alade (2012) that "…only three hospital beds were available for every 10,000 people while only 45.9% have access to medical facilities in the country in 2006". The inadequacy of health facilities in Nigeria especially at urban fringes is a reflection of non-commitment and mismanagement of resources on the part of governments at all levels considering the fact that Nigeria is blessed with abundant natural and human resources.

The educational facilities show similar characteristics as the health facilities. About 12.9% of respondents ranked public schools as good, 29.0% ranked them as fair while 58.1% opines they were poor. Under Section 18(1) and (3) of the 1999 Constitution of the Federal Republic of Nigeria, it is the responsibility of government to provide free and compulsory basic education with a view to ensuring that there are equal and adequate educational opportunities at all levels (Olamiju and Olujimi, 2011). Most educational facilities are concentrated at the urban centres at the expense of the fringe communities. Ibulesoro has only two primary schools. The school buildings are dilapidated and the classrooms are sub-standard in terms of availability of teaching and learning facilities (See Plate 1). On the provision and management of roads in Ibulesoro, 85.5% of respondents revealed that roads in the community were constructed/repaired through communal efforts and 14.5% agreed it was by individuals, while government involvement was nil. In addition, rural access roads leading to farms are neither tarred nor graded, this undoubtedly would have a backwash effect on the rural economy. This trend is a recurring decimal in the provision of road infrastructure in Nigeria: the rural areas had been neglected by the various governments at federal, state and local levels (Olamiju, 2014).

FGN (2009) noted that the current neglect of these roads implies a loss of network value of N80 billion per year and additional operating costs of N35 billion per year. This situation is economically unhealthy and cannot support the country's drive for economic transformation. About 82.0% of respondents indicated the absence of drainage facility in front of their houses while 18.0% confirmed its presence. These trends explain persistent flooding hazards experienced by residents after a little shower of rain.

Plate 1: A dilapidated secondary school building at Ibulesoro

CONCLUSION

The results have shown clearly that there are more females than males in the study area and the population is generally made up of vibrant youths and adults who reside at Ibulesoro and work/school in Akure. About 50% of the population are married; highly literate but not gainfully employed as they engage in petty trading and subsistence farming. They are therefore, generally poor as they live on less than 1 US dollar per day.

It is also clear from this study that provision of electricity in Ibulesoro is poor. However, the intervention of an NGO such as the WAAPP/FCA on the introduction of Biogas Digester to solve energy problem in the community is commendable. The major source of domestic water supply is the well which is usually uncovered and hence, unhygienic. The average distance of respondents to a portable source of water is about 1kilometrer. There is only one ill equipped health centre and two (2) dilapidated primary schools in the community.

Therefore, it is obvious that government involvement in the provision of infrastructure and social services in Ibulesoro and other fringe communities in Ondo State is limited if not absent. Infrastructural development policies, plans and programmes are carried out in time and space for the benefits of the people and improvement of their welfare; they have to be carried out in human settlements, hence proper plan and adequate provision for such settlements by government is imperative. Since Ibulesoro relies on the main city (Akure) for the extension of most infrastructure such as electricity and water among others, this paper recommends that the Ondo State government should embark on an integrated land use Master Plan with particular emphasis on infrastructure facility development for Akure (the main city), Ibulesoro and all other fringe communities such as Aye, Ipinsa, Igushin, Ikota and Irese among others, for sustainable urban-fringe development in Ondo State. To make this plan comprehensive and sustainable, the use of high resolution satellite data is canvassed; this will speed up the process of planning and management of infrastructure in the city and its fringe areas, especially in planning for water supply, electricity, and road network among others. This recommendation is in line with Patkar, (2003) opinion that satellite data is a veritable source of information for urban land-use and infrastructure planning.

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The Challenges of Urban Sprawl Development in Suleja, Niger State

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ABSTRACT

Urban sprawl has been used to describe a wide variety of the undesirable aspects of urban growth; it is consciously referred to as, unplanned and uncontrolled development resulting in poor and much unplanned urban fringe. Across the world, there is growing concern and awareness about urban sprawl and its consequences, as urban system are evolving and emerging in surprising ways. Urban sprawl is a major problem in the course of development in developed and developing countries. This paper aimed at examining the challenges of sprawl development in selected neighbourhood of Suleja. The objectives are to examine the drivers of urban sprawl and challenges of urban sprawl development in the peri-urban of Suleja. Remote sensing along with Global Positioning System (GPS) and Geographical Information System (GIS) were helpful in this regards. This study reveals that the development of urban sprawl settlement in the suburbs of Suleja is as a result of rapid population increase and its proximity to Abuja, the Nigeria Federal Territory. The cost of land which is relatively cheap at the suburb has caused the shift in population to the peri-urban of the town forming a sprawled like characteristics of development, the town is growing without a proper planning, despites its advantageous location and proximity to the Federal Capital of Nigeria. Weakness of the physical planning agencies in enforcing planning standards, rules and regulation is the evidence of the current t pattern of growth of the town. However, the impact of urban sprawl development in Suleja is enormous; range from environmental to transportation and to economy. In order to reduce further impact, the peri-urban of Suleja should be planned and developed in the view and assumptions of Vence's theory of urban realm; creating a suburb that is independently sustainable and functional viable.

Keywords: Urbanization, Urban Sprawl, Urban Growth, Planning, Development

INTRODUCTION

The world's urban areas are now home to nearly half of humankind. Kofi Annan, the former General Secretary of the United Nation in 2001 emphasized that the world has entered into the realm of urban millennium, a period with a remarkable difference in innovations, for an irresistible urban growth (UN-Habitat, 2001; Idowu, 2015). The industrial revolution of the 18th century began the current phase of urban growth, which the world is facing in the recent time (UN-Habitat, 2001). The growth of the world population since the turn of the 19th century and particularly after the World War II has been unparalleled in the history of the world. With the increased population, the phases of urban settlements are changing rapidly, with the semi-urban areas and medium-sized towns turning into full urban town (Obateru, 2005; Idowu and Olaniyan, 2009; Idowu, 2015b).

UN-Habitat (2001), presented the global report on the collective implications of the growing population of the world during the two hundred years (19th and 20th centuries) of global economic expansions. It was published that the cities which grew at less than 30 million in that century, now recorded more than 3 billion at the beginning of the 21st century, with over 500 cities harbouring thousands of people. This implies that, the planet earth hosts a range of population of people across the world. Other studies also established that, the process of urban growth will, however, continue as this century advances. The prediction is that, there will be an increasing urban agglomeration in all regions of the world by 2050 (UN-Habitat, 2008; 2011; 2013; United Nations, Department of Economic and Social Affairs, Population Division - UNDESA, 2014; 2015).

Idowu, O.O.; Shaibu, S. I.; Adeleye, B. M.; Medayese, S.O. & Abd'razack, N.T.A. (2016). The Challenges of Urban Sprawl Development in Suleja, Niger State. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1591-1598

Consequently, growth is a natural phenomenon in life, therefore it is expected that cities and towns should grow (Popoola, 2014). Meanwhile, the growth of cities and towns increasingly subjected the urban environment into dramatic problems which ranges social to physical and environmental problems. The negative implications of urbanization and urban growth are widely linked to several problems such as urban sprawl development (Durieux, Lagabrille, and Nelson, 2008).

Urban sprawl has been used to describe a wide variety of the undesirable aspects of urban growth; it is consciously referred to as, unplanned and uncontrolled development resulting in poor and much unplanned urban fringe. There is growing concern and awareness about urban sprawl and its consequences across the world, as urban system are evolving and emerging in surprising ways (Downs, 1999; Torrens, 2006. Feng, 2009). It is agreed as one of the problems affecting the course of development, both in the developed and the developing countries.

The idea and early studies on urban sprawl is unanimously agreed to start from the United States of America (Hamidi and Ewing, 2014). As rightly observed by Franz et al. (2006) the discussions and researches on urban sprawl were anchored predominately in the context of the urban morphology and land use pattern in the US for a long time, but, it later spilled over to Europe and other regions of the world. Alabi (2009) and several other scholars, however, observed the variations in the degree of urban sprawl between the developed and developing countries, he accepted that there are differences in the challenges of urban sprawl all over the world. The components of urban sprawl, however, have been highly debated by several scholars in the field of urban studies; it means different things to different people. Concomitantly, it remains a hot topic attracting a considerable attention from geographers, planners and social scientists across the world (Downs, 1999; Paul and Tonts, 2005; Frenkel and Ashkenazi, 2008).

On the perspectives of urban sprawl Torrens (2008), Liu and Jiang (2011) and Idowu (2015a), however, maintained that, the term ‘urban sprawl’ is characterized to be popular, complex and as well surrounded by controversy. Several reports on sprawl begin with the admission that, sprawl has no definite definition, it is a value loaded term and a reference point in many planning literature (Frank, et al., 2000; Adaku, 2014).Other contentions areas in the study extend to the bottleneck associated with the characterization, measurement, causes and consequences (Torrens 2008; Hamidi and Ewing 2014). Several authors have made several attempts to describe how urban sprawl looks like, without a clear cut accepted features to describe it (Ewing, 1997; 2002; Burchell et al., 1998; Glaster et al., 2001). Franz et al. (2006) on the contrary, however, argued that these features describing urban sprawl are ambiguous; it’s jointly reflecting the causes and consequences in the same manner its presenting what characterized by urban sprawl, while, the existing methods for measuring urban sprawl have been contested worldwide. The entire areas still remain unresolved based on the divergent views of the scholars.

The causes of urban sprawl in the world are universal, but vary in character, impact and challenges (Oueslati et al., 2015).Urban sprawl has not only generated a series of studies and discussions in the developed countries, but also in the developing countries. For instance, in Nigeria, Mabogunje (1968), Olorunfemi (1979), Okewole (2002), Barredo, et al., (2004), Fabiyi (2006), Olujimi (2009) Alabi (2009), Aguda and Adegboyega (2013) among several others scholars have reported the sprawling nature of several urban centres in Nigeria. Barredo, et al., (2004), Olujimi (2009) and Aguda and Adegboyega, (2013), have attributed the rapid increasing urban agglomeration in Nigeria to the prevailing inadequate institutional framework, economic growth and population increase. The unprecedented demographic

changes have seriously laid huge challenges on the peri-urban space, mostly in the development of residential accommodations (Olujimi, 2009, Wapwera et al., 2015).

The location and proximity of Suleja to Federal Capital of Nigeria speaks volume on the development of sprawl settlements in the town. This study is aimed at examining and challenges of sprawl development in selected neighbourhood of Suleja. The objectives of this study include, examining the development pattern of the peri-urban settlements, to identify the physical characteristics of the selected per-urban neighbourhoods and the challenges of sprawl development on urban landscape.

STUDY AREA

Suleja, lies on latitude 7˚ 31′N and longitude 7˚58′E. The town was formerly referred to as Abuja prior to the time of the establishment of the Federal Capital Territory. The town is situated on the Iku River, a minor tributary of the River Niger at the Abuchi Hills and lies at the intersection of several roads. The Local Government reform of 1976 facilitated the creation of the Suleja Local Government Council from the defunct Abuja Native Authority. The Local Government Council shared boundary with Gurara and Tafa Local Government Councils in Niger State and Gwagalada in FCT. The Local Government land expanses for about 153.4 sqkm land coverage (Fig. 1). The Census report of 1991 put the population of Suleja Local Government at 151,300 persons, the population was estimated at 174,638 in 1996 and it rose to 216,578 people in the 2006 National population Census. This study is centred on four peri-urban neighbourhoods in Suleja. This consists of Maje in the Northern part of the Local Government, Chassa and Paulossa in the Southwest region of the town and Gwazunuin the Eastern part of the town (Fig. 2)

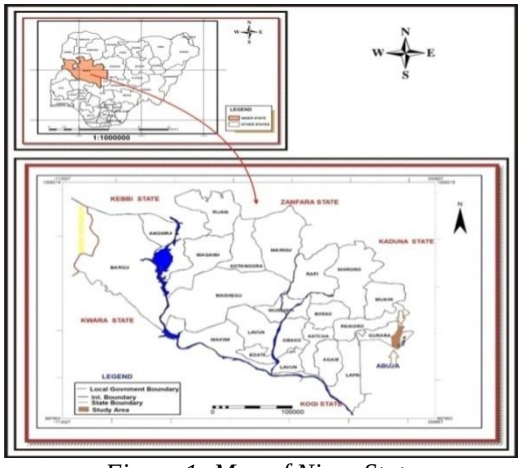

Figure 1: Map of Niger State

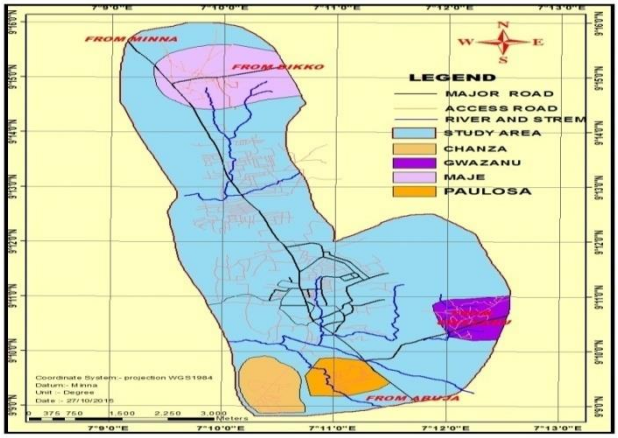

Figure 2: Selected Neighbourhoods for the study

METHODOLOGY

This study explored both secondary and primary sources of data required for this exercise. The secondary data employed in the study include the remote sensing imagery (Google earth data), Census data and published materials obtained from libraries and the internet. The primary data were sourced through the direct survey and investigation of the study area. Google earth image was retrieved from the internet and digitized using ArcGIS 10.2software in order to show the housing density and pattern of development in the selected peri-urban neighbourhoods.

RESULTS AND DISCUSSIONS

Patterns of Development in Suleja

The digitization and analysis of google earth image of the selected four neighbourhoods reveal the development pattern of the study area. For instance, in Maje, the neighbourhood covers approximately about 567,246.01sqmarea. Based on the pattern, this neighbourhood exhibited a continuous characteristic pattern, showing an intense development of unused land and forming unbroken fashion of development. Although the settlement is supported by major access linking Kaduna – Abuja road, haven bounded by the Minna – Suleja regional road (Figure 3). With the population of just 1,302, the outward march of low density is observed in ribbon low pattern development along major suburban highways is an evidence of sprawlin that axis of Suleja.

Paulossa neighbourhood covers about 548,017.88sqmarea with 1,866 people. Paulossa exhibited clustered pattern of development, haven linked the neighbourhood with several alleged environmental problems, in regards tothe natural feature (River and mountain) which bounded the area eastward, these featureshave bunched the growth and developmentof the neighbourhood tightly, minimizing the amount of land for development of residential or nonresidential units (Fig. 4).

Chaza neighbourhood covers about 49,361.87sqm area, with 900 people living in the area. This peri-uban neighbourhood is a low density area surrounded by open spaces (Fig. 5),it has the attributes fora high countinous pattern of leap frog development and the potential for the development to extend toward any direction in the neighbourhood. Gwazunu has the coverage of about 638,277.60 sqm area and the estimated population of 1,140 people. The settlement is characterized as clustered pattern settlement, bounded by roads and rivers

All these imply that, the peri-urban of Suleja commonly exhibits a clustered or continuity pattern of development, based on the advantages of landscape, terrain and the morphology of the town. In most cases, the relatively unstable land-form affects the pattern of development in the urban fringe.

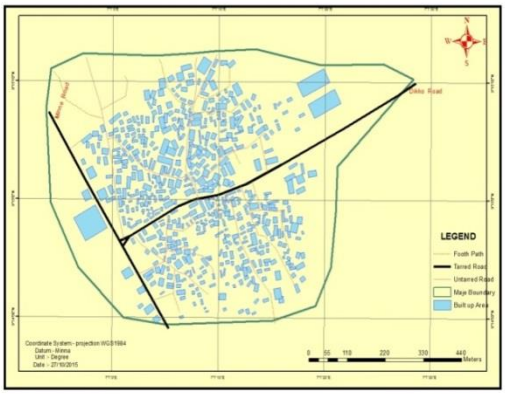

Figure 3: Development Pattern of Maje

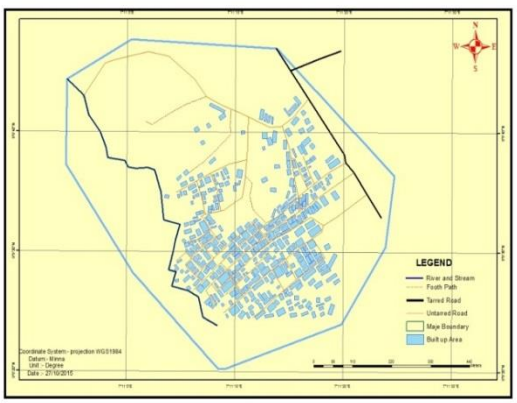

Fig. 4: Development Pattern of Paulossa

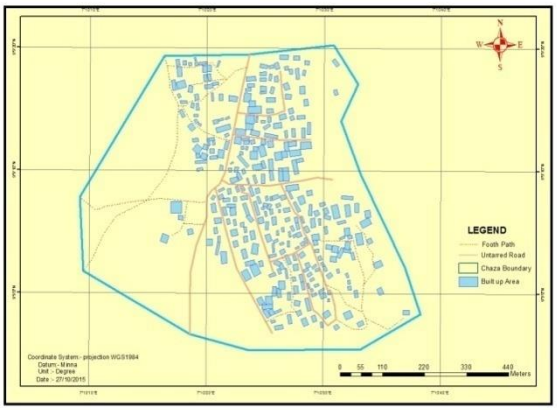

Figure 5: Development Pattern of Chassa

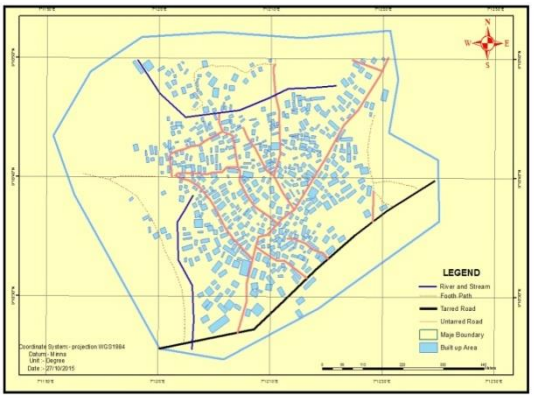

Figure 6: Development Pattern of Gwazunu

The physical Characteristics of the Selected Peri-urban Neighbourhoods

The data reveals the three major factors responsible or the spread of sprawl in Suleja and they are, social, economic and physical factors. Different attributes such as ethnicity and religion, safety and security, community or infrastructure facility, reduction in the rent and low price of land were among the major causative drivers of urban sprawl and the choice of neighbourhood in Suleja. Table 2 shows the physical, environmental characteristics of the selected peri-urban neighbourhoods.

Plate 1: Unplanned structure onPaulossa

Plate 2: Wastes deposit along Gwazunu

Challenges of Urban Sprawl Development in Suleja

The Challenges of urban sprawl development in the peri-urban of Suleja are basically categorized into three main headings:

i. **Transportation:** this category of challenge is enormous, as it is influenced by the use of automobiles. Studies by Gordan and Richardson (1997) Glaster et.al (2001) firmly asserted this with respect to the volume of traffic and distance travel by the residents of the neighbourhoods examined.

ii. **Economy:** the influence of market forces is more prominent in the spread of sprawl settlements. The influence of low rental value in these suburbs areas and the cheap cost of land are considered high in this study to promote the development of urban sprawl in Suleja. Also urban sprawl directly affects the provision of infrastructure facility into the hinterland

iii. **Environment:** this is seemingly numerous. This includes the development in the ecological unstable area, reduction of regional open space, indiscriminate disposal of wastes, increase pollution and higher energy consumption, increase runoff of storm water and risk of flooding, removal native vegetation and ecosystem fragmentation.

Table 2: Physical Characteristics of the selected Peri-urban Neighbourhoods

Environmental Attributes	Maje	Paulossa	Chassa	Gwazanu
Neighbourhood Layout	Unplanned residential landscape, presence of other complimentary land use like commercial area and industrial areas.	Unplanned residential area and presence of other complimentary land use.	Unplanned residential area and presence of other complimentary land use.	Unplanned residential area and presence of other complimentary land use.
Building Type	The buildings presence ranges from traditional houses to modern '. There are mixed use of buildings especially for the buildings along the major highways.	The buildings in this area are predominantly modern, and are mostly owners occupiers houses, with just few of them as tenement	The buildings in this area are predominantly traditional; it's mostly owners' occupiers' houses.	The buildings in this area are predominantly modern, and are mostly owners occupiers houses, with just few of them as tenement
Building Condition	The buildings in this area are of different categories, mostly, the houses are inadequate.	Buildings in this area are of different categories, reflecting the status of the residents of the area.	Buildings in this area are of different categories, reflecting the status of the residents of the area.	Buildings in this area are of different categories, reflecting the status of the residents of the area.
Condition of Access	Apart from the major access road, all other roads connecting houses were untarred and are in poor condition	The access roads are fair within the neighbourhood	The access roads are poor within the neighbourhood	The access roads are fair within the neighbourhood
Water Supply	Water supply to this neighbourhood is inadequate, as quite number of the population relies on water vendors and well	The neighbourhood was not connected to water mains.	The neighbourhood was not connected to water mains.	The neighbourhood was not connected to water mains.
Electricity Supply	Not regular	Not regular	Not regular	Not regular

RECOMMENDATIONS

In view of the patterns of development exhibited by the Neighbourhoods selected for this study Maje, Paulossa, Chassa and Gwazunnu) in Suleja Local Government area of Niger State, these Neighbourhoods were observed to exhibit a serious trend of clustered and continuous spread patterns. This pattern, however, is observed to have a serious negative impact on the sustainability of urban Agriculture in Suleja as these areas form the Peri-Urban Fringe of the city. There is, therefore, the need for a comprehensive Land use Planning and Development Control with a view to limiting the outward spread of the Neighbourhoods and Predisposing the Suleja and by extension Niger State to Food Insecurity and adverse effect of climate change.

The challenges of sprawl development in Suleja is exhibit three (3) dimensions that is; transport, economic and environmental dimension. There is therefore, the need for a comprehensive development plan which can be harnessed into the sustainable development agenda and the climate change framework in order to improve transport infrastructure, promote economic development through improved urban agriculture and proper land management and conservation to reduce the challenges of environmental degradation.

CONCLUSION

The suburbs of Suleja are increasingly spreading with the evidence of unplanned growing peri-urban neighbourhoods. The proximity of Suleja to the Federal Capital of Nigeria has attracted quite a number of people into the town, the low rental value and cheap land in the suburbs were few of the factors encouraging the movement of people into the suburbs. The patterns of development in the selected neighbourhoods have also established that the peri-urban of Suleja are intensely clustering and continuously spreading. The social, economic and physical factors, however, are responsible for the choice of neighbourhoods

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Slum Development and Urban Renewal in Nigeria

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ABSTRACT

This paper is a spin-off from the general concern expressed about gaps identified in the Nigerian urban environment. It is an expository research which, on the basis of secondary data, analyses slum development (upgrading) and urban renewal in developed and developing countries like Nigeria. This paper highlights the present state of the Nigerian urban environment and comes up with the following: overpopulation, over-stretching of infrastructure, corruption, gross inadequacy of housing, poverty, lack of political will around the issue, emergence of numerous slums and squatter settlements, insufficient legal and regulatory systems, based as major causes of increased pressure other urban environment. On the findings, the paper recommends measures to address the problems. The measures include improvement of urban cities, making legal and regulatory systems functional, Poverty reduction, and Government matching infrastructure with development, slum development, rural development etc. The paper concludes that without slum development and urban renewal in Nigeria, the country will continue to be behind global standards in environmental development.

Keywords: Development, Environment, Renewal, Slum, Urban

INTRODUCTION

Cities have become the front line for many of the world's most pressing challenges,from climate change, water scarcity and air quality, to economic disruption, public health and social instability. In the next 20(twenty) years, the world's urban population will increase more as majority of people will live in cities because we are in the midst of urban century.

Human wellbeing in cities relies on a complex Web of interconnected institutions, infrastructure and information. People are drawn to cities as centers of economic activity,opportunity and innovation. The scale of urban risk is increasing due to the number of people living in cities. While developed countries are busy trying to find out what's next in making their cities resilient, how to have healthy urban growth and how cities can be smart? The Nigerian urban environment is being subjected to crisis of unprecedented proportions.

The urban infrastructure in Nigeria is under great pressure from the teaming population migrating from the rural areas, including search of better means of livelihood. Hence the urban centers are experiencing growth that is not matched with development, resulting in emergence of numerous slums and squatter settlements and breakdown of infrastructural amenities due to over stretching. There is therefore gross inadequacy of housing and social services.

Slums are heavily populated urban settlement characterized by substandard housing and squalors. While slums differ in sizes and other characteristics from country to country, most lack reliable sanitation services, supply of clean water, reliable electricity, timely law enforcement and other basic services.

Background

Slums are home to the poorest of urban populations in Africa. The houses inhabited by slum dwellers are mostly decrepit, overcrowded, in neighborhoods that are prone to flooding &

Emma-Ochu, C. A. & Onwuka, E. (2016). Slum Development and Urban Renewal in Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1599-1607

beset with poor sanitation & shortage of portage water. (Bobadoye S. A. & Fakere A.A. (2013). Slum residences vary from shanty houses to built dwelling and because of poor design or poor construction have deteriorated into slums.

According to UN-HABITAT, around 33% of the urban population in developing world in 2012, or about 863million people lived in slums; with the highest population living in sub Saharan Africa (61.7%), South Asia (24.6%), South East Asia (31%), East Asia (28.3%), West Asia (24.6%), Oceania (24.1%), Latin America and Caribbean 23.5% and North Africa 13.3%.

Slums have posed a huge problem for developing because they are by definition areas in which the inhabitants lack fundamental resources and capabilities such as adequate sanitation, improved water supply, durable housing or adequate living space. Many governments have tried to find solutions to the problem, and one of the proposed solutions is slum upgrading. Slum upgrading is essentially a strategy in which the infrastructure of a slum is improved, such as giving adequate water supply and sewage to the community. Additionally, because of the tenuous legal status of slum inhabitants, often strategies include the legalization of the right to the land on which slums are built.

Slums such as Dharavi, in Mumbai, are the result of extensive urban growth. Slum upgrading goal is to transform these areas into decent housing areas

The concept of slum upgrading, a strategy for the improvement in a slum's infrastructure, is one that has evolved out of a period of unprecedented urban growth since the mid-20th century. In fact, nearly two thirds of the population growth that has occurred in that time period has been in urban areas. Not only have we seen the growth of urban populations a whole, but the world has also seen phenomenal growth with regards to individual cities, including megacities (cities in excess of 8 million inhabitants) and hypercities (in excess of 20 million inhabitants). The key factor in this has been that the cities that have grown most rapidly have been cities in the developing world. For example, the cities of Dhaka, Bangladesh, and Lagos, Nigeria, are forty times larger than they were in 1950. While much of this growth has come as a result of population explosion, mass migration from rural areas to the cities has accounted for a huge portion of this worldwide urbanization. The great increase in population has had tremendous implications in the urban ecology in the developing world. The major effect of this has been the rise of the slums.[Slum upgrading-Wikipedia, the free encyclopedia

Many countries have shifted policies towards slum upgrading policies (where the inhabitants are not inherently evicted from their dwellings) and away from what was once the policy and practice of governments – eviction and bulldozing. Some countries, such as China, still hold the policy of bulldozing squatter settlements (which form the basis of many slums), but other countries, such as Brazil, have shifted away from this strategy and worked on urban renewal projects via slum upgrading policies. Slum upgrading proved easier and cheaper and without the public relations nightmare that comes with pictures of housing developments getting bulldozed.

Yet until recently, most countries had very little in terms of formal policy measures to undertake slum upgrading, and so the problem of slums has generally gotten a lot worse over the years. The World Bank has undertaken many major slum upgrading projects since the 1980s, but fundamentally, it does not solve the problem of slums – it simply helps fix the problems with current slums. Worldwide, there are approximately one billion people living in slums. However, that number is expected to rise to two billion by the year 2030, and the policy of slum upgrading will not affect the mass migration of the rural poor to the cities..

According to the 2006/2007 UN-HABITAT State of the World's Cities Report, the countries of Egypt, South Africa, Mexico, Tunisia, and Thailand stand out in their efforts towards slum upgrading. Indeed, their slum growth rates had fallen markedly in the various countries (though the fact that the growth rate is still positive speaks to the fact that slums are not going away or even shrinking). The report went on to say that in order to stem (or at least slow) the growth of slums in the world's cities, countries are going to have to make some hard choices and make major financial commitments (with the help of the World Bank, a major player in the worldwide effort to promote slum upgrading) in order to accomplish the Millennium Development Goals towards lifting significant amounts of slum dwellers out of poverty.

Many slums lack basic local authority services such as provision of safe drinking water, sanitation, wastewater and solid waste management. Slum upgrading is used mainly for projects inspired by or engaged by the World Bank and similar agencies. It is considered by the proponents a necessary and important component of urban development in the developing countries. However, many people do not believe that slum upgrading is successful. They point to the difficulties in providing the necessary resources either in a way that is beneficial to the slum-dwellers or in a way that has long- term effectiveness.(Housing &Slum upgrading- UN-Habitat).According to Habitat for Humanity International some common barriers to slum upgrades are: Insufficient legal and regulatory systems, excessive land regulation, gender discrimination, corrupt inefficient, or inadequate land registration systems, disintegration of customary and traditional protections,Lack of political will around will around the issue.

In Nigeria, the inadequacy of affordable housing leaves the urban poor with a instinct to survive at all costs. The urban poor is compelled to provide some form of roof over his head. According to Uji, Z.A(2004), what he (the urban poor) does provide for himself may be well below what is generally regarded as acceptable by the so-called 'official standards' but it is probably as good as can be expected given the social and economic constraints under which he operates, the nature of the materials available and the type of technology utilized.

Purpose of Study

This research work is an attempt at critically highlighting the salient points in slum development and urban renewal in Nigeria.

Research Objectives

i. Identification of factors and causes of slum dwelling in Nigerian cities.
ii. Identification of issues and challenges in Nigerian urban cities.
iii. Appraisal of the state of the Nigerian urban environment.
iv. Identification of strategies to urban renewal.

Research Questions

i. What do you understand by slum and slum upgrading?
ii. Do you think that some factors are responsible for the degradation of the Nigerian urban environment?
iii. Do you agree that slum development (upgrading) and urban renewal will have a positive impact on the Nigerian urban environment?
iv. Do you agree that the Nigerian urban environmental growth is not matching infrastructural development?
v. Do you think that the following factors are challenges in urban development:
    a. Demographic factors
    b. Socio behavioral factors
    c. Economic Factors
    d. Environmental Factors

e. Financial Factors
f. Governance?

SLUM AND SLUM DEVELOPMENT

Slum is a dilapidated neighborhood where many people live in a state of poverty. The main objective of slum upgrading is to alleviate the poor living standards of slum dwellers. The concept of slum upgrading, a strategy for the improvement in a slum's infrastructure, is one that has evolved out of a period of unprecedented urban growth since the mid-20th century. In fact, nearly two thirds of the population growth that has occurred in that time period has been in urban areas. Not only have we seen the growth of urban populations a whole, but the world has also seen phenomenal growth with regards to individual cities, including megacities (cities in excess of 8 million inhabitants) and hypercities (in excess of 20 million inhabitants).

Urban Renewal

Urban renewal (also called urban regeneration in British English) is a function of urban planning. It has had a massive impact on the urban landscape of many cities and continues to do so in the present day. It has played an important role in cities worldwide such as London, USA, Melbourne, Victoria,Glasgow, Scotland etc.(Wikipedia, the free encyclopedia).

In the United Kingdom, it was a program of land redevelopment in areas of moderate to high density urban land use. Renewal has had both successes and failures. Urban renewal involves the relocation of businesses, the demolition of structures, the relocation of people, and the use of eminent domain(government purchase of property for public purpose) as a legal instrument to take private property for city-initiated development projects. This process is also carried out in rural areas, referred to as village renewal, though it may not be exactly the same in practice.

In some cases, renewal may result in urban sprawl and less congestion when areas of cities receive freeways and expressways. Urban renewal has been seen by proponents as an economic engine and a reform mechanism, and by critics as a mechanism for control. It may enhance existing communities, and in some cases result in the demolition of neighborhoods.

Many cities link the revitalization of the central business district and gentrification of residential neighborhoods to earlier urban renewal programs. Over time, urban renewal evolved into a policy based less on destruction and more on renovation and investment, and today is an integral part of many local governments, often combined with small and big businessincentives.

In USA(United States of America),large scale urban renewal projects in the US started in the interwar period. Prototype urban renewal projects include the design and construction of Central Park in New York and the 1909 Plan for Chicago by Daniel Burnham. Similarly, the efforts of Jacob Riis in advocating for the demolition of degraded areas of New York in the late 19th century was also formative. The redevelopment of large sections of New York City and New York State by Robert Moses between the 1930s and the 1970s was a notable and prominent example of urban redevelopment.

The Housing Act of 1949 kick-started the "urban renewal" program that would reshape American cities.

Urban Renewal, was a federal program started in 1949 with the goal of clearing large slum areas in and around the downtown areas of American towns and cities through the government’s coercive use of eminent domain and replacing the slums with new commercial development. The arbitrary premise behind Urban Renewal was that, if left alone, developers

in the free market would not rebuild or renovate slum properties, without the government helping them to do so by first condemning the properties. .

Additionally, urban renewal can have many positive effects. Replenished housing stock might be an improvement in quality; it may increase density and reduce sprawl; it might have economic benefits and improve the global economic competitiveness of a city's centre. It may, in some instances, improve cultural and social amenity, and it may also improve opportunities for safety and surveillance.

As many examples listed above show, urban renewal has been responsible for the rehabilitation of communities—as well as displacement. Replacement housing – particularly in the form of housing towers – might be difficult to police, leading to an increase in crime, and such structures might in themselves be dehumanising. Urban renewal is usually non-consultative. Urban renewal continues to evolve as successes and failures are examined and new models of development and redevelopment are tested and implemented.

An example of urban renewal gone wrong is in downtown Niagara Falls, New York. (Urban renewal-Wikipedia the free encyclopedia)

Urban renewal is controversial, although renewal projects did revitalize many cities; it was often at a high cost to existing communities. Examples like this abound in Nigeria, the case of the demolition of Maroko, a slum settlement on the outskirts of Lagos close to the highbrow Victoria Island neighborhood in 1990 and similar operations within the Federal Capital Territory of Abuja.

Strategies to Urban Renewal

Slum development or upgrading is essentially a strategy in which the infrastructure of a slum is improved, such as giving adequate water supply and sewage to the community. It can be extended to giving legal status to slum inhabitants, in the former of legalization of the right to the land on which slums are built.

Slum development or upgrading consists of physical, social, economic, organizational and environmental improvements to slums undertaken cooperatively and locally among citizens, community groups, businesses and local authorities.

Issues and Challenges in urban development

Sticky N. & Koch L. (2015), posits that there are issues and challenges in urban development which are summarized thus:

i. Demographic factors: Increasing demand for urban housing & infrastructure services due to more urban citizens in the future.
ii. Socio behavioral factors: Increase of social differentiation & increase of heterogeneous communities in urban areas: education,consumption & culture.
iii. Economic factors: Domestic macroeconomic growth needed to provide the basis of urban development.
iv. Environmental factors: Growing demand for infrastructure puts pressure on natural resources.
v. Financial factors: Current level of FDI & IDA & government financing are not meeting the demands for upgrading.
vi. Governance: Centralized & strict top- down approach to urban governance.

The State of the Nigerian Urban Environment

The Nigerian urban environment used to be attractive and descent with well planned clean streets, maintained landscape and buildings. Additionally, infrastructure like water, electricity, good drainage systems and proper refuse disposal amongst others were available and attracted people from the rural areas to the urban cities. Emma-Ochu, C.A.(2007).

The present Nigerian urban environment can be described as over populated, dirty,disorderly,in descent and unplanned amongst others. The amenities like clean water, clean streets,good roads,maintained landscape and buildings, proper refuse disposal mechanism which used to attract people from the rural areas to the urban cities are no longer there, but people still troop to the urban areas due to hardship and poverty level and where they cannot afford public or private residency, they settle for slums and squatter residence to survive.

So many factors have led to the present state of Nigerian urban cities and they are:

Overpopulation, Over stretching of Infrastructure, Corruption, Gross inadequacy of housing, Poverty, Lack of Political will around the issue, Emergence of numerous slums and squatter settlements, Insufficient legal and regulatory systems amongst others.

As earlier mentioned, developed countries are busy trying to find out what's next in making their cities resilient, how to have healthy urban growth and how cities can be smart? The Nigerian urban environment is being subjected to crisis of unprecedented proportions. This situation of inadequate environment leads to crowding and diseases, effect of climate change, increase in crime rate, amongst other bad effects.

An environment is capable of influencing growth, development, existence: mentally, physically and spiritually. To achieve these and more in our Nigerian urban environment, several strategies have to be adopted. Establishing a good degree of urban improvement through:

Redevelopment of Urban cities, Improving Urban landscape, Managing urban development problems. Supporting public participation in urban environmental improvement programs, Slum development, Giving attention to city appearances, Promoting planting of urban trees, Strict adherence to planning methods,building patterns and regulations etc.

Factors Resulting in the Formation of Slums in Nigeria

According to Bobadoye S.A. & Fakere A.A.(2013), the following factors in the formation of slums in Nigeria:

i. Scarcity of lands service and security of tenure
ii. Poverty and illiteracy
iii. Neglect to building and environment
iv. Use of substandard building materials
v. Poor maintenance culture
vi. Congestion
vii. Poor enforcement of sanitation etc.

METHODOLOGY

Data for the study was collected with the aid of a structured questionnaire which were administered to the various professionals in high institutions in Imo State, Nigeria; these were selected based on their knowledge and involvement with the topic in question. The questionnaire were administered to 50 randomly selected professionals but 30 were retrieved. The professionals includes Architects, urban planners, builders, estate surveyors and civil engineers. The data retrieved was analyzed using the relative Importance index and simple percentage respectively. This index was computed by the following equation [Lim et all 1995].

$$Importance\ Index\ = \frac{5n^5 + 4n^4 + 3n^3 + 2n^2 + n^1}{5[\mathrm{n1} + \mathrm{n2} + \mathrm{n3} + \mathrm{n4} + \mathrm{n5}]}\ x\ 100$$

Where
n1=No of respondents who answered a little degree
n2=No of respondents who answered some degree
n3=No of respondents who answered average degree
n4=No of respondents who answered large degree
n5=No of respondents who answered very large degree
The importance index was calculated. An ordinal measurement scale, which is ranking or rating data that normally use integers in ascending order was also used in this study. The respondents were asked to rank the factors that are responsible for increase pressure in the urban environment,Factors responsible for the degradation of the urban environment and factors that contribute to formation of slums in Nigeria according to degree of importance i.e.

i. 1-Affects with little degree
ii. 2-Affects with some degree
iii. 3-Affects with average degree
iv. 4-Affects with large degree
v. 5-Affects with very large degree

FINDINGS AND DISCUSSION

Table 1: Designation of Respondents

Respondents	Frequency	Percentage
1. Architects	**6**	**20**
2. Urban Planners	**7**	**23**
3. Builders	**7**	**23**
4. Estate Surveyors	**4**	**14**
5. Civil Engineers	**6**	**20**
Total	**30**	**100**

Table 1: Shows the percentage representation of the respondents, 20% for Architects, 22% for urban planners & builders, 14% for Estate surveyors and finally another 20% for civil engineers. This result expresses the opinion of the professionals in the study area.

Table 2: Years in practice

RESPONDENT	FREQUENCY	VALID PERCENTAGE
Above 5years	6	20.0
Above 10 years	8	26.7
Above 15 years	10	33.3
Above 20 years	6	20.0
Total	30	100

Table 2: Shows the respondents years of experience as professionals. With average working experience of 10 years, respondents are deemed experienced enough to supply reliable data for this research.

Table 3: Respondents opinion to this state of Nigerian urban infrastructure

Is the Nigerian Urban Infrastructure under pressure which invariably leads to the development of slums	Frequency	Percentage
	30	**100**

From Table 3: 100 percent of the respondents were of the view that Nigerian Urban Environment is under pressure which invariably leads to development of slums in the urban centers.
Factors responsible for increase pressure on the urban environment.

Table 4: Factors responsible for increase pressure in the urban environment

S/No	Factors responsible for increase pressure on environment	Importance index	Rank
1	Gross inadequacy of housing	64.8	1
2	Overpopulation	63.7	2
3	Lack of Political will around the issue	57.7	3
4	Inadequate Infrastructure maintenance	56.7	4
5	Poverty	52.6	5
6	Corruption	51.7	6

Table 4: Shows the factors and their relative important index with corresponding ranking. It can be observed that the most important factor is inadequacy of housing which has an important index of 64.8 and is ranked No 5, followed by Overpopulation, lack of political will around the issue, inadequate infrastructure maintenance, Poverty and finally corruption. This is justified by Bobadoye et.al (2013), stating that the inadequacy of the quality of most urban housing starts mainly from the poor physical state of the building.

Table 5: Factors responsible for the degradation of the urban environment

S/N	FACTORS RESPONSIBLE FOR THE DEGRADATION OF THE URBAN ENVIRONMENT	Importance Index	Rank
1	Insufficient legal and regulatory systems	58.7	1
2	Emergence of numerous slums and squatters	57.8	2
3	Poverty	48.8	3

Table 5: Shows the factors responsible for the degradation of the Nigerian Urban Environment. The number one factor responsible for degrading the urban environment is the insufficient legal and regulatory frame work. This is followed by Poverty and emergency of slum and squatter settlements. This is justified by Sticzay et.al (2015).

Table 6: Positive impact of slum development and urban renewal in Nigerian environment

Positive impact of slum development	Frequency	Percentage
1. Decent housing	**30**	**100**
2. Increased productivity (Poverty reduction)		
3. Low risk to health hazard		
4. Improvement in Urban physical and socioeconomic landscape are		

Table 6: Shows that 100% of the respondents were of the opinion that the factors in table 6 above are all positive impact of slum development (upgrading)

Table 7: Challenges to urban development

Factors	Frequency	Percentage
1. Demographic factors	30	100
2. Socio behavioral factors		
3. Economic factors		
4. Environmental factors		
5. Financial factors		
6. Governance factors		

Table 7: Shows that all the respondents were of the opinion that the following poses great challenges to Urban Development in Nigeria

Table 8: Factors that contribute to formation of slums in Nigeria

	Importance Index	Rank
Poor enforcement of sanitary laws.	65.0	1
Poverty and illiteracy	63.5	2
Neglect to building and environment	60.0	3
Poor maintenance culture	57.5	4
Congestion	50.5	5
Use of substandard building materials	50.5	5

Table 8: The number one factor that contributes to formation of slums in Nigeria is poor enforcement of sanitary laws and the others follow in order of ranking.

CONCLUSION

Slums are a clear manifestation of a poorly planned and managed urban sector and, in particular, a malfunctioning housing sector. Urban renewal (also called urban regeneration) is a function of urban planning. It has had a massive impact on the urban landscape of many cities and continues to do so in the present day. It has played an important role in cities worldwide.

We live in times of great and accelerating change: in human capability, population growth and societal upheaval. In response we can choose to use the following measures to address the problems of slum development in Nigeria.

i. Improvement of urban cities through private public partnership
ii. Enforcement of town planning laws and regulations by the appropriate authorities
iii. Alleviating Poverty through employment opportunities in environmental related areas like waste management, waste recycling, waste disposal etc.
iv. Education and enlightenment of the populace on maintenance culture with the aid of Building surveyors employed in those areas.
v. The total demolition of slum areas should be stopped by government since it does not solve the problem of urban development, rather there should be slum upgrading in areas that have not been planned by the government.
vi. When all these happens, the result will be positive impact like ensuring healthy lives and promoting wellbeing for all at all ages, ensuring availability and sustainability management of water and sanitation for all, making cities and human settlements inclusive, safe, resilient and sustainable as well as strengthening the means of implementation and revitalize the global partnership for sustainable development.

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Gender Involvement in Sustainable Water Project Management in Ibadan, Nigeria: A Physical Planning Perspective

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ABSTRACT

Water is an environmental resource and it is essential to sustain life. Both male and female have different roles to play in the sustainable management of water as a resource hence this study aims at assessing the level of involvement of each gender at the management stage of Sustainable Ibadan Project (SIP) water projects. The nine identified water projects were studied and 729 respondents were selected within 500 - meter radius of the project site as recommended by the United Nations for the 9 project sites. It was revealed that projects that involved more women are better managed and involvement of more women in subsequent water projects is recommended. The study concluded that women are more interested in sustainability of community water projects because they are more hit by its scarcity.

Keywords: Gender, involvement, sustainable management, water and water projects

INTRODUCTION

Gender reflects a set of behavioural norms ascribed to men and women in a given social group or system. Gender thus reflects attitudes and beliefs that a particular cultural group considers appropriate for male or females on the basis of their biological sex. Allocation, distribution, utilization and control of resources reflect gender relations embedded in both ideology and practice (Peter, 2006). He stated further that in most parts of the world, there exist gender biases, which disadvantage women. This is in line with the submission of Metha and Srinivasan (2001) that gender is not a static condition; it differs across cultural, geographical and temporal context. It is contingent on factors such as age, class and tribe. Therefore, it is wrong to assume homogeneity amongst women.

Gender is also a term used to convey the process of social construction that mediates the relations between women and men. They are social as well as ideological and cultural relations suffused with power differentials that map the range of processes, behaviour, activities, forms of organization considered appropriate for women and for men given collectively over a period of time (Olurin, 2003). It was further stated that gender is a key concept in understanding the social differentiation of women and men. The activities involved cover not only interactions between individual women and men in the sphere of personal relationships but include all aspects of social activity, particularly the exercise of authority and power, divisions of labour, access to and control of resources of production, control of proceeds, remuneration of rewards for work, distribution of income, goods, consumption, participation in the political, cultural and religious activities.

Water is one of the most important natural resources and its effective management is essential, given its scarcity (Aladuwaka & Momsen, 2010). Issue of management of resources is the genesis of environmental conservation which makes it an essential ingredient for sustainable development by meeting the present needs without jeopardizing future requirements.

Due to different tasks involved in water supply (such as transportation and storage of water for cooking, cleaning and washing dishes and clothes, bathing children, household hygiene among others), women have different priorities, demands and knowledge on water management than men. However, women are not as widely consulted on issues relating to water supply and women's priorities and requirements are not given as much attention due to

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different power relations between women and men (Intallance & Porter, 2010). This operates in most cities both in and outside Nigeria including Ibadan, our case study.

Ibadan was specifically selected for this study because the city exhibits both urban and rural settings and is well endowed with water resource in terms of existence of numerous natural springs that could be developed to provide potable water and even construction of deep well and borehole for the community use. Besides these features, residents of Ibadan have long records of insufficient supply of potable water that calls for deserved attention (Agboola, 1996).

Aim and Objectives

The aim of this study is to assess the implications of gender involvement in the management of water projects in Ibadan with a view to ensuring sustainability of the projects.
The specific objectives are to;

i. identify the water projects in Ibadan
ii. highlight the involvement of each gender at the initiation stage of the projects
iii. investigate the main contributions of the community to the water projects
iv. assess way(s) the projects are being managed
v. highlight the implication of gender in the management and sustainability of the water projects.

METHODOLOGY

Information were sourced from both primary and secondary sources. Secondary sources are books, journals and internet while primary data were sourced from questionnaire administration and focus group discussion. The sample population for the study were buildings that are within 500-meter radius from the project location. The project location was gotten by getting the coordinates of the location of the project site with the use of Global Positioning System (GPS) and the proximity analysis tool in the Geographic Information System (GIS) was used to identify the buildings that are within 500-meter radius. This gave a total of 14,412 residential buildings out of which 5% were randomly selected and this constituted 729 residential buildings on which the questionnaire was administered on a selected adult (that is, respondent) per building. The distribution of the 729 samples in each of the nine communities is as shown in Table 1.

The questionnaires were administered on adults of not less than 35 years of age who were believed to have good knowledge of the projects from inception as they were at least 18 years old (age of adulthood in Nigeria) at the inception of the project in 1996. Four research assistants were engaged in the administration of the questionnaires. The survey was conducted both on week-days and weekends to give opportunity to those that were not usually at home on week-days to participate.

Table 1: Sample Size for the Residents of Host Communities

S/No	Target (Community/Agency)	Number of Residential Buildings	Sample Size (5%)
1	Akeu	6,063	303
	Agbadagbudu	1,999	100
	Moga	565	28
	Adegbayi	530	27
	Sango-Isopako	1,425	71
	Onipasan	1,542	77
	Bodija Market Area	1,068	53
	Seeni	173	09
	Odo-Ona / Gada	1,220	61
	Total	**14,412**	**729**

FINDINGS

Main Contribution of the Communities to the SIP water projects

The communities made contributions to the development of the SIP water projects in their communities though at varying level. The findings during the FGD held in the communities revealed that all the communities donated the land used for the project free of charge and labours were also members of the host communities engaged at no charges, these are referred to as contribution in kind. Though some of the respondents (7.4%) do not appreciate this contribution which made them believed that their communities did not make any contribution towards the project. Some communities contributed to the project in cash (1.6%), some in both cash and kind (74.5%) and some in kind only (16.5 %). The cash contributions made by the communities were derived from levy. For instance, in communities like Bodija Market area, Agbadagbudu, Onipasan, Akeu and Odo-Ona/Gada, each building was levied one hundred naira (₦100) which was put together as the cash contribution by the communities towards the projects.

Table 2: Contribution of the Communities to the SIP water projects

S/No	Contribution of Communities To Projects	Frequency	Percent
1	No way	54	7.4
2	Cash	12	1.6
3	Kind	120	16.5
4	Cash and Kind	543	74.5
Total		**729**	**100.0**

Ways SIP Water Projects are Being Managed

There are statutory ways by which management of water projects should be done. As recommended by the Department of Health and Human Services of Centre for Disease Control and Prevention, USA (2012), proper management of water are measured through the following means;

i. Cost recovery strategy
ii. Replicating the project
iii. Upscaling / Expansion of the project.

The Federal Republic of Nigeria (2000), as highlighted in the water supply and sanitation interim strategy note stated the following as ways of measuring proper management of water projects. These are;

i. Fixture and replacement of faulty parts
ii. Monitoring on regular basis
iii. Determination and payments of water tariffs and rates.

From these two documentations, payment is common to them, that is, cost recovery strategy through the determination and payments of water tariffs and rates. Four of these SIP water projects - Agbadagbudu, Onipasan, Bodija Market area and Akeu complied with this as user-charge of ₦20 for any container of maximum of 25 liters is determined and paid.

The cleaning of the project site is done by the women through the wash of the site on regular basis. This is done with the assistance of the children. This fee is used to meet other management strategies like purchase of upscaling items among others. For example, Bodija market area community purchased power generating set; Onipasan community purchased two storex water tanks of 2,000 gallon capacity to complement the underground water tank. Also, attendants were employed in some of the project sites like the Bodija market area community

and Onipasan. These attendants are the ones that open the project site at 7.00 am and close it at 7.00 pm. They collect the user fee and oversee the orderliness at the project site.

Plates 1: The Upscaling Items at the Bodija Market Area Community Borehole Project Site

Plates 2: Upscaling Items at Onipasan Natural Spring Project at Onipasan Community

The project inspection being done by the Local Government Community Development Inspection Officers is a way of managing the project properly. The Community Development Inspection Officers usually visit the sites to inspect and SIP officials equally do monitor the projects. It can be inferred from these submissions that the SIP water projects are being properly managed but it is worthy of note that only the projects that charge user fee are buoyant to manage the projects well which include; Agbadagbudu, Onipasan, Bodija Market area and Akeu while the Moga natural spring project and Seeni borehole projects are no longer functional due to poor management.

The study probed into the area of involvement of women in environmental management. As revealed in Table 3, 57.1% of the respondents opined that women should be involved while 42.9% did not want women to be involved. The closeness in the percentage of those with the two opinions may not be unconnected with the fact that women are believed not to have good knowledge about such projects in the past but the current trend on the campaign against women maginalisation may be responsible for change in opinion of some of the residents.

Table 3: Involvement of Women in Environmental Projects

S/No	Women to be Involved in Environmental Projects	Frequency	Percent
1	Yes	416	57.1
2	No	313	42.9
Total		**729**	**100.0**

Test of Level of Involvement of Men and Women at the Initiation Stage of Development of SIP Water Projects

The level of involvement of both male and female at the initiation stage of the SIP water projects was tested in order to accept or reject the hypothesis that was postulated. The findings revealed that there was a significant difference between the level of involvement of male and female at the initiation stage. (Tables 4 and 5). This test corroborated responses of

the members of the FGD that the initiation stage is believed to be technical and it required a lot of negotiations hence, men were more involved than women.

As shown in Table 4, the Chi-Square value of level of involvement of men at the initiation stage is 14.250 with P-value of 0.000 and degree of freedom of 1.

Table 4: Percentage of Men Involved at the Initiation Stage of SIP Water Project as rated by each Sex

Sex	**Percentage of Men Involved at Initiation Stage (%)**									
	0 – 25		**26 – 50**		**51 – 75**		**76 – 100**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Male	0	.0	0	.0	138	18.9	355	48.7	493	67.6
Female	0	.0	0	.0	36	4.9	200	27.4	236	32.4
Total	**0**	**.0**	**0**	**.0**	**174**	**23.9**	**555**	**76.1**	**729**	**100**
Chi-Square = 14.250				**P-Value = 0.000**				**Df = 1**		

Table 5 revealed that the Chi-Square value of level of involvement of women at the initiation stage is 44.640 with P-value of 0.000 and degree of freedom of 2.

Table 5: Percentage of Women Involved at the Initiation Stage of SIP Water Project as rated by each Sex

Sex	**Percentage of Women Involved at Initiation Stage (%)**									
	0 – 25		**26 – 50**		**51 – 75**		**76 – 100**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Male	340	46.6	151	20.7	2	0.3	0	.0	493	67.6
Female	183	25.1	36	4.9	17	2.3	0	.0	236	32.4
Total	**523**	**71.7**	**187**	**25.7**	**19**	**2.6**	**0**	**.0**	**729**	**100**
Chi-Square = 44.640				**P-Value = 0.000**				**Df = 2**		

The P-value for both men and women is less than 0.05 which indicates that the values are significant hence, the null hypothesis (Ho) was rejected and the alternative hypothesis (H_1) was accepted. By accepting the alternative hypothesis, it means that there is significant difference in the level of involvement of male and female at the initiation stage of the SIP water projects

Test of Level of Involvement of Men and Women at the Management/Maintenance Stage of Development of SIP Water Projects

This study investigated the level of involvement of male and female at the management stage of the SIP water projects. As revealed in Tables 6 and 7, there is significant difference. At this stage, the activities involved are majorly cleaning of the project site and replacement of faulty parts.

The cleaning of the project sites are done more often while replacement of faulty parts is done as occasion demands. The cleaning is done by women and children while the replacement is usually handled by the PMC or CBA which have more male members than women. All these points are pointers to the significant difference between involvement of male and female despite that they are both involved.

The Chi-Square value of level of involvement of men at the management/maintenance stage is 91.900 with P-value of 0.000 and degree of freedom of 3.

Table 6: Percentage of Men Involved at the Management Stage of SIP Water Project as rated by each Sex

Sex	**Percentage of Men Involved at Management Stage (%)**									
	0 – 25		**26 – 50**		**51 – 75**		**76 – 100**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Male	349	47.9	29	4.0	34	4.7	81	11.1	493	67.6
Female	103	14.1	43	5.9	0	.0	90	12.3	236	32.4
Total	**452**	**62.0**	**72**	**9.9**	**34**	**4.7**	**171**	**23.5**	**729**	**100**
Chi-Square = 91.900				**P-Value = 0.000**				**Df = 3**		

The Chi-Square value of level of involvement of women at the management/maintenance stage is 97.929 with P-value of 0.000 and degree of freedom of 3.

Table 7: Percentage of Women Involved at the Management Stage of SIP Water Project as rated by each Sex

Sex	Percentage of Women Involved at Management Stage (%)									
	0 – 25		26 – 50		51 – 75		76 – 100		Total	
	F	%	F	%	F	%	F	%	F	%
Male	98	13.4	34	4.7	12	1.6	349	47.9	493	67.6
Female	102	14.0	0	.0	31	4.3	103	14.1	236	32.4
Total	**200**	**27.4**	**34**	**4.7**	**43**	**5.9**	**452**	**62.0**	**729**	**100**
Chi-Square = 97.929				**P-Value = 0.000**				**Df = 3**		

The P-value for both men and women is less than 0.05 which indicate that the values are significant hence, the null hypothesis (Ho) was rejected and the alternative hypothesis (H_1) was accepted. By accepting the alternative hypothesis, it means that there is difference in the level of involvement of male and female at the management/maintenance stage of the SIP water projects.

It is worthy of note that the results of tests of level of involvement of men and women at the various stages of the development of the SIP water project shows that there are differences in the level of involvement of men and women at the various stages of the project development.

RECOMMENDATION AND CONCLUSION

The study revealed that the projects which involved more women are better managed than the ones with less number of women. The proper management of such project will definitely enhance sustainability and longevity of the projects. It was also observed that projects in which communities made financial contributions to will last longer as the community members regarded such projects as theirs. This will ensure continuous availability of good source of water for the use in the communities.

The study therefore recommends that in replicating the water projects in other communities, more women should be involved from the stage of project initiation through to the management/maintenance stage. Also, members of the host community should be made to contribute financially to the project in their communities as this will make them more committed to the project and take it as their project and ensure their sustainability.

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Sustainable Urban Development and Management Strategies in Nigeria Perspective

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ABSTRACT

The development and management of cities from antiquity to the 21st century have been central to urban discourses in all fields of environmental studies. This is with focus on the specifics of pressures on land, shelter facilities and other sectors to accommodate the geometrically growing urban population. Consequent upon resultant environmental challenges in cities and dwindling resources, these have been hinged on the sustainability debates. This paper examines the factors responsible for the formation, development and management crises of components of cities in developing nations with emphasis on Nigeria towards identifying sustainable practices and principles. It highlights the key urban environmental sectors and their principal stakeholders, discusses their roles and appraises their challenges, including their management strategies in some selected Nigerian cities. While the paper notes the existence of urban management initiatives and policies, it equally notes the challenges still confronting urban environmental governance. It concludes by asserting the need for all the three levels of government in Nigeria through its relevant agencies to mount a seamless enforcement operational system towards enhancing livable and sustainable Nigerian cities.

Keywords: cities, management, policies, professionals, resources, sectors, sustainability

INTRODUCTION

> *Befitting the nature of the urban, the complex multi-faceted make-up of the city, how cities have been studied is itself an entangled story. By their nature, the understanding of cities – how they grow and decline, are structured and function, give meaning to social life – intersects with each of the principal social science disciplines, sociology, economics, geography and political science in particular, as well as urban planning. To varying degrees, each social science discipline has developed distinctive epistemologies by which to understand the city, and the key issues of structure, process and change.* (Paddison, 2001:1)

The significance of understanding the complex urban phenomenon called city before examining its development and management strategies cannot be overemphasized and demands recalling its rigorous seminal definition in classical discourse as follow:

> *The city is not, however, merely a geographical and ecological unit; it is at the same time an economic unit. The economic organization of the city is based on the division of labour. The multiplication of occupations and professions within the limits of the urban population is one of the most striking and least understood aspects of modern city life..... The city is something more than a congeries of individual men and of social conveniences - streets, buildings, electric lights, tramways, and telephones, etc.; something more, also, than a mere constellation of institutions and administrative devices -courts, hospitals, schools, police, and civil functionaries of various sorts. The city is, rather, a state of mind, a body of customs and traditions, and of the organized attitudes and sentiments that inhere in these customs and are transmitted with this tradition. The city is not, in other words, merely a physical mechanism and an artificial*

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> *construction. It is involved in the vital processes of the people who compose it; it is a product of nature, and particularly of human nature.* (Park, 1925: 1-46).

This definition of the urban place encapsulates the natural, cultural, human, biological, religious, political, physical, social, economic and infrastructural components of city as a complex and organic environmental entity. According to Lawanson (2005) and Jiboye (2009), good mixes of these are necessary to securing functional and liveable city that will be sustainable. Jiboye and Omoniyi (2010) opined that a socially, economically or an environmentally sustainable system should achieve distributional equity; provide adequate social services including health, education, housing as well as functional and liveable environment among many others. UN-habitat (2012) equally highlighted four dimensions of equality in facilitating the development of a liveable and inclusive city as:

> *Social, providing all residents – regardless of race, ethnicity, gender or socio- economic status – with adequate housing and decent basic services, and facilitates equal access to social amenities, opportunities and other public goods that are essential to the general and environmental well-being of everyone; Political, upholding citizens' rights and liberties, and promotes social and political participation for the sake of better-informed and more democratic decision- making; Economical, fostering economic development by way of equal opportunities for business and access to employment, and promotes pro-poor economic policies;*
> *Cultural, promoting social integration and celebrating diversity.*

The development of urban enclaves in the developing world has been the subject of numerous authors at various spatial scales and dealing with different issues and challenges. These include shelter, infrastructure, real estate, environment and urban governance, sustainability, open spaces, environmental quality, among many others (Fadamiro and Adedeji, 2014; Cheru, 2002; Fadamiro and Atolagbe, 2005; Fadamiro and Odeyale, 2007; Igbuzor, 2009; Fadamiro and Adedeji, 2009; Fadamiro, 2010; Ogun, 2010; Yunusa, 2011). Considering the current and emerging environmental challenges in these contexts, the following questions are germane to guiding the discourse on the urban phenomenon globally and in Nigeria: What are the developmental forces on the urban enclaves? How have these forces been implicated on the quality of the cities? What are the policy frameworks towards achieving sustainable management of urban places and their success rates? This paper sets to attempt these questions focusing on the specifics of pressures on land, shelter facilities and other sectors in the urban discourse. It examines the factors responsible for the formation, development and management of the components of cities in developing nations with emphasis on Nigeria towards identifying sustainable practices and principles. It further discusses the concepts of urbanisation and its factors, the pace of urban developments in developing world and Nigeria in particular. It enumerates the urban development strategies, principal stakeholders and policy initiatives at international, continental and national levels.

Urbanization and City Development

Redmond (2007) opined that urbanization is essentially a shift of population from rural areas to cities, and the resulting growth of urban areas. Unfortunately, developing nations are grabbling with the outcomes of unplanned urbanization and the resulting cities are plagued with development of urban sprawls, slums, and squatter settlements. Urbanization also breeds inequality, social stratification and many other negative social outcomes. Indeed, "a growing extent of social disorganization and crime is a function of substantial inequalities in access to

land, housing and other services in the cities" (Connell & Lea, 1996:177). Specifically, UN-Habitat (2012) estimated that around 62% of African cities are composed of slums, much of them on informal land arrangements.

As a phenomenon, urbanisation may not be a problem. It only describes the process of change in the growth of population due to changing conditions in the society. It is equally a process of demographic, social, economic and physical change, which requires complex governmental action (Green 2011). As a social process, it hinges more on changes or alterations in the mode of interaction and behavioural patterns than on the availability of infrastructural facilities (Strein et al 2011). According to Anderson (2011) urbanisation is made possible mainly by mass communication, transportation and it implies spread of urban influences to other neighbouring areas as economic process. As an ecological process of aggregating for a variety of reasons, it involves social transformation along with shifts in the pattern of population, morphological pattern of settlement, and the locus of power and influence from the rural to the urban area (Anderson, 2011).

Fadamiro and Adedeji (2009) argue that statistical factor in term of population growth is a precursor to urbanization processes. According to Oluwasola (2007), the restriction of the definition of urbanization to terms of population concentration looks at first limited but it move us away from ambiguity and other forms of intellectual distress and helps us to eliminated other processes that may have opposing effects on urbanisation. In the same veins World Bank (2000) and United Nations (2000) largely perceives urbanization in purely demographic terms.

According to estimate by the United Nations, the world population has been put at 6.572 billion people, of which 3 billion (about 50%) now live within the urban areas, and by 2030, about 61 percent of the world population is projected to live in the cities; and this growth is expected to occur mainly in developing countries (UNFPA, 2007; Daramola & Ibem, 2011; United Nations, 2013). According to Population Reference Bureau (2008:5),

> *The world population has risen from 2.5 billion in 1950 to 6.7 billion in 2008. The proportion living in the developing countries of Africa, Asia and Latin America and the Caribbean has expanded from 68 percent to more than 80 percent. African's population, currently growing faster than any other major region, is projected to account for 21 percent of world population by 2050, up from just a percent in 1900. In 1950 less than 30 percent of the world population lived in urban areas, while a mile stone has been passed in 2008 with 50 percent of the world's 6.7 billion population living in urban areas. Despite this scale of urbanisation the vast majority of these urbanites reside in small towns and villages, not large modern cities. Just 37 percent of urban dwellers live in cities with 1 million residents, and just 8 percent are in mega cities of 10 million or more.*

Currently, this world population has been surpassed to well over 7 billion. The 2014 revision of the *World Urbanization Prospects* by UN DESA's Population Division notes that (United Nations, 2013):

> *the largest urban growth will take place in India, China and Nigeria. These three countries will account for 37 per cent of the projected growth of the world's urban population between 2014 and 2050. By 2050, India is projected to add 404 million urban dwellers, China 292 million and Nigeria 212 million.*

This is an improvement over the 2005 world population status. In 2005, out of the world population, 8 percent live in cities of 10million or more population, 7 percent in cities of 5 million to 9.9 million, 22 percent in cities of 1 million to 4.9 million 10% in cities of 500,000 to 0.9milion and 52 percent in cities of fewer than 500,000. Dawes (2004:2) speculated that the population of developing countries will double to nearly 4 billion over the next generation. He opined further that there will be the "burgeoning of new mega cities with populations in excess of 8 million, and even more spectacularly, hyper cities with more than 20 million in habitants" while the former aspect of this speculation is closely fulfilled (3.3billion against 4 billion speculated), the latter aspect with respect to hyper cites is yet to come. According to the United Nations (2006) by 2030, nearly two-thirds of the world's population will live in urban areas.

The possibilities in the developing countries are there as well. UNFPA (2007) estimated that by 2030, the 3.3 billion people currently living in urban areas will swell to almost 5 billion and "while the world's urban population grew very rapidly (from 220 million to 2.8 billion) over the 20th century, the next few decades will see on unprecedented scale of urban growth in developing world. This will be particularly notable in Africa and Asia where the urban population will double between 2000 and 2030: that is, the accumulated urban growth of these two regions during the whole span of history will be duplicated in a single generation! By 2030, the towns and cities of the developing world will make up 81 percent of urban humanity (UNFPA, 2007).

As the scale and pace of urbanization in Africa (Fadamiro and Adedeji, 2009) becomes more dramatic, Cairo and Lagos has emerged as the first African megacities. According to the UN-Habitat (2008) projections,

> *Before 2015, Kinshasa will be the third and is projected to surpass Lagos in size by 2025 when Kinshasa, Lagos and Cairo will have 16.7, 15.7 and 15.5 million inhabitants respectively. But this is not the full picture. Progressing urbanization introduces shifts in cities' spatial patterns and configurations. Traditional city based urbanization is moving towards regional urbanization patterns, including the emergence of city regions and their associated urban corridors, creating what is known as mega urban regions. Such regional urban systems comprise several multi-million urban cores. The regional urban systems of Suez-Cairo-Alexandria, Kenitra-Casablanca, Gauteng, and Ibadan-Lagos-Accra are key examples.*

In this emergence of urban corridors, centrifugal urbanization forces have replaced the earlier centripetal ones. Because of pressures on land use, highly escalating cost of real estates, urban poverty and a new dawn of urban renewal efforts consequent upon changing political landscapes and emerging landscapes of politics, the urban dwellers are forced to move to the peri-urban fringes where the pressures are perceived to be less. In the recent past, this pattern of urban development used to generate satellite towns like Egbeda in Ibadan, Nyanyan in Abuja and numerous peri-urban settlements along the boundaries of Lagos and Ogun States. These include Mowe and Shagamu. In the present pattern of urban development, these points of increasing population concentration are vastly having their boundaries disintegrating leading to the present urban corridors. If the current rate and pace of this pattern of urban development is sustained, the emergence of megalopolis is imminent in the near future.

Also in 2007, the 380 developed region cities in the top 600 cities by GDP accounted for 50 % of global GDP, with more than 20 % coming from 190 North American cities alone. The 220 largest cities in developing regions contributed another 10%. By 2025, 136 new cities from the developing world are expected to enter the top 600; 100 of them from China and 13 from India (Richard et al. 2011). According to UN-Habitat (2008),

> *Africa's three giant urban agglomerations, Cairo, Kinshasa and Lagos, continue to rise rapidly in their ranking among the world's largest metropolitan regions. In 2007, the urban agglomeration of Cairo had 11.9 million inhabitants; Lagos had 9.6 million and Kinshasa 7.8 million. In 2015, Cairo will have 13.4 million; Lagos 12.4 million; and Kinshasa 11.3 million inhabitants - 11th, 17th and 19th respectively among the world's largest metropolitan regions. Projections show that Kinshasa, with 16.7 million inhabitants, will be Africa's largest urban agglomeration in 2025, Lagos 15.8 million and Cairo 15.5 million, ranking 11th, 12th and 13th among the world's largest megacities.*

As far as Nigeria is concerned, 4.8% was urbanized in 1921. It was moved to 10.2% between 1952 and 1954. It further increased to 19.2% in 1963 and jumped to 42% in 2002. Estimation however suggests further increase to about 68% by 2020 (Ademiluyi and Solanke, 2008). In 2008, Nigeria was the seventh most populous country of the world out of the ten with population of 148.1 millions. The list has china as the highest of 1,324.7 million and Japan as the lowest (127.7 million). 2050 population estimate for Nigeria is 282.2 million moving to the sixth position out of the ten most populous countries with India in the first position (1,755.2 million) and Philippines (150.1 million) coming last (Population Reference Bureau, 2008). In 2014, Nigeria's population is estimated to be 177 million being in the 7th position with a projection of 396 million in 2050 to move to the 3rd position (Population Reference Bureau, 2014). This whooping population of Nigeria is largely urbanizing. The trend has continued from pre-colonial period through the sixty years of colonial rule to the present post colonial period. While the current rate of urbanization for the world is 2.5%, that of developed countries is 0.8%, developing nations generally is 3.4%, Africa's rate of urbanization is a "whooping" 4.4% and Nigeria has the highest of 5.5% (Oluwasola, 2007: 4). For instance, in 1950 Lagos, a giant city has a population of 300,000 which increased to 10 million in 2004. The two other giant cities of Nigeria are Kano and Ibadan, Ibadan being the third largest by population but the largest in geographical area. According to the 2006 census results, the population of Ibadan was 2,550,593 while that of Kano and Metropolitan Lagos were 3,848,885 and 7,937,932 respectively (National Bureau of Statistics, 2006).

Urban Development Forces

The developments of urban places have been attributed to two sets of push and pull factors (Bhatta, 2010). These are essentially centrifugal and centripetal forces that leads to increase in size of points of population concentrations and multiplication of points of population concentration. These can be due to migration from the countryside to urban areas and natural increase in population from excess of births over deaths. Migration is defined as "the long-term relocation of an individual, household or group to a new location outside the community of origin", push factors being "conditions in the place of origin which are perceived by migrants as detrimental to their wellbeing or economic security," and pull factors are "the circumstances in new places that attract individuals to move there "(Bhatta, 2010:9). Push factors are negative and include joblessness, poverty and lack of modern social, educational and economic opportunities, and general rural conditions. Pull factors include job opportunities and possibilities for a better lifestyle, including better opportunities for higher

salaries, better services, and better lifestyles, which attracts people to urban places (Thomas, 2005).

Urban development is also hinged on other city-generating factors in the urban design parlance, especially morphological patterns. In these patterns, natural features like geology, landforms and vegetation play key roles. Also, man-made features like transportation infrastructures, including roads, rail lines, water ways and air-transport facilities often determine the emerging urban forms in growing settlements. While there is a general consensus on the features of a sustainable development agenda amongst many working in the field of urban design, nevertheless there are differences in emphasis, (Carmona et al., 2003). Over a decade ago, Calthorpe (1993) outlined the principles for the Transit-Oriented-Development: an agenda that many could still accept as a general guide. In summary, the principles of Transit-Orientated Development according to Paddison (2001) are:

a. Organizing growth on a regional level so that it is compact and transit-supportive.
b. Locating commercial, housing, jobs, parks, and civic uses within walking distance of transit stops.
c. Designing pedestrian-friendly street networks which directly connect local destinations.
d. Housing should be a mix of densities, tenure and cost.
e. Sensitive habitat, riparian zones, and high-quality open space should be preserved.
f. Public spaces should be the focus of building orientation and neighbourhood activity and
g. Encouraging of infill and redevelopment along transit corridors within existing neighbourhoods.

Availability of transportation facility is therefore a high precursor to urban development and is the basic urban design agenda that is compatible with sustainable development ideas. They not only allow transit between the urban and countryside settings, they attract developments like housing, industries and enhance commercial enterprises. Also, resulting transportation nodes often supports commuters overnight stays and commercial activities and such nodes often emerges into transit-corridor cities like Ibadan and Lagos.

Furthermore, the perceived better conditions attract poor people from rural areas into urban areas mainly to seek economic opportunities. In contrast to the rural areas, cities are known to be places where money, services and wealth are centralized. Cities are places where fortunes are made and where social mobility is possible. Businesses that generate jobs and capitals are usually located in urban areas. While the source of such fortunes may be trade or tourism, it is also through the cities that foreign currency of possible higher values flows into a country. Also, cities are abodes of better basic services as well as other specialist services that are not found in rural areas while the job markets in cities are highly diversified compared to the few job categories of rural areas. Health is another major factor that is better enhanced in the cities because of the availability of higher levels of healthcare facilities. Other urban development factors include a greater variety of entertainment (restaurants, movie theatres, recreation parks and gardens, amusement centres, etc.) and a better quality of education.. All these lead to growth and development beyond the available capabilities of resources and the resulting challenges bedeviling the environment and its components.

Urban Environmental Challenges

The rapid growth rates of urban agglomerations and the lagging response by governments in developing nations of Africa and others have been associated with significantly increasing urban poverty, problematic urban environments and ever more complex urban management

issues. These include "uncontrolled growth of urban informal settlements, prevalence of substandard and overcrowded urban housing, inadequate basic urban services and infrastructure provision, declining urban livelihood options, frequent civil unrest, and infectious diseases and crime" (UN-Habitat, 2008:10). In most parts of Africa, cities and urban agglomerations have become centres of urban squalor, aggravated poverty and human misery. While they are rapidly becoming social hot-beds and breeding grounds for unrest and political risk, the rate of urban insecurity is unimaginable (Adedeji and Fadamiro, 2014). Consequent upon poverty, urban public spaces privatization, thriving of informal sector trading activities, coupled with anemic urban governance, the cities have been turned to hazardous places in environmental phenomena (Adedeji, Fadamiro and Adeoye, 2014). The cases have been worsened by global environmental hazards and crises in terms of climate change, ocean surges, tsunamis, volcanic eruptions, auto-accidents, professional quackery, volcanic eruption, earthquake, landslide, flood, cyclones, cold waves, drought, thunderstorm, heat waves and storms, fire outbreak, damaged pipelines, oil spillage, gas flaring, building collapse, chemical spill, road accident, food poisoning, epidemic industrial disaster, deforestation, war and plane crashes (Adedeji and Adeboyejo, 2011).

Unless carefully managed, the urban transition in West and Central Africa could have adverse implications for the regional economy, the environment and social stability. Most of the nations have unbalanced population concentrations and experience rapid urbanization without effective physical planning, development control and urban social policy. Lagos and Kinshasa are classic examples, combining haphazard, uncontrolled and unrestrained population and spatial growth with few additional housing, infrastructures, services and livelihood opportunities. "The region's urbanization is driven by demographic forces and perceived availability of urban livelihoods rather than by significant broad-based economic progress and urban livelihood creation." Despite the relative expansion of economic activity, the cities are becoming increasingly dysfunctional in terms of access to key resources and livelihoods for its urban dwellers. Social unrest and violence could be the outcome of these poorly functioning cities (UN-Habitat, 2008:11).

The fast expansion of urban populations has caused rapid increases in the demand for urban land. Urban plots cannot easily be reproduced or have the demand met by converting rural land at the urban periphery. As a result, land prices rise sharply and land becomes increasingly unaffordable to the urban poor. Because of the strategic importance of land, the prevailing land tenure systems and because land markets are not serving the needs of the urban poor, governmental interventions - both directly and indirectly – are critical to broadening access to land beyond those who can afford the open market prices. Land policy is an important tool in modifying land markets in the interest of national development, and particularly as an instrument for achieving greater equity and social justice. Local authorities, within their ideological and political confines, can moderate the land market to achieve specific planning and spatial aims or improved accessibility to urban land for a broad range of stakeholders, including low-income households and slum dwellers. In the absence of equitable land allocation in a market-driven environment, low-income households' limited financial capacities force them to solve their shelter and livelihood problems informally. Given their vast numbers, poor urban dwellers are now the dominant market sector. They transform the city to meet their needs in manners that are often in conflict with laws and urban development plans (UN-Habitat, 2008:12).

Urban infrastructure provision and development are the key components of proactive environmental approaches. Unsafe water, sanitation and hygiene account for about six percent of the disease burden in the region. In terms of services Lagos, Kano and Ibadan rank among the region's most deficient cities. Only three percent of the Ibadan residents has

access to piped water. Greater Lagos does not do much better, servicing only nine percent of its 10 million people. These are abysmally low rates, not only in absolute terms but also relatively if compared with Accra's 51.6 and Abidjan's 70.9 percent of the urban population served with piped water. Poverty is central to the human settlement sector as housing and services have become market commodities with access determined by the ability to pay market prices (UN Development Agenda, 2012). With piped water and improved sanitation, economic rather than social goods, they have gradually ceased to be the responsibility of urban managers. There is need for the region's governments and local authorities to start perceiving access to improved water and sanitation as a social good, a human right and an essential commodity for human health rather than marketable commodities. Successive governments in West African countries have shown much concern for transport planning and development. Increasing road networks notwithstanding, transport is in disarray. UNEP (2009) argued that sound management and concerted public outreach and preparedness efforts can prevent the devastating destruction that characterized urban disasters in the 20th century.

Sustainable Urban Development

At global, continental and country levels, there seems to be widespread agreement that solving urban environmental problems means the adoption of policies and programmes that lead to sustainable development. Sustainable development, however, has many different meanings (Pearce, 1989). The shades of meaning given to sustainable development closely mirror – or perhaps match – the writer's intellectual or emotional position along the spectrum of green philosophy. There is also a great danger that the concept will become meaningless, or simply be used as another wordy panacea instead of action for dealing with the environmental ills that befall the planet. The pursuit of a sustainable future for the human race in an environment of quality will require the design of effective policies and programmes which directly address the related problems of unsustainable activities and environmental degradation; they must also be politically acceptable in the jurisdiction where they are proposed. If these policies and programmes are grouped beneath the generic term 'sustainable development', then that term must have a generally accepted meaning which does not reduce it to an anodyne instrument for political obfuscation. A generally accepted definition of sustainable development, and a good point to begin an exploration of this concept, is taken from the Brundtland Report: "Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

This definition contains three key ideas: development, needs, and future generations. According to Blowers (1993), development should not be confused with growth. Growth is a physical or quantitative expansion of the economic system, while development is a qualitative concept: it is concerned with cultural, social and economic progress. The term 'needs' introduces the ideas of distribution of resources: "meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life" (World Commission on Environment and Development, 1987). Also, the term "sustainable development" has been viewed from different perspective. The World Food Programme, WFP (2010), defines it to mean allowing for "future generation requires that we preserve our remaining resources and that we had or rehabilitate resources that have been treated carelessly in the past". Blackwell, Goodwillie and Webb (1991) described sustainable development as a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspiration.

Huang, (2008) states that the best strategy for sustainable urban development and to limit urban decay is care for existing cities. This is especially a challenge in rapid urbanizing countries like Nigeria. This has been explored through urban renewal which has also been linked with the sustainable provision of basic amenities such as water, and electricity" (Vander and Graaf, 2010). Sustainability also "implies the careful husbandry of the natural and man-made environment. It implies a return to the mores of farming traditions, that is, leaving the land in a better condition than it was found" (Moughtin, Oc and Tiesdell, 1999:150). Urban environmental sustainability has also been described as "a process of change in which the exploitation of resources, investments, application of technology and institutional change are in harmony and enhances both current and future potential to meet human needs and aspirations" (Adeyinka, 2005). Urban sustainability debate is thus germane as "urban areas are central to the demographic, economic and environmental challenge of the 21st century (UN and UNCHS, 2010).

Sustainable Cities and Management Initiatives

The development of sustainable cities has constantly been hinged on sustainable urban governance and management initiatives at all levels. This is essentially the promotion of good governance as entrenched in the United Nations Global Sustainable City's Agenda and several others alike which target the poor and the vulnerable group for poverty reduction, job creation, provision of decent and affordable shelter; and ensuring a socially, culturally, economically as well as environmentally sound and serviced human settlements in other to improve the overall living conditions of the people in Nigeria (UN-Habitat, 2007; UNDPI, 2008). The premise of the nation's effort is as enumerated by the Earth Summit in 1992: "without improving environmental management, development will be undermined and without accelerated development the environment will continue to degrade". Accordingly, Wilmoth (2014) asserts that managing urban areas has become one of the most important development challenges of the 21st century. Our success or failure in building sustainable cities will be a major factor in the success of the post-2015 UN development agenda. These initiatives therefore naturally divide into two non-mutually exclusive groups: United Nations and Nigerian.

United Nations Urban Development and Management Initiatives

Between 1972 and 2012, the United Nations organised international conferences as global giant strides to achieve sustainable urban developments (Fadamiro and Adedeji, 2014). Specifically, the United Nations Conference on Sustainable Development (UNCSD) marked the 40th anniversary of the first major international political conference that specifically had the word "environment" in its title. The UNCSD was charged with securing renewed political commitment for sustainable development, assessing progress and implementation gaps in meeting previously-agreed commitments, and addressing new and emerging challenges. In addition, the UN General Assembly called for the conference to focus on the following themes: a green economy in the context of sustainable development and poverty eradication, and the institutional framework for sustainable development (IFSD).

Table 1 shows the milestone conferences and respective outcomes. The final outcome consists of the following summarized key resolutions on urban development and management strategies by the UN General Assembly on 11 September, 2012 (UN, 2012):

i. If cities are well planned and developed they can promote economically, socially and environmentally sustainable societies, recognizing the need for a holistic approach to urban development and human settlements;
ii. To promote an integrated approach to planning and building sustainable cities and urban settlements;

iii. Emphasize the importance of increasing the number of metropolitan regions, cities and towns that are implementing policies for sustainable urban planning;
iv. Recognize the important role of municipal governments in setting a vision for sustainable cities, from the initiation of city planning through to revitalization of older cities and neighbourhoods;
v. Developing sustainable, locally appropriate transport system;
vi. Recognize the importance of mixed-use planning and of encouraging non-motorized mobility including by promoting pedestrian and cycling infrastructures;
vii. Recognize that partnerships among cities and communities play an important role in promoting sustainable development.

Table 1: Timeline of Environment and Development Discussions

Date	Milestone	Outcomes or Issues
1972	United Nations Conference on the Human Environment (the "Stockholm Conference")	Stockholm Declaration; Stockholm Action Plan; and 5 resolutions calling for ban of nuclear weapons, a databank of environmental data, an environmental fund, actions on development and environment, and establishment of the U.N. Environment Programme (UNEP)
1987	Report of the World Commission on Environment and Development (the Brundtland Commission)	*Our Common Future:* Defines "sustainable development": meets the needs of the present without compromising the ability of future generations to meet their own needs"
1992	United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil	Rio Declaration; Agenda 21; United Nations Framework Convention on Climate Change; Biological Diversity; Statement of Forest Principles
1997	19th Special Session of the U.N. General Assembly	Programme for Further Implementation of Agenda 21
2002	World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa	Johannesburg Plan of Implementation; Johannesburg Declaration on Sustainable Development; Marrakesh Process—recognized contribution of "partnerships"
2012	Informal-Informal Negotiations on the Zero-Order Draft Communique	Draft Communique of more than 200 pages; two subsequent sessions have reduced it to about 80 paragraphs.
June 13-15 2012	Third Prep Comm in Rio de Janeiro, Brazil	Agenda, Rules of Procedure, draft Communique, etc
June 16-19 2012	Sustainable Development Dialogues in Rio de Janeiro, Brazil and on the worldwide web	Recommendations expected from each of Dialogues on 10 topics, to be conveyed to the high level Rio+20 Partnership Forum
June 20-22 2012	High-Level Rio+20 Partnership Forum in Rio de Janeiro, Brazil	Communique *discussed below.*

Source: Leggett and Carter, 2012.

Nigeria's Urban Development Agenda

Nigeria's urban development agenda emanates from that of United Nations being an active member. The Draft Objectives and Strategies for Nigeria's Agenda 21 (http://www.nesrea.org/images/NIGERIA%27S%20AGENDA%2021.pdf) remains the best white-paper from the United Nations initiatives which, according to Johnson (1993), has the following outlines:

i. Providing adequate shelter for all;

ii. Improving human settlement management;
iii. Promoting sustainable land use planning and management;
iv. Promoting the integrated provision of environmental infrastructure: water, sanitation, drainage, hazardous and solid waste management;
v. Promoting sustainable energy and transport systems in human settlements;
vi. Promoting human settlement planning and management in disaster-prone areas;
vii. Promoting sustainable construction industry activities and
viii. Promoting human resource development and capacity-building for human settlement development.

The mission of the agenda is to

> *"achieve a state of environmentally sound human settlements free from slum conditions and in which all have access to adequate and affordable shelter, efficient infrastructure and services which will foster sustainable economic growth, improved standard of living for the well-being of all Nigerians" (Adegoke et al, undated).*

This will involve providing an integrated infrastructural system of water, electricity, sanitation, drainage, liquid and solid waste management in cities to effectively implement and enforce all existing relevant sectoral laws, standards and regulations that make for sustainable human settlements.

Furthermore, there is need to encourage private sector and community participation in urban renewal activities, housing and infra-structural provision; replicate the Sustainable Cities Programmes (SCP) in major urban centres in Nigeria; develop and implement guidelines and put in place appropriate institutional arrangement for effective urban land administration (Sanni 2010). It also requires promoting green infrastructure and efficient transportation in cities.

Accordingly, the National Housing Policy was formulated and launched in 1991. The document outlines policies and strategies to provide decent housing for all by the year 2000 or in the shortest possible time. A fall-out of the policy is the establishment of the Housing Policy Council to monitor activities in the housing sector and evaluate policy impact on the sector. To achieve this, The National Housing Fund was established in 1992 to solve the problem of finance for housing development. The Federal Government, through the Federal Housing Authority (FHA) started the National Housing Programme in 1994 to produce 121,000 housing units for low, medium and high income earners. So far 600 housing units in various stages of completion are being constructed in Lagos, Kaduna, Port-Harcourt, Jos, Kano and Lafia (Adegoke et al, undated). Also, The Federal Government has provided through the National Sites and Services Programme over 15,000 plots at subsidized rate to the public. Over 250m has been committed to the programme in the last six years.

To address the goal of strengthening urban data systems, a National Index of Building Standards (NIBS) was established in 1994 to collect data on building starts and other housing indicators. The project is being undertaken by the Nigerian Institute for Social and Economic Research (NISER) in collaboration with the Federal Ministry of Works and Housing, Regional Workshops have been held on the use and implementation of NIBS (Obadan, 2003). Several policies have been adopted by government to improve Urban Management. These include:

i. The National Urban Development Policy formulated in 1992 to provide guidelines for urban development and management.

ii. Infrastructure Development Fund through a U.S. $180 million financial assistance from the World Bank, the Infrastructure Development Fund financed urban development projects in 15 States of the federation covering storm drainage, sanitation, urban roads rehabilitation, water and solid waste management, market development, water rehabilitation, motor parks development, river draining/channelization, street lighting.

iii. Sustainable City Programme, the country is participating in the sustainable cities programme under the UNCHS (Habitat) and World Bank/UNDP urban management programme (UMP). Under the programme, sustainable Ibadan. Project (SIP) is being implemented. Through the initiative, Local Governments, NGOs, CBOs, private individuals are encouraged to participate and contribute to urban improvement and management programme. The process of replicating the sustainable city programme has already begun. Two other cities, Kano and Enugu have commenced their projects. The sustainable Kano Project has already prepared the Kano Environment profile study forming the basis for consultative actions on the management of Metropolitan Kano.

iv. Capacity Building towards enhancing the management capacity of agencies responsible for urban development, technical assistance for human resource development has been received. Under the World Bank infrastructure Development Fund Programme, officers of State and Federal agencies were trained in various aspects of urban management and computer literacy. Supply and installation of computer hard ware and software were also sponsored. Other international agencies that have offered training assistance include the UNDP, UNEP, UNCHS and UNICEF. Furthermore, the following have been put in place to promote sustainable land use, planning and management: Land Use Act of 1978, Federal Land Registry and a similar one in Ondo State, Urban and Regional Planning Decree, Infrastructure Development Fund programme and Urban Basic Services programme (UBS) (Igbuzor, 2009).

RECOMMENDATION AND CONCLUSION

The need for collaborative efforts by all governmental Agencies at regional, national and local levels towards ensuring good governance and sustainable urban development cannot be overemphasized in view of the the poor outlooks of Nigerian urban

places. These include the New Partnership for Africa's Development (NEPAD) which is an initiative for speeding up sustainable development in Africa which Nigerian government should explore. Other counterpart initiatives like National Economic Empowerment and Development Strategy (NEEDS) and State Economic Empowerment and Development Strategies (SEEDS) (Ariyo, Odusola and Ayorinde, 2006; NEEDS, 2006; Ogoh, 2006),) which operate at the national and state levels in Nigeria should collaborate to ensure speedy actualization of the UN Global Agenda 21 and Goal 7 of the MDGs Agenda on the sustainability of cities. Also, the African Ministerial Conference on Housing and Urban Development (AMCHUD), a body of ministers responsible for housing and urban development in Africa (Okunola, 2010; Daramola & Ibem, 2010; Adegun, 2011) has a key role to play in facilitating these initiatives.

Furthermore, achieving sustainability in housing provision requires major societal changes, restructuring of institutions and management approaches. It also requires the appropriate political will based on the conviction of the responsibility of government to its citizens, and the need to create humane and decent environment for dignified living (Olotuah and Bobadoye, 2009). Since one of the most important challenges facing Nigeria is the provision

of affordable housing to the poor and low-income group in view of alarming rates of urbanisation, the resulting social, economic, environmental and political challenges need to be urgently addressed (Oduwaye, 2009). Despite a series of government policies towards housing delivery, one thing that is clear is that there exist a gap between housing supply and demand (Oduwaye, 2009), therefore, this should be urgently addressed. This can be through arrangements between government and private sector entities for the purpose of providing public infrastructure and housing in cities (Sanni, 2010).

The existing approaches of environmental planning and management in Nigeria is grossly deficient of citizen participation (Akinmoladun and Oduwaye, 2000) controlling the use of land and the character of buildings and communication routes so as to achieve economic security, convenience and incorporating local people in the decision making process should be re-visited. On the whole, there is an urgent need for the Federal Government of Nigeria through its relevant agencies to mount a seamless and premium enforcement operational system towards enhancing livable and sustainable Nigerian cities. This should be all-embracing to include spatial planning for safe and aesthetically sustainable cities, socially-inclusive urban enclaves and urban governance with enhanced all-round management strategies. All urban sustainability dimensions (Alberti, 1996) should be adequately planned for, including the following: Urban Patterns: community- population, economy, society; Structure – form, density, connectivity; functions- housing, industry, services, and transportation; Urban Flows: information and communication, natural resources- energy, water, materials; infrastructure and technologies; Urban Quality: environmental quality, human health, efficiency, equity, diversity and accessibility.

In view of the forthcoming Third United Nations Conference on Housing and Sustainable Urban Development, the New Urban Agenda tagged Habitat III in Quito, Ecuador, from 17 – 20 October 2016, focusing on "policies and strategies that can result in effectively harnessing the power and forces behind urbanization" (http://futureofplaces.com/2013/11/towards-habitat-iii-2016/) engaging all the stakeholders, it is expected that cutting-edge strategies would be formulated on sustainable urban development and management. The conference promises to open discussions on these important urban challenges and questions towards suggesting sustainable strategies for urban governance.

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Appraisal of Characteristics of Slum Neighbourhood of Minna, Niger State

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ABSTRACT

Slum is a consequential effect of unplanned urbanization in cities especially in developing countries. Insecure tenure, crime, overcrowding, uncollected waste and poor sanitation are problems that often characterized slum neighbourhood. The problems of Slum is not a peculiar problem as most slum areas tend to exhibit the same trait, these identified problems are evident in the slum area of Kpakungu, a Neighbourhood in Minna, Niger State. Since the inception of the present political dispensation (1999 till date), the state government has been enforcing all the planning tools to control its development but this has proved abortive. This study aims at appraising the characteristics of slum neighbourhood of Minna, Niger State with reference to Kpakungu between 1999 and 2014. This was achieved by examining the factors responsible for slum proliferation in kpakungu neighbourhood and the impact of town planning activities in kpakungu between 1999 and 2014. Quantitative approach was used in data collection and stratified random sampling was used to select respondents. The neighbourhood was divided into 8 units from which random sampling was used to select the respondents for the study. A total of 95 questionnaires were administered due to the size of the population and the respondents. Geospatial techniques were also used to substantiate data from both sources. The Rasi 700 gas meter was further used to determine the pollution level. The analysis of the spatial development of the neighbourhood indicated that there is a significant increase in the size of the slum between the periods of investigation. The pollution level of the neighbourhood shows higher level than the stipulated value of 10ppm for CO, 0.04-0.06ppm for NO2 and 0.01ppm for SO2 by NESREA. There is also increase in crime rate in the neighbourhood by 25%. The study recommends inclusive planning approach in the management and planning of neighbourhood and proper monitoring and implementation of development control measures should be enforced by the relevant agencies in the state.

Keywords: Development Control, Geospatial, Inclusive Planning, Pollution and Slum

Introduction

Over the years, scholars in urban studies are faced with the challenging phenomena of increasing rates of urban growth in the world, especially in developing countries, where less urban planning is being carried out to contain such growth in a viable manner (Egunjobi, Jelili, Adeyeye, 2007). Unplanned urbanization and rapid urban growth are linked to various environmental challenges in developing countries. Olthuis, Jiya, Eichwede and Zevenbergen (2005) opined that unplanned urban and rapid urbanization often result in chaotic development which in turn breed slum settlements in developing countries of the world with Nigeria inclusive. Also, Agbola and Agunbiade (2009) share the same opinion about development and slum formation. Slum settlements are defined as any neighbourhood or city with half or more of its residents lack access to improved potable water supply, sanitation, sufficient living area, durable housing and secure tenure (UN-Habitat, 2009).

Consequently, proliferation of slums areas are seen as major challenge to development in the developing countries. This is because slum areas are often characterized by appalling living and environmental conditions which frequently result to inadequate water supply, squalid conditions of environmental sanitation, breakdown or non-existence of waste disposal managements, overcrowded and dilapidated habitation, hazardous location, insecurity of tenure, and vulnerability to serious health risks (Arimah, 2010). More so, social vices such as drugs addiction, prostitution, smuggling, etc. are attributed to slum proliferation in

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developing countries (Fourchard, 2003). All challenges that are associated with Slum areas are seen as an impediment undermining the actualization of goal number 7, target d of the Millennium Development Goals that seeks to improve the lives of at least 100 million dweller by the 2020 (IDB, 2013).

The rate of the proliferation of slum in the world at large is alarming and this calls for stern concern by stakeholders. According to the UN (2008) a total of one billion people worldwide were estimated to be living in slums currently and this figure translates to one-sixth of the world's population. Thus, with the rapid and unplanned urbanization experienced in most cities of the world, especially Africa, there is a likelihood of a significant increase in the number of slum dwellers and environmental problems that will accompany the influxes (IDB, 2013). Challenges posed by rapid urbanization are peculiar to all, but the developing countries are the ones finding it increasingly difficult to respond to these challenges (Siddharth, 2008).

Nigeria has also had its own fair share of slum proliferations which are evident in urban centres across the country. Olotuah (2006) opined that 75% of dwelling units in Nigeria urban centres are substandard and these dwelling units are cited in slums. In Minna, the Niger state capital Aliyu (2008) reported that 70% of the population of Minna reside in slums and squatter settlements. This analysis from Aliyu (2008) affirms Olotuah's (2006) assertion that 75% of urban dwellers in Nigeria reside in Slum neighbourhood. The "story" of slum proliferation is not different in the case of Kpakungu a neighbourhood in Minna, Niger state. The study area shows that it is an undulating neighbourhood which has valley towards the southern part. This allow for the indiscriminate sewage and solid waste disposal in and around the neighbourhood. The environment is filthy and shows high level of unplanned and uncontrolled growth. The people of Kpakungu neighbourhood are gregarious in nature and lives in a compact ties, they have similar social and economic characteristics. Due to negligence on the part of the authority and the poor socio-economic status of the people, Kpakungu neighbourhood has shown a near or total collapse of urban infrastructure which has resulted to high crime incident and growing environmental problem such as air pollution, uncollected waste, poor accessibility, poor sanitation, silted drains and erection of buildings without planning permit. These phenomenons have led to the growth of slum in Kpakungu.

Efforts to address these issues by the Niger State Urban Development Board right from the inception of the present political dispensation (1999 till date) have proven abortive. Against this background, the planning activities toward revitalizing Kpakungu were assessed in this study.

Aim and Objectives of the Study

The aim of this study is to appraise the characteristics of slum neighbourhood of Minna, Niger State with reference to Kpakungu between 1999 and 2014. To effectively carry out this appraisal, the factors that are responsible for slum proliferation in Kpakungu were examined, the trend of slum proliferation between 1999 and 2014 was analyzed, the implications of slum proliferation in Kpakungu is looked into and the impact of town planning activities between 1999 and 2014 are also examined.

STUDY AREA

Kpakungu, a suburb of Minna is located on Latitude 9°35’ North and Longitude 6°31’ East and occupies a land area of 801.402 Hectares and an estimated population of about 22,587 projected from NPC, 2006 population census. Kpakungu is one of the 24 neighbourhoods of Minna city and one of the largest populated neighbourhood in the city. Figure 1 shows the spatial extent of the neighbourhood and its location in relation to Minna. Kpakungu

neighbourhood is bounded by Fadipe, Soje, Barkin Sale and Gbaganu community to the North, East, South and West respectively.

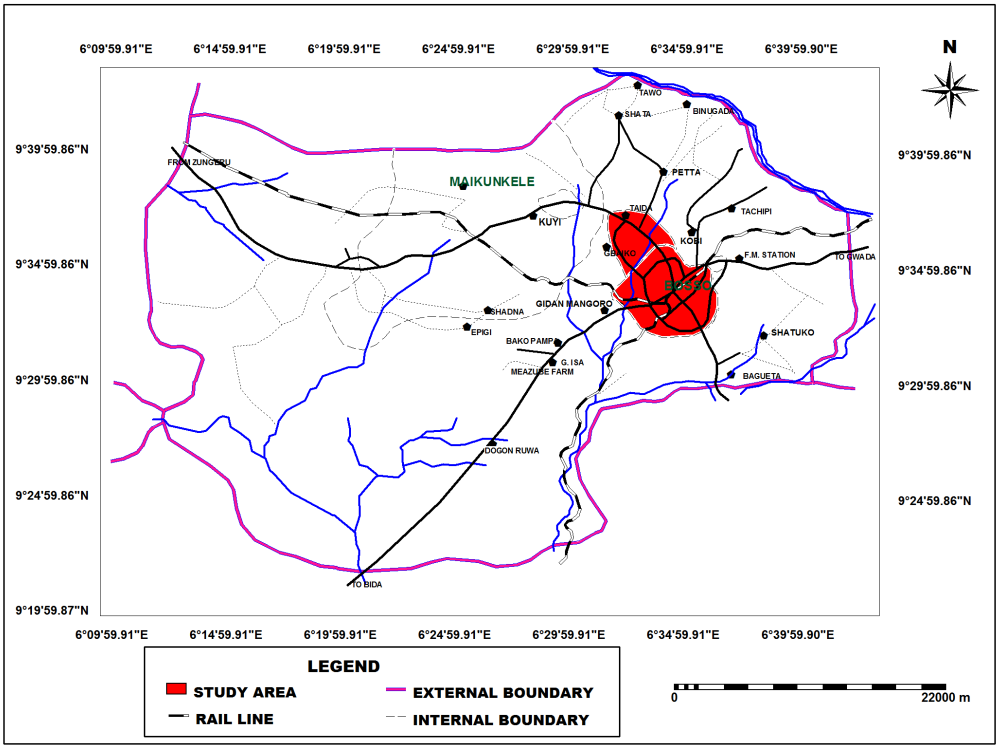

Figure 1: Street Guide Map of Minna Highlighted in Bosso L.G.A.
Source: Department of Urban and Regional Planning, FUTMINNA

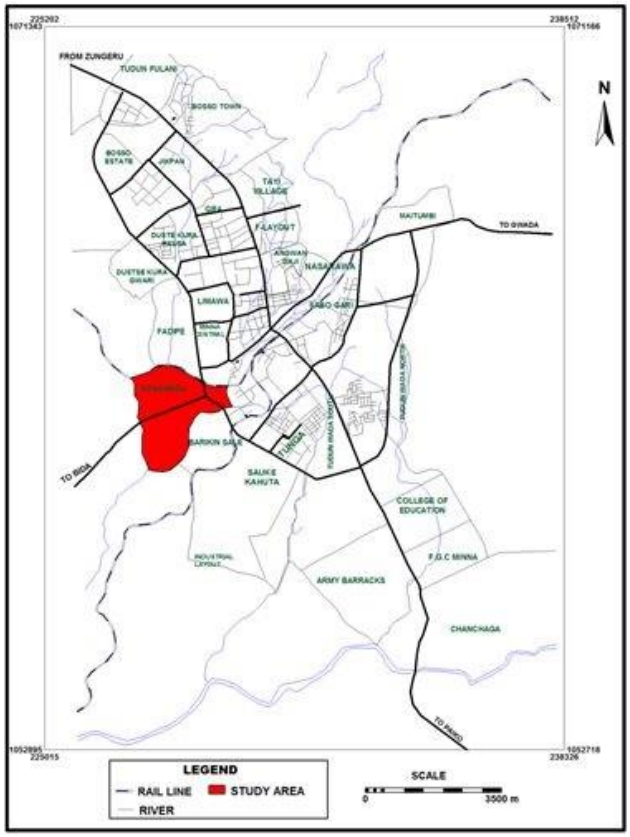

Figure 2: Kpakungu Neighbourhood highlighted in the Street Map Guide of Minna
Source: Department of Urban and Regional Planning, FUTMINNA

MATERIAL AND METHOD

Sources of Data

Data for this study were collected through Primary and Secondary sources. A total of 95 questionnaires were administered using Stratified random sampling, and each unit has certain number of questionnaire based on the population of the unit. Kpakungu neighbourhood was divided into eight units for easy administration. At each unit a random sampling was employed to give each household an equal chance to be selected. At unit one, nine questionnaires were administered; at unit two, eleven questionnaires, were administered; at unit three, fifteen questionnaires were administered; at unit four, sixteen questionnaires were administered; at unit five, thirteen questionnaires were administered; at unit six, twelve questionnaires were administered; at unit seven, ten questionnaires were administered and at unit eight, nine questionnaires were also administered. The perception of the households on the issues of slum and town planning activities in Kpakungu neighbourhood was ascertained. Pollution levels in Kpakungu were recorded for seven days at three different intervals (morning, afternoon, and evening). This was done with the use of the Rasi 700 gas metre and the mean of the gases were computed. The coordinates of the location where these gases were taken was also recorded. Data on the development control in Kpakungu were sourced from Development Control Department of the Niger State Urban Development Board, Minna through an oral interview. Data on crime was obtained from the Nigeria Police Force Kpakungu Division, the crime report was later corroborated by the findings from the literatures on crime in Minna.

Post Processing

Spatial analysis of the growth of the neighbourhood over the planned period was obtained from three sets of images, which are the Enhance Thematic Mapper of 1999, 2006 and 2014 (Table 1). The area of interest (Kpakungu) was "clipped" out of the three images using Arcgis 10.2 software. Band combination of 4,3,2 were used to form the "False Colour" composite for the images via the use of the "New Map list" operation tool on ILWIS 3.3 Academic. On band 4,3,2 "False Color" composite, Vegetation appears in shades of red while Urban areas and Densely populated urban area come out in cyan blue and light blue respectively. Sample Set for urban areas and vegetation were created on all the images in question (1999, 2006 and 2014) after which the images were subjected to maximum likelihood classification on ILWIS 3.3 academic.

On each of the classified images of Kpakungu neighbourhood the urban area were digitized and then over laid. This task was performed in order to determine the direction and spatial extent of Slum in Kpakungu neighbourhood. Finished were composed into maps by adding graticules, scales, legend and cardinal point.

Data Processing Techniques

Data processing techniques used for this study include: Data evaluation, Image Sub-setting, Image Classification, Overlay Analysis and Map Composition.

Table 1: Image Properties

S/No	Image Year	Path and Row	Sensor	Captured Date
1	Kpakungu 1999	P189 R053	ETM^+	03 /04/1999
2	Kpakungu 2006	P189 R053	ETM^+	11/07/2006
3	Kpakungu 2014	P189 R053	ETM^+	04/04/2006

RESULT AND DISCUSSION

Factors Responsible for Slum Growth in Kpakungu, Minna

Several factors were advanced by the perception of respondents as reasons for its spatial growth. Factors responsible for slum proliferation in Kpakungu reveals that 3.2% of the

respondents were of the view that transportation nodes in Kpakungu must have influenced slum proliferation in Kpakungu, 15.8% of the respondents opined that economic activities in Kpakungu is responsible for Slum proliferation. Low land value was attributed for slum growth by 26.3% of the respondents in Kpakungu. Majority of the respondents (42.1%) are of the view that low rent must have influenced the growth of slum in Kpakungu while 12.6% of the respondent believed that the development of micro housing has swayed the growth of slum in Kpakungu (Table 2).

Table 2: Factors Responsible for Spatial Growth of Kpakungu

Factors	No of Respondents	Percentage
Transportation Node	3	3.2
Economic Activities	15	15.8
Low Land Value	25	26.3
Low Rent	40	42.1
Development of Micro Housing	12	12.6
Total	**95**	**100.0**

The result of the study indicated that all these factors contributed in different proportion to development of slum spatially in the neighbourhood. Though perception is subjective, it corroborated the findings of other researcher that low cost of illegal land, unplanned and unserviced land as well as low rental value is the factors that encourages slum development (UN-Habitat, 2003; Tibaijuka, 2005; UNDP, 2003; and World Bank and UNCHS, 2002).

Spatial development of Kpakungu, Minna between 1999 and 2014

Table 3: Land Area of Slum between 1999 and 2015

Year	Area (Hectares)	Percentage of Increase
1999	119.610	
2006	272.970	128
2014	482.940	77

Table 3 reveals a progressive growth spatially in the size of Kpakungu neighbourhood between 1999 and 2014. The spatial extent of Slum area in Kpakungu in 1999 (base year) was 199.610 Ha. In 2006, the Slum area rose to 272.970 Ha (128 percentage of increase). The relocation of Federal University of Technology, Minna and National Examination Council in 2005 to Gidan-kwano and Gidan Mangoro respectively, influenced the proliferation of slum in Kpakungu neighbourhood in 2006. These settlements (Gidan-Kwano and Gidan Mangoro) are all adjoining settlement to Kpakungu Neighbourhood. In 2005, construction of buildings were done to meet the housing need of staff of National Examination Council and Staff and students of Federal University of Technology with little or no regard for development control. Slum proliferation in Kpakungu increased by 77% in 2014 compared to 2006 size. As at the end of 2014, Kpakungu neighbourhood has spread territorially to about 482.940 Ha. The proliferation of Slum at this period can be attributed to increase in Commercial activities in Kpakungu. Figure 3 and Figure 4 shows the spatial extent of Kpakungu in 1999, 2006 and 2014 respectively.

The overlay of the spatial development of the Kpakungu slum over the study period is indicated in Figure 5. This was depicted by different colours, the red colour indicated the area extent of the neighbourhood in 1999, the green indicated the area extent in 2006 and blue colour implies the development in 2014. The overlay shows that between 1999 and 2014 (period of 16 years), the slum has expanded more than two folds.

The development of the slum is toward the western and southern part of Kpakungu neighbourhood. At the western axis Federal University of Technology and National

Examination council are seen as growth pole while Shiroro Hotel is seen as the growth pole at the southern axis of the neighbourhood.

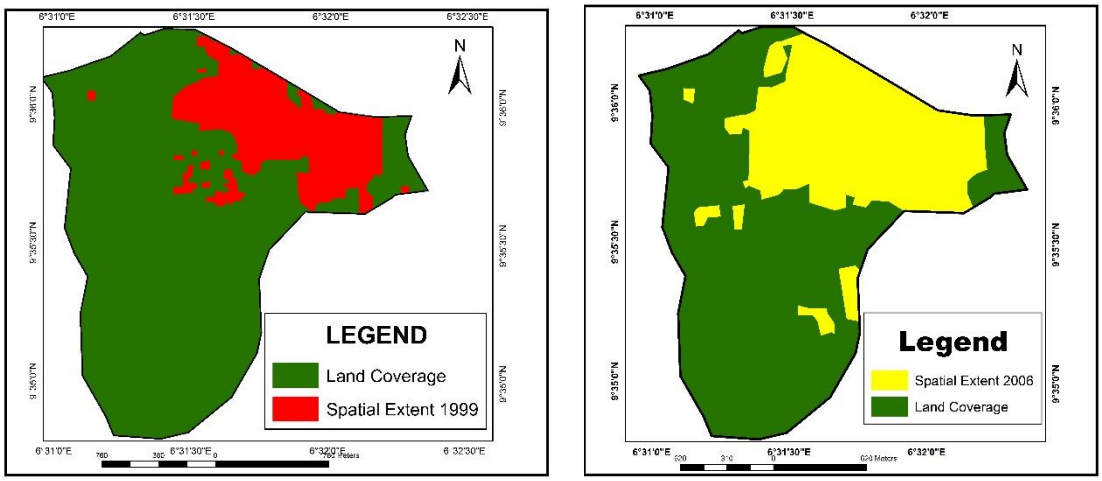

Figure 3: *Spatial Extent of Slum in 1999 and 2006*

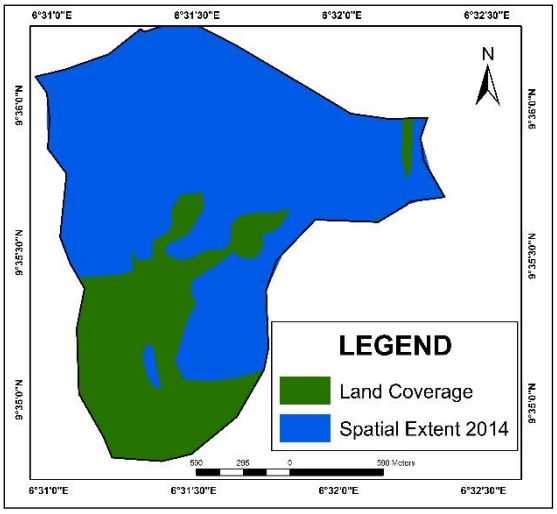

Figure 4: *Spatial Extent of Slum in 2014*

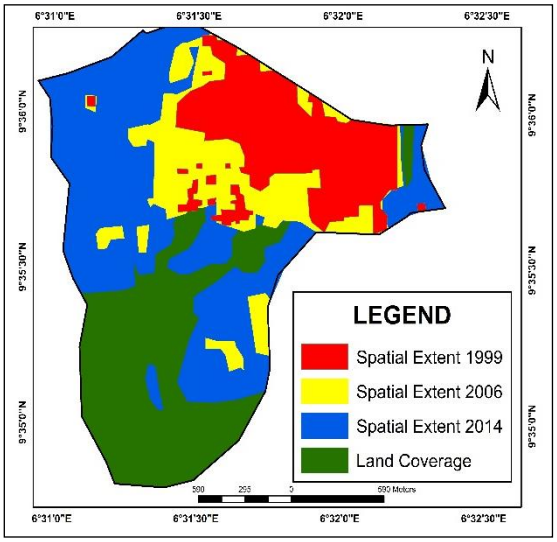

Figure 5: Overlay of Spatial Extent

Implications of Slum Proliferation

There are many implications of the slum development in Kpakungu, these ranges from all forms of social vices to local acts. The prominent types of insecurity faced by the inhabitant of Kpakungu neighbourhood are Armed Robbery, Burglary, Stealing and increase in Juvenile delinquency. A significant number (46.3%) of the respondents believed that stealing was more pronounced in Kpakunugu, 25.2 % of the respondents were of the view that burglary was rampant in Kpakungu, 25.3% of the respondents were of the opinion increased in juvenile delinquencies was raging Kpakungu while Armed Robbery which constitute 3.2% of the respondents was believed to be threatening.

According to the Nigerian Police force, Divisional Headquaters Kpakungu, a total of 86 cases of crime was reported between 1999 and 2014 in Kpakungu. The police force opined that out of the other neighbourhoods in Minna, the number of cases of crime in Kpakungu was more. As a result of this Kpakungu neighbourhood was termed as a hot spot area. Jinadu, Morenikeji, Sanusi, Dukiya and Owoyele (2013) in their study on "Digital Mapping of Crime Statistics in Minna" also termed Kpakungu neighbourhood as a hot spot zone when it comes to crime. Between 2000 and 2011, Kpakungu recorded the highest incidence of crime in Minna, Niger State and this was attributed to slum proliferation (Jinadu, et al., 2013). It was observed that the inhabitants of Kpakungu were faced with the problem of flooding, Land Degradation and Erosion at the western part of the neighbourhood these problems can as well be attributed to the slum expansion.

The problem of poor sanitation in Kpakungu was also seen in the manner of waste disposal as 33.7% (highest number of respondents) of the respondents disposed their waste in the drainage channels. The methods of burning and incineration were adopted by 6.3% of the respondents and 24.2% of the respondents respectively. The services of the Niger State Environmental protection agencies were employed by 23.2% of the respondents.

Problem of insecure tenure were also pronounced in the Kpakungu as 72.6% of the respondents do not have a secure tenure. Only 15.8% of the respondent could boast of a secure tenure. The low number of secure tenure in Kpakungu can be attributed to the organic nature of the neighbourhood.

Level of Pollution in Kpakungu Neighbourhood of Minna

One of the environmental consequences of slum development in Kpakungu is pollution as a result of poor sanitation and unclean environment. The national air quality standard according to National Environmental Standard and Regulation Enforcement Agency (NESREA) indicated that the amount of various components of the air ranges between 10ppm for CO; 0.04 -0.06ppm for NO_2 and 0.01ppm for SO_2.

Table 3: Level of Gas Emission in Kpakungu in 2011 and 2014

Coordinate		Standard	2011	2014
	Gases	Unit (PPM)	Unit (PPM)	Unit (PPM)
229272 1061852	CO	10	10.00	15
	H_2S	10	0.00237	5
	NO_2	0.04 -0.06	0.00312	14
	SO_2	0.01	0.00295	0.02

Table 3 reveals the level of gas emission in Kpakungu in 2011, after the average emission of the were recorded CO constitutes 10.00ppm, H2s constitutes ppm while No_2 and So_2 reads 0.00312ppm and 0.00295ppm respectively (ATPS, 2013). The level of gas emission increased in 2014, 15ppm was recorded for CO, 5ppm was recorded for H_2S, 0.02ppm was recorded for SO_2 and 14ppm was recorded for NO_2. The value recorded in 2014 were higher

than the stipulated value by the NESREA which state 10ppm for CO, 0.04 -0.06ppm for NO_2 and 0.01ppm for SO_2 (FEPA, 1999). The High pollution values can be attributed to slum proliferation and large concentration of Motor cycles in Kpakungu.

Impact of Town Planning Activities in Kpakungu between 1999 and 2014

Since the inception of the present political dispensation (1999) the Niger State Urban Development Board has been saddled with the responsibility of curbing the problems posed by slum proliferation in Kpakungu. Development control mechanisms were employed by the Agency on a smaller unit and building plans were properly scrutinized before approval. More so, site inspections were often carried out by the agency to checkmate the activities of contraveners in Kpakungu. The Niger State Urban Development Board opined that development control cannot be done on a larger scale in Kpakungu because the neighbourhood was just an organic settlement with no initial plan.

As a result of the ineffectiveness of the "smaller unit of development control" the Niger state urban Development Board proposed a Slum Upgrade for Kpakungu in 2008 before the entire Neighbourhood degenerate. The proposal of the Slum Upgrade for Kpakungu was defended that same year (2013) at the Federal Ministry of Lands, Housing and Urban Development.

The Slum upgrade proposal was accepted by the Federal Government and this was published in the memo of the National Council of Lands, Housing and Urban Development in 2013. Niger State Urban development Board believed that lack of political will by the government has hindered the implementation of the proposal. The Niger State Urban Development Board were of the opinion that the inability of the board to have her proposal approved has further made planning deteriorate in Kpakungu and this in turn has made development control ineffective in kpakungu.

RECOMMENDATION

Based on the major findings in the study, the following recommendations are made to ameliorate the problems of Slum proliferation in Kpakungu Neigbourhood.

There is need for slum upgrading in Kpakungu through rehabilitation, creation of accessibility as well as provision of urban basic services. This approach will go a long way to revitalize Kpakungu. More so inclusive planning approach should be adopted in the slum upgrade plan intended for Kpakungu, this will make the plan more viable.

The reconnaissance survey of the study area shows that there is no designated solid waste disposal area. The only waste collection point in the study area is far from the houses of the residents of the neighbourhood. The agency responsible for waste collection concentrated on only the designated dump site, and this has led to problem of indiscriminate waste disposal in drainage channels, open spaces uncompleted buildings. Niger State Environmental Protection Agency therefore need to address the problem of waste management in Kpakungu to forestall environmental and health hazard. Also public enlightenment campaign should be carried out on the dangers of insanitation by the Niger state Environmental Protection agency. This will help the inhabitant of Kpakungu keep a more hygienic environment.

All the Activities of the Niger State Urban Development Board should be well supported by the Niger State government through effective development control mechanism. In addition, Inhabitants of Kpakungu should be made to revalidate their tenure because this will assist in controlling slum development in Kpakungu and Minna at large.

CONCLUSION

From the analysis presented above, it can be seen that the relocation of the Federal University of Technology, Minna and NECO has contributed to the development of slum in Kpakungu neighbourhood of Minna. It was also observed that within the spate of 16 years, the Slum grows more than 2 folds (192.61 Ha in 1999 and 484.7 Ha in 2014). This implies that the slum is growing astronomically. The implication of this growth has been the increase in crime activities, poor sanitation and increase in air pollution beyond the national standard. The tools of town planning (development control) have not being able to stem the tide of unplanned development in the neighbourhood.

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Assessment of Peri–Urban Zones in Benin City, Nigeria: A Focus on Ekiadolor Community

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ABSTRACT

Peri-urban zones are areas capable of promoting urban and rural livelihoods and coping with the pressure and dynamics of population and land use changes. On the other hand, they constitute areas that lead to progressive degradation of the environment and collapse of institutions. This study examined the drivers of growth, characteristics and environmental challenges of the peri urban zones in Benin City, Nigeria using Ekiadolor as a case study. A sample size of 393 amounting to 30% of the total number of building stock in the area was chosen. For the survey, one household per building was selected. A random sampling approach was subsequently adopted to select any available head of household for interview. Some of the attributes investigated included occupation, family size, reasons for staying in the community, length of stay, buildings characteristics, infrastructures, road network and land related issues. The peculiar characteristics of a typical peri-urban community and its associated environmental problems were well amplified in Ekiadolor community. It was observed that the establishment of the College of Education and the accompanying employment opportunities was the major driver for the transformation of Ekiadolor to a peri-urban settlement. Other observed drivers include the relatively low housing rents and low cost of land in the community. The study concluded that the establishment of institutions such as universities, colleges of education and research institutes among others outside the immediate precinct of cities could trigger peri – urbanization and therefore recommends that adequate provision should be made in anticipation of the envisaged challenges that are associated with such development. The study further advocated for the creation of a specialized unit to plan and coordinate such settlements. It finally calls for a synergy between the peri-urban communities and the main cities through progressive integration.

Keywords: Benin City, Ekiadolor, haphazard growth, Peri-urbanization, urban growth

INTRODUCTION

Peri-urbanization refers to a process, often a highly dynamic one, in which rural areas that are located on the outskirt of established cities become more urban in character (Webster and Muller, 2004). This transformation occurs in physical, economic, and social terms, and often in piecemeal fashion. Peri-urban development usually involves rapid social change, as small agricultural communities are forced to adjust to an urban or industrial way of life in a very short time. High levels of in-migration are an important driver of such social change. Rapid environmental deterioration and infrastructure backlogs are usually another characteristic of the peri-urban landscape. Typically, peri-urbanization is stimulated by an infusion of new investment, generally from outside (Webster and Muller, 2004). Therefore, peri-urban area could be defined as the transition zone between fully urbanized land in cities and areas in predominantly agricultural use (Appiah, Bugri, Forkio and Boateng, 2014). Thus, it is characterized by mixed land uses and indeterminate inner and outer boundaries. In general, peri-urbanization often arises because effective land use guidance systems are virtually non-existent in many countries (Webster and Muller, 2004).

Key characteristics of the peri-urbanization process, particularly in developing countries include: changing economic structure, a shift from agriculturally based to manufacturing dominated economy; changing employment structure, rapid population growth and urbanization, changing spatial development patterns and rising land costs (Webster and Muller, 2004). The peri-urban (sometime also called the urban fringe) may be the dominant urban form and spatial planning challenge of the twenty-first century (Ravetz, Fertner and Nielsen, 2013). In older industrial or post-industrial countries, the peri-urban is a zone of

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social and economic change and spatial restructuring while in new industrializing countries, and most of the developing world, the peri-urban is often a zone of chaotic urbanization leading to sprawl (Ravetz, Fertner and Nielsen, 2013). Peri urban zone exhibits a relatively low population density by urban standards, scattered settlements, high dependence on transport for commuting, fragmented communities and lack of spatial governance (Ravetz, Fertner and Nielsen, 2013).

The term peri-urban is used frequently in the literature and in policy discussions, yet definitions are largely situational and case specific. They provide little basis for unified understanding of what constitutes peri-urban. Organization of Economic Co-operation and Development (OECD) (1979) therefore concludes that the term "peri-urban" cannot be easily defined or delimited through unambiguous criteria. It is a name given to the grey area which is neither entirely urban nor purely rural in the traditional sense; it is at most the partly urbanized rural area. Whatever definition may be given to it, it cannot eliminate some degree of arbitrariness.

The peri-urban areas have and continue to experience incessant push and pull tendencies from the cities and the rural areas due to their strategic locations, and multifunctional territorial nature (Ravetz, Fertner, and Nielsen, 2013).). According to Lawanson, Yadua, and Salako (2012) in their study of Lagos and Ibadan in Nigeria, the preference for the peri-urban areas for settlement and other commercial pursuits, is motivated by the fact that these fringes of cities have some of the relatively affordable rent in comparison to the main city and big towns.

Masanja (1999) identified two major driving forces for conversion and transformation of land use in the peri-urban peripheries. They include: demand for housing for the growing population and the deteriorating housing conditions and inadequate urban services. Webster (2002) however attribute the reason for conversion of land for urban development as being a result of higher economic gains from conversion and transformation to other land uses other than agriculture. With economic rationality of the land owners, they would opt for other activities with higher future earning returns on their land, against agriculture (Irwin and Geogeghan, 2001), in the end, subtly creating pressures on food security in the areas.

In general, peri –urban settlements are usually a reflection of the urban settlement. Urban population growth results to increased population densities within established urban areas as well as in the outward thrust of urban agglomeration, that is, peri-urban regions. It is therefore anticipated that the development of a peri-urban area is an inevitable consequence of urbanization and as cities in developing countries continue to grow, the peri-urban area moves outward in waves (DFID, 1998). This process is manifested primarily by an outward expansion of built-up areas and the conversion of prime agricultural lands for residential and industrial purposes (Brennan, 1999). As the cities expand, the main zone of direct impact is the peri-urban area.

Cities in Nigeria like other parts of the world are experiencing unprecedented rates of growth. According to the Nigeria National Economic Empowerment Development Strategy (NEEDS, 2004), *the rate of urban growth in Nigeria is one of the fastest in the world.* Since the emergence of ancient cities such as Benin, Kano and Zaria between the 14th and 17th century, there has been a steady evolution and multiplication of urban centres. The rate of multiplication however became greater from the 1960's with more urban centres emerging than before then. As at 1960 only four major administrative centres existed, these centres were Lagos, Ibadan, Enugu, and Kaduna. By 1967, the centres rose to 13, while it became 21 centres in 1987. The centres again rose to 30 administrative state headquarters in 1991.

Similarly administrative changes were undertaken at the local level resulting in the emergence of towns which are now headquarters of local government areas (Onokerhoraye and Omuta, 1994a).

In the 1996 state and local government creation, the number of state administrative centres increased to 36 while local; government headquarters increased to 774. These administrative centres have over the years attracted commercial and industrial activities which have in turn encouraged immigration from rural areas to them thereby leading to rapid urbanization. The 1950 estimated percentage of Nigeria's population living in the urban areas was 15%. This rose to 23.4% in 1975 and 35% in 1991. By the 2006 estimates, Nigeria has a population of 140 million. By this figure, approximately 60.7 million Nigerians are currently living in the urban areas. The rate of urbanization is 5.5% while the annual population growth is 3.0%. Using the 140 million estimates of 2006 and the rate of urbanization, it is believed that more than half of Nigerian population will be living in urban centres by the year 2020 (Oluwasola, 2007).

Rapid urbanizations have changed the urban landscape of most Nigerian cities. This rapid rate of urbanization according to Organization for Economic Cooperation and Development (1979) has significant impacts on urban growth and population increase. These impacts of economic growth and physical expansion of the urban area are not confined within urban boundaries; they reach into much wider areas surrounding urban centres, creating so-called urban fringe areas, or peri-urban areas. There have been concentration and congestion in inner cities and the opposite process of suburbanization and dispersal at the urban fringes, the peri-urban areas.

Onibokun, Olokesusi and Egunjobi (1987) and Onibokun and Kumuyi (1999) assert that various political and socio-economic factors have mainly been responsible for the rapid growth of urban population. The economic opportunities offered by cities are strong drivers for rural-urban migration. Many of these rural migrants find it difficult to fit themselves in the urban centres and therefore settle in the urban fringes (peri-urban areas). Pasquini and Maconachie (2005) also pointed out that the Nigerian structural adjustment policies of the 1980s forced many people to the peri-urban areas for agricultural purposes to supplement their meager income. Large numbers of urban residents, pushed out by high housing costs in the city, look for cheap accommodations in the peri-urban areas.

Peri-urban areas in developing countries pose many problems including unintensive use of land, low level of services and infrastructure, few job opportunities, uncoordinated development and high cost of providing services, lack of clear jurisdictions and weak planning control, etc. They manifest the deep seated problems that face third world cities and societies. Some of these causal factors are unsustainable urbanization and urban growth, poor economic policies and poor management of available resources, etc. Challenges of peri-urban areas in developing countries are similar in nature. Most of developing countries experience spontaneous development pattern rather than planned growth. Hence the challenge of peri-urban zones is development in informal way. Land development takes place without conforming to planning regulations. Due to high demand of land, marginal lands in low lying areas, hills and infrastructural setback are being filled up for development purpose, without considering any environmental impact. As corroborated by Onokerhoraye and Omuta (1994b), peri-urban area in Nigerian is characterized by incomplete range of penetration of urban utility services and uncoordinated zoning. The perception that the peri-urban area is no man's land accounts for environmental problems therein. Activities of land speculators who involve in indiscriminate subdivision of peri-urban land are also responsible for the environmental problems. Globally, peri-urban areas are often characterized by extremely

vibrant mix of land uses, not as a result of deliberate planning, but because unregulated development has taken place within the specific peri-urban area. Thus in a single street, commercial uses in form of stores, residential apartment, educational institutions, light or small scale industries and agricultural uses can all be found. All these land uses are also often associated with problems of safety, pollution (air and noise) and general poor quality of life.

These peri-urban areas, on the other hand offer many positive opportunities by absolving the overspill populations and jobs from the cities and therefore relieving them of serious problems of congestion, overcrowding and pollution. They also offer land for agriculture for food production for the urban dwellers and a means of living for many of the urban poor, cheap land for housing, industry among others.

Like many other settlements in Nigeria, settlements in Edo State are also fast urbanizing. The rapid growth in population and socio-economic activities of major towns in the area in recent years indicates this trend. In this regard, there has been an unprecedented transformation of many rural settlements into urban centres. This scenario is most amplified in Benin City which is now enclosed with notable peri-urban communities. This study intends to investigate the characteristics and the drivers of this peri-urban zone in the city using Ekiadolor Community as a case study.

MATERIALS AND METHODS

Research Site

The study area is Ekiadolor community in Benin City, Edo State, Nigeria. Benin City is a city in southern Nigeria, and capital of Edo State. It is located on the latitude 6^{o} 30N and 6^{o} 00E. The city lies in the Warm Humid Equatorial Region in the tropics with two dominant seasons, that is, the wet and dry season. The vegetation of the area falls within the rain forest belt. The predominant ethnic group is Bini which constitutes about 70% of the population. Other ethnic groups in this community include Igbo, Urhobo, Esan, Etsako, Ijaw, Isoko and Yoruba.

Ekiadolor community is about 18 km from Benin City. It is an ancient community. Prior to the establishment of the College of Education in the 1980s in the community, Ekiadolor could rather be described as a village. The establishment of the College of Education resulted into influx of people especially the staff of this College. Other ancillary workers especially traders and artisans also moved to this community. There was a general belief that the establishment of this College will herald rapid infrastructural development of the community. The high quality of life expected in this community led to the massive activities of land speculators and their indiscriminate land subdivision. At the inception of this College, house rent was rather too low in Ekiadolor. Thus, urban dwellers in Benin City who had been facing acute shortage of housing now found respite in Ekiadolor. This increase in the population of the community is further enhanced by its strategic location along the Benin – Ore Expressway. Thus, residents of Ekiadolor could easily commune between the city and the community with ease. This expressway also links Benin with other parts of Nigeria and also serves as connecting distributaries to major towns and roads that converge along its axis.

The Database

Ekiadolor is a community with a population of 5,593. It comprises of 32 streets with 1,350 buildings. Using the total number of buildings as sample frame and an assumption of one household per building, a sample size of 30% amounting to 393 buildings was used for this study. Based on this assumption, a total number of 393 questionnaires were distributed. Subsequently, random sampling approach was employed to select the 1^{st} building, and every 3^{rd} building was systematically selected in that order on each street from which any available

head of household was interviewed. This appears plausible since there are traits of homogeneity in habitability in this study area. For the purpose of data analysis, descriptive statistics including tables, charts, frequencies and means were utilized. Pictures were also used to depict the nature of the environment.

RESULTS AND DISCUSSION

Findings revealed that the working class group (31 – 50 years) constitutes the dominant (67.3%) age group in the study area. This group is the active force of any settlement and will have positive effect on the economy of the residents. Among these two groups are those that are still in the civil service and self-employed (Table 1). This observation reinforces the fact that the inhabitants of Ekiadolor community are possibly workers who were originally living in Benin City.

About 30% of the inhabitants in the area are illiterates. 23.4% have only primary school leaving certificate, while 20% attempted secondary school and 25.3% have tertiary education (Table 1). The implication of the low level of education of the people in the area undermined the importance of healthy environment as significant proportion of the inhabitants live below the minimum environmental standards stipulated in the planning code of the country.

A greater percentage, that is 46.4% of the respondents are within the income range of N151,000 – N300,000. This implies that they receive the stipulated minimum wage which is N18,000 per month. While only 15.4% receives above the minimum range and 38.2% receives below (Table 1). This shows a high prevalence of poverty in the area. This observation attests to the fact that the immigrants from Benin City to this community might be relatively low income group who are in search of low rents.

It was observed that 47.1% of the respondents are civil servants. Some are engaged in the College of Education in the community while a greater percentage are those who work in the city centre but have either built or rent an apartment in Ekiadolor in a bid to move away from the crowd in the city centre and its associated problems. This is closely followed by traders (31.2%). These traders are found within and outside the school premises with their various kiosks, shops used for various businesses like canteen, business centres, phone booths etc. Other occupations are farming (12.7%) and artisanship (8%) (Table1). The community still has pockets of fairly large vacant land that is yet to be developed.

The implication of the foregoing is that the establishment of the College of Education was a major driver for the transformation of the community to peri-urban settlement. In addition, one could infer that the relatively low rents and cost of land in the community must have informed other civil servants especially from Benin to build their own houses or rent apartments for living in this community. The data further revealed that the traditional occupation of this community is gradually waning as less than 12% are now into farming. The observed large pockets of vacant land in the community attests to weakness of physical planning instruments as buildings are arranged in haphazard manner.

Ekiadolor is essentially a Bini community. However, the study observed that the community is inhabited by different tribes. As informed by the Edionwere (the community head), apart from the Binis, others tribes in the community are Yorubas, Urhobos, Isokos, Ibos, Calabars, Kwales. Only 56% of the inhabitants are Binis. It could be inferred that a significant proportion of other tribes in this community might have been the College of Education workers and migrants from Benin City and other communities who have come to seek greener pasture and more comfortable accommodation.

Employment opportunities offered by the College of Education which also triggered trading opportunities among the inhabitants account largely (65.3%) for decision to reside in Ekiadolor (Table 1). Another significant reason (22.9%) is the prevailing low cost of land and rent in the community. Other identified reasons include safety (1.8%) and nativity (6.3%) (Table 1). Thus, it could be concluded that the most important drivers for the transformation of Ekiadolor into a peri-urban community are the establishment of the College of Education and the accompanying employment opportunities, low cost of land and low housing rent.

Table 1: Socio-Economic Characteristics

Variable		Frequency	Percent
Age Bracket			
	Below 20	2	0.5
	20 – 30	46	11.9
	31 – 40	163	42.4
	41 – 50	103	26.9
	Above 50	70	18.3
Nativity			
	Binis	220	56
	Yorubas	78	18
	Ishan	47	12
	Urhobos	39	10
	Others	16	4
Reason for residing in the community			
	Safety	7	1.8
	Employment	158	41.1
	Nearness to market	93	24.2
	Place of birth	24	6.3
	Family land	11	2.9
	Others	3	0.8
Educational Level			
	Primary	90	23.4
	Secondary	77	20.0
	Tertiary	97	25.3
	No Formal Education	120	31.3
Occupation			
	Trading	123	31.2
	Civil Service	185	47.1
	Artisanship	31	8.0
	Farming	50	12.7
	Others	4	1.0
Income Level			
	Below N50,000	9	2.3
	N51,000- N150,000	138	35.9
	N151,000- N300,000	178	46.4
	N301,000-N500,000	42	11.0
	N500,000 +	17	4.4

A greater percentage of the buildings sampled are used for residential purpose. Most of the buildings (94.8%) sampled in the study area are bungalows (Table 2). While some are flats which are preferred by private owners who reside therein with their families, others are tenement buildings which are mostly preferred by developers who put the structures on rent because of their high rent yield. The pattern of building revealed in Ekiadolor is the informal type. It is obvious from these findings that Ekiadolor is essentially a residential corridor for the College of Education workers and the civil servants who commune daily between Benin City and the community.

The condition of housing in the study area is very poor due to the low quality of materials used for their construction, inadequate technology and poor planning standards of the building components. Most houses in the study area have relatively low habitability, as they were not properly maintained by their users who are mostly tenants. The area lacks any

evidence of physical planning and development control as about 80% of the landlords do not have any building permit for their buildings (Table 2). The buildings are scattered and do not conform to any building standard. They lack accesses. Setbacks and airspaces between buildings are rarely observed. These parameters are major determinants of the quality of an environment (Mabogunje, 1980). Thus, the quality of the environment in Ekiadolor community could be described as very low.

About 13% of the buildings are mud houses, 44.79% made with concrete, 26.83% plastered, and only 15.36% plastered and painted (Table 2). Roofing materials of the buildings in the community are 89.9% of zinc coated corrugated iron sheets types, only about 4.2% are made of PVC (Table 2). This depicts the different stages and years of development in the area.

In the assessment of general condition of the environment, about 50% of the respondents agreed that their environment is unkempt and overgrown with grasses. This was followed by the 28.5% who affirmed that the environment was dirty. Only 18.3% considered their environment as clean while 4.1% assessed theirs to be flooded (Table 2). Transect walks around the community further confirms this response.

Ekiadolor community has no approved layout. This implies that the community is unplanned while physical planning standards and regulations are compromised. This is a clear manifestation of lack of government presence in this community. Thus, buildings are indiscriminately built on drains, setback etc. In addition, there is no distinct road network pattern. Access to most buildings (51.7%) is by footpath while 48.3% has distinct access road. However, only 20.3% of the respondents access their buildings through tarred road (Table 2). This observation indicates that the Government failed to respond to the physical planning needs of this community irrespective of the envisaged increase in population following the development of the College of Education.

Most of the roads in the community are untarred (Table 2). However, due to constant use and lack of drainage the road is in a dilapidated state with potholes and flooded during the rainy seasons. There is no evidence of government intervention in the area of road construction and maintenance in the community.

Table 2: Building characteristics

Variables	Frequency	Percent
Building Type		
Bungalow	364	94.8
Storey Building	12	3.13
Duplex	8	2.07
Availability of building permit		
Without building permit	307	80
With building permit	47	20
Wall		
Mud	50	13.02
Concrete	172	44.79
Plastered	103	26.83
Plastered and painted	59	15.36
Roof Type		
Corrugated iron sheet	344	89.8
Clay tiles	24	6.0
PVC	16	4.2
Environmental Condition		
Clean	70	18.3
Dirty	109	28.5
Unkempt	189	49.1
Flooded	16	4.1
Accessibility to building site		
Footpath	198	51.7
Tarred road	78	20.3
Untarred road	108	28.0

Most households (65.7%) in this community depend on pit latrine (Table 3 and Fig. 1). As confirmed by some respondents, age of buildings, ignorance, lack of proper education and awareness on health and hygienic issues are largely responsible for this option. Again, latrines are easier and cheaper to construct. Only 10.4% used modern day water closet, while 23.9% depend on open defecation (Table 3). This category of respondents makes use plastic bags which are subsequently thrown into the nearby bush, dunghills, backyards, stream and drainage channels. Thus, the community appears aesthetically unpleasing as it is polluted with plastic bags and human wastes making it vulnerable to diseases such as diarrhea, typhoid and cholera. This scenario indicates the high level of prevailing poverty in Ekiadolor.

Table 3: Household Facilities

Facility		Frequency	Percent
Toilet Facility			
	Pit latrine	198	65.7
	Water Closet	78	10.4
	None	108	23.9
Disposal Method			
	Open Space	170	43.3
	Burning	97	24.7
	Roadside & Drainage	88	22.5
	Others	38	9.5
Source of Energy			
	Electricity (PHCN)	355	92.5
	Generator	7	1.7
	None (Kerosene Lamp)	22	5.8
	Natural Gas	-	-

Figure 1: A typical latrine in the community

A large proportion of the buildings examined have bathrooms and kitchen, only that they are substandard, inadequate or inconveniently located. Many of the bathrooms are just small enclosures, some of which are made of materials like bamboo, rusted iron sheets, or planks and located at the backyard. The use of firewood and charcoal for cooking is common; hence many of the buildings have their kitchens located at the backyard, residents of such areas cook food in the open rendering food items and utensils vulnerable to disease causing pathogens. Only the few ones that used kerosene stoves cook at the passage or right inside their rooms.

Water supply is not a serious challenge in the community. Most respondents revealed that adequate provision is made for supply of water as it has about twenty six (26) boreholes constructed in different years and located at various streets within the community among

which twenty (20) are still functional. These bore holes were constructed by individuals, past governors and Federal government.

The state of waste disposal in the area is generally poor. There is no controlled method of waste disposal in the community (Table 3). Over 40% dispose their refuse in open spaces (Fig. 2); some through burning within residential environment (24.7%) thereby causing air pollution while others dispose theirs at road sides and drainages (22.5%).This hampers the free flow of run-off and constitutes comfortable breeding grounds for flies, mosquitoes other health-infected animals that could contribute to the spreading of diseases. In the rainy season flooding is also prominent in the area as a result of blocked drains.

Figure 2: Indiscriminate dumping of refuse

The main source of electricity supply to the area is through the Power Holding Company of Nigeria (PHCN), which accounts for 92.5% of the sampled households. About 1.7% used generating plant as supplements (Table 3). This is quite impressive as respondents were of the opinion that supply of electricity in the community is constant except for a situation where a fault is identified, then such area affected may be put in total darkness for weeks or sometimes months. To ensure adequate supply of electricity, the community is furnished with three (3) transformers which were facilitated by community members through the Ekiadolor Community Development Association. This association has also helped in other areas such as road maintenance, supplies of instruction materials to schools and security among others.

Other facilities investigated in this category include school, health and security facilities. Educational facilities available are limited in number. There are three (3) primary schools, three (3) secondary schools (one owned by the Government and two private owned) and a higher institution located in the community. The schools are poorly funded, managed, lack good structures, learning facilities and conducive environment (Figure 3). The students also do not have access to water and toilet facility. They make use of open field for defecation.

Figure 3: The existing schools is the community are in a state of disrepair

The community has three hospitals/ health centres. Two are owned by the government (Health Management Board and Primary Health care) while the third is owned by an

individual. The surroundings of the Government health centres are unkempt as they are engulfed by weeds. A large number of the respondents complained of having the facilities either farther away from their dwellings or completely absent within their neighbourhoods. A large proportion of the inhabitants confirmed paucity of health facilities in this community (Figure 4). No doubt, in terms of infrastructure, there is a palpable neglect of Ekiadolor community by the government.

Figure 4: The Primary Health Centre in the community appears unused as it is overgrown with weeds

CONCLUSION

This study has investigated the characteristics and the drivers of a typical peri-urban zone in Benin City, Nigeria using Ekiadolor Community as a case study. It was observed that the establishment of the College of Education and the accompanying employment opportunities was the major driver for the transformation of Ekiadolor to a peri-urban settlement. In addition, the relatively low housing rents and low cost of land in the community must have informed civil servants from Benin City to build their own houses or rent apartments for living in this community. Thus, Ekiadolor is essentially a residential corridor for the College of Education workers and the civil servants who commune daily between Benin City and the community.It was further observed that the traditional occupation of Ekialdolor community which is farming has waned over the years as most inhabitants are now civil servants.

There was a clear evidence of poverty in Ekiadolor as manifested in all the indexes of quality of life including educational facilities, health facilities, water and sanitation facilities among others. In general, evidence of government intervention in the development process of this community is scanty as manifested in the poor quality of technical and social infrastructure. This situation is further amplified by the weak applications of appropriate physical planning standards to regulate land use thereby resulting into haphazard development of this community.

It could be concluded from this study that the establishment of institutions such as universities, colleges of education and research institutes among others outside the immediate precinct of cities could trigger peri – urbanization. Such facilities have the potential of transforming their communities of abode to growth centres. Once this is envisaged, adequate provision should be made to meet the challenges that could be posed by such development.

In a bid to mitigate the anticipated effect of peri – urbanization especially with respect to checking the haphazard growth and expansion of the peri – urban community under focus and other communities in the developing countries and ensuring that developers adhere to planning standards for development, the creation of a specialized unit to plan and coordinate such settlements is advocated. This specialized unit should focus on the design and implementation of some planning strategies such as master planning, land use planning, development control that would curtail haphazard growth and ensure that developers adhere

to planning standards for development. The sub-unit handling development control should be strengthened in terms of finance and manpower to be able to efficiently discharge its duties. Other issues to be addressed by this unit include upgrading programme through rehabilitation/renovation approach as well as provision of urban basic services. Specifically, this unit should give adequate attention to the provision of necessary facilities that would enhance habitability such as the provision of adequate supply of water and sanitation.

The cooperation of government and community is essential to achieving the goals of this specialized unit. The government should be prepared to facilitate development in peri – urban communities while community members should be encouraged to be willing to contribute towards community development. Specifically, there should be a synergy between the peri – urban communities and the main cities through progressive integration. This is desirable since these peri urban communities are the agents that usually absorb the pressure and dynamics of population and land use changes in cities.

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Socio-Economic Implication of Urban Sprawl on Changing Land Use Pattern in Akure, Nigeria

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ABSTRACT

This study made use of mixed-method approach of Survey Research Design (SRD) to explore the socio-economic impact of urban sprawl on pattern of land use changes in Akure and its environs. The SRD methods involved structured questionnaire, observation and interview on selected households. The study area is organized into two areas – Akure Urban and Akure Peripheries. The average households in Akure Urban were estimated at 95,232 while those at the Peripheries (adjoining communities) were 14,794; totaling 110,026 households. Out of this, a sample of 1% was systematically selected for questionnaire interview in a succession of 10th buildings on one respondent per building. Findings revealed unguided expansion in the growth of the city and undue encroachment into green areas at the suburbs. There were incompatible conversions in land uses which were observed to be feedbacks from socio-economic status of residents. The study suggests effective zoning strategy to mitigate the unguided nature of the expansion. Adequate monitoring by the Development Control Department and other stakeholders in urban planning is also recommended to check the incompatible land use changes in the area. More importantly, the age-long master plan of Akure is noted for review while a more comprehensive regional plan is advocated to guide the development of the entire region.

Keywords: Urban Sprawl, Land-use Changes, SRD, Zoning, Akure

INTRODUCTION

The concept of urban sprawl has been described by different scholars in different ways. While some interpreted it to mean a fallout from increasing urban densities, land use and racial segregation as well as population growth, others conceptualized it as unplanned expansion of urban areas which is characterized by low density physical development and the non-existence of basic municipal infrastructure usually beyond urban fringes (Poahn, 2000; Glaeser and Kahn, 2004). Some early urban development researchers like Alonso (1964), Mills (1967) and Muth (1969) attributed the emergence of sprawl to *'mono-centric city model'*. This model suggests that spatial structure of urban areas results from the tradeoff between the rent of land and cost of commuting. The low cost-center coupled with relatively low rent at the peripheries of cities in many developing countries is facilitating the growth of peri-urban areas. Other factors such as the desire of urban dwellers to flee poor governance, housing congestion, lack of planning and inadequate social amenities occasioned by high pressure at the city center also contribute to city sprawling.

Land use change is a product of urbanization, which has been recognized as a global problem present in most countries of the world. Balogun et al (2011) affirmed that urban populations in developing countries grew by 40% between 1900 and 1975. This submission gives further alert that the trend will continue adding approximately 2 billion people to the urban population of the presently less-developed nations for the next 30 years. Arnfield (2003) argued that the world is becoming increasingly urbanized with 45% of the population already living in the urban areas as at the year 2000, with a projection that half of the world will live in urban areas by 2007. It was earlier estimated by the United Nation Population Fund (1999) that by the year 2025, 60% of the world's population will live in cities. According to UN-Habitat (2013), cited in Oduwaye (2015), it is expected from the advent of the urban

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millennium that 70% of world population will be living in urban areas by the year 2050. This trend shows the inevitability of cities urbanization.

Akure is not in any way going contrary to these submissions as the population has been more than tripled of what it used to be before it became the administrative headquarters of the state and local governments on February 3rd, 1976. For example, the population was just 71,106 in 1963. But with the influx of public servants into the town due to the change in its nomenclature, the population rose to 239,124 and 360,268 by the 1991 and 2006 national population censuses respectively with a projection of 476,159 to year 2014 (on 3.18 annual growth rate) when this study was carried out. The trust of this paper, therefore, is to:

i. investigate the socio-economic implication of urban sprawl on pattern of land use changes in Akure; and
ii. examine the impacts on adjoining communities with a view of proffering measures to mitigate the effects.

LITERATURE PERSPECTIVE

Land is vital to every development. It is an essential factor in production sector of a classical economy, next to labour and capital. In agricultural sector, for example, land is seen as the backbone as it offers substantial benefits that are crucial to the carrying out of its various activities. Observation from literatures shows that land use change is an essential issue necessary for economic development and social progress. Wu and Irwin (2008) believe land use change does not go without costs and consequences. As highlighted in his work, and Owoeye (2015), the costs essentially focus on reduction in the amount of land available for food and timber production as most of the agricultural lands are converted to urban uses. Urban development encroached upon rural areas often make such communities to lose their social identities through urban influence and interactions. Sometimes, it may bring serious segregation and disparity in income and economic activities among communities through excessive land use control emanating from city policies. This may hinder the efficiency of market forces in favour of rural dwellers. Land use regulations aimed at curbing land development often time raises housing prices, thereby making housing unaffordable to low- and middle-income earners. There are other challenges that land use change may pose to farmers on the urban fringes, such as destruction of farm products, especially if the lands are acquired before the maturation of the crops. This may generate conflict and setback for the concerned farmers. Wu and Irwin (2008) argued that competition for labour from nonagricultural sectors has the possibility of increasing farmers' overhead costs as labour become scarce and expensive to hire. Thus, urbanization causes lack of confidence in the stability and long-run profitability of farming to farmers (Lopez, Adelaja and Andrew, 1988). In view of this, the local agricultural economy may collapse when the total amount of farmland falls below a critical level as all supporting sectors begin to disappear.

As urban population continue to increase and more people desire privacy and green areas, so development continue to creep beyond city limit. Consequently, some other negative implications are experienced, such as increased community costs for maintaining roads, sewers, and other services needed when businesses and residences are spread out (Luther, 2005; Mashour and McDonell, 2005). Part of the effects also includes increased need for automobiles, traffic and noise pollutions. Researches have shown that providing public infrastructure and services for sprawling and low density subdivisions costs significantly more than providing for the same number of houses in urban areas (1000 Friends of Florida, 2005; Wu and Irwin 2008).

In spite all the negative implications, urbanization still presents important opportunities to farmers and rural dwellers. For example, the emergence of new customer based provides people in the rural areas great privilege of selling their farm products at higher prices and make huge profits. As observed in Lopez, et al (1988), vegetable producers tend to receive higher prices in urbanized areas. In like manner, Wu and Irwin (2008) acknowledged that the explosion of nurseries, vegetable farms, vineyards and other high-value crop industries in many sub-urban areas illustrates how quickly agricultural economies can evolve through urbanization. According to them, many farmers have shown remarkable adaptability in adjusting their enterprises to take advantage of new economic opportunities at the urban fringes. They farm more intensively in areas with high population density (Lockeretz, 1988; Wu, 2006). More than half the value of total farm production in United States is derived from counties facing urbanization pressure (Larson, Findeis, and Smith 2001).

Besides, it has been argued that suburbanization brings urban and rural people together. Most lands, watersheds and rock outcrops in rural places are utilized for urban uses, which in most cases, generate income for the rural owners and as well bring urban life closer to them. In view of this, Wu and Irwin (2008) opined that the urbanites and agencies have legitimate concerns about the use and condition of rural natural resources, just as rural populations have legitimate concerns about urban–based pressures on the natural world. This has important socio-economic implications on the natural environment, which may have profound impact on the society in future.

MATERIALS AND METHODS

The Research Locale

The study centers on Akure city and its immediate environments. Akure is a fast growing city in the South-western Nigeria; it became the capital of Ondo State on February 3rd, 1976. It is located between Latitudes 7^0 15^1 and 7^0 17^1 North of the Equator and between Longitudes 5^0 14^1 and 5^0 15^1 East of the Greenwich Meridian. It is about 204 km east of Ibadan, capital of Oyo state; 168 km west of Benin City, capital of Edo state; 311 km north-east of Lagos; and 323 km south-west of Abuja, the Federal Capital Territory of Nigeria. Akure town spreads over an area of about 15,500 km^2 in about 370m above the sea level. Its population figure by the National Population Census (NPC, 1963) was just 71,106.

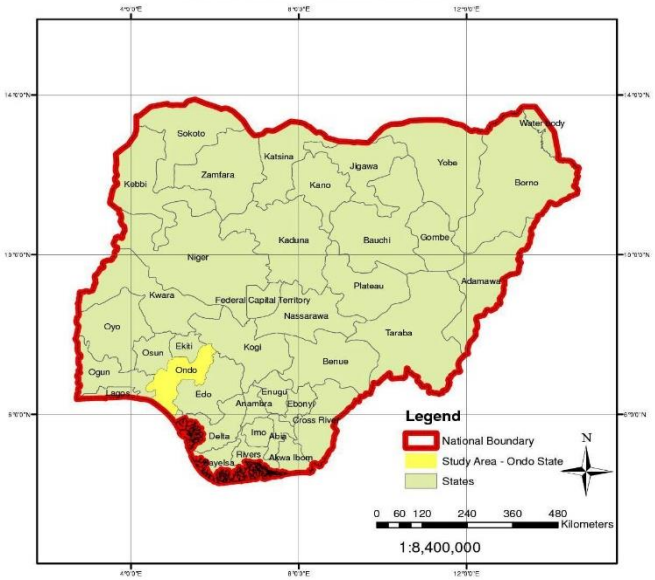

Figure 1: ONDO State in the National Setting.

Source: Dept. of Surveys, Federal Ministry of Works, Abuja (2014)

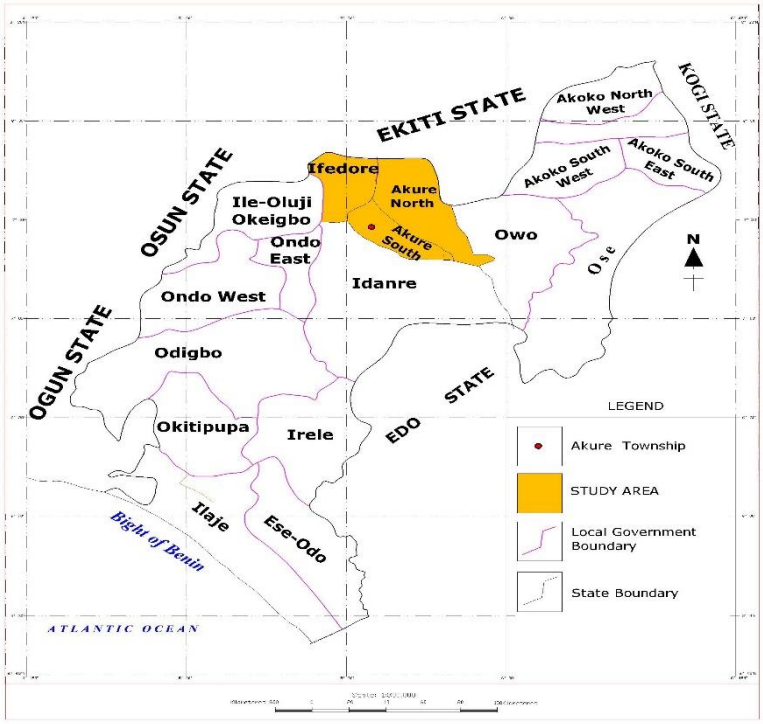

Figure 2: Akure Region in Ondo State map

Source: Ondo State Ministry of Lands and Housing, Akure (2014)

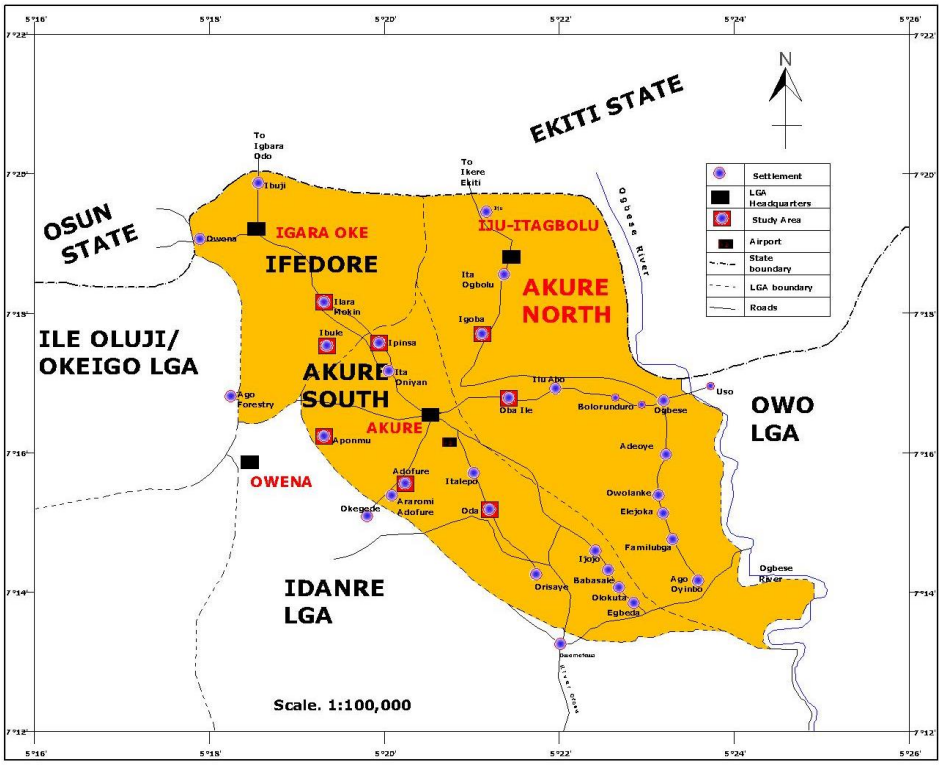

Figure 3: Locational Map of the Study Area in Regional Setting

Source: Ondo State Ministry of Lands and Survey, Akure (2014)

The Database

Data collection for this study was essentially through mixed-method approach involving structured questionnaires, interview and personal observation. Other sources include

government ministries and establishments for historical milieu of the area as well as maps and population data used for the study. Internet facilities were equally explored for relevant information. The study area was disaggregated into three zones namely: the urban core, the transition zone and residential estates vis-à-vis the urban peripheries. The total population projected for the three zones is estimated at 476,159 in 2014 which was sub-divided into 95,232 households. The estimated household population for the eight adjoining settlements was 14,794. Altogether, 110,026 households were estimated in the two areas. From this, a 1% sample size was taken from each area for questionnaire survey. These were randomly administered in a succession of 10^{th} buildings to a household-head per building. Data collected were analyzed using descriptive statistics, chi square test, stepwise multiple regression and ANOVA statistical test.

RESEARCH FINDINGS AND DISCUSSION

A total number of 818 questionnaires were retrieved in usable form out of 952 that were distributed in Akure urban and 129 out of 143 disseminated in the adjoining settlements. Socio-economic variables investigated include length of stay, age, sex, marital status, educational level, occupation, employment status, and rent per room, rent per flat, income and household size of sampled respondents to unravel the socio-economic implication of sprawling incidence on pattern of land use in the study area.

Respondents' Length of Stay in the Study Area (LENSTAY)

As revealed in literature, respondents' length of stay was determined as a viable factor accounted for possible land use changes in a given area (Wu and Irwin 2008). A descriptive statistics was used in this research to explore this fact as shown in Table 1. From the table, over 50.0% of the respondents live in the core area of the city (i.e. zone 1) for more than 30 years. Majority of these people are indigenes who lived in family houses together with their extended family members. Personal interview conducted revealed that original owners of most of the houses at the city core are dead. They are only inhabited by children who, in most cases have altered the original uses, most of which were done indiscriminately without proper planning guide.

Table 1: Respondents' Length of Stay (LENSTAY) in the Study Area

	Zone 1		Zone 2		Zone 3		Total	
Length of Stay	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Less than 1 year	22	7.1	23	7.6	22	10.5	67	8.19
1-10 years	57	18.5	132	43.9	109	52.2	298	36.43
11-20 years	39	12.7	70	23.3	58	27.8	167	20.42
21-30 years	31	10.1	39	13.0	11	5.3	81	9.9
31-40 years	102	33.1	23	7.6	6	2.9	131	16.01
Above 40 years	57	18.5	14	4.7	3	1.5	74	9.05
Total	**308**	**100.0**	**301**	**100.0**	**209**	**100.0**	**818**	**100.0**

Some of the residential buildings are sold and been converted to commercial, educational or mixed used of both residential and commercial purposes. This is common mostly along Adesida, Arakale and other major routes in the city core where most of the residential buildings are shared with various land uses, especially for commercial purposes. Some of these changes are seriously incompatible. For example, a residential building that was pull down and changed to petrol filling station within a residential neighbourhood is considered incompatible. In the other two zones; majority of sampled respondents (51.5% and 62.7%) resides in transition zone and residential estates/urban peripheries respectively in less than 10 years. This implies that most of the people are either new occupants or residents of newly built houses. In most of these buildings, the occupants do not have direct access to the right of changing the original purpose of the building nor have such intension since they are recent

buildings, except in few cases where some may have small shops or kiosks in the frontage of their rented apartments.

Implication of Socio-economic Variables on Land Use Changes in Akure

The result of Chi square (χ^2) test employed to examine the implication is shown in Table 2. In all, eleven socio-economic variables were investigated against the original purpose of land acquisition (PURAQ). The variables include age of respondents (AGE) and sex (SEX) distributions, marital status (MARSTAT), educational level (EDULEV), occupation of respondents (OCCUPAT), employment status (EMPSTAT), religion (RELIGION), rent per room (R_ROOM) and rent per flat (R_FLAT), annual income distribution (INCOME) and household size (HHDSIZE) of respondents.

Table 2: Chi square (χ^2) Result of Socio-economic Implication on Land Use Changes

Association	χ^2 Calculated	χ^2 Tabulated	Df	Asymp. Sig.	Decision
PURAQ vs. AGE	27.367	26.30	16	0.038	S
PURAQ vs. SEX	4.593	9.49	4	0.332	NS
PURAQ vs. MARSTAT	12.398	21.03	12	0.414	NS
PURAQ vs. EDULEV	37.201	26.30	16	0.002	S
PURAQ vs. OCCUPAT	43.762	36.42	24	0.008	S
PURAQ vs. EMPSTAT	48.945	26.30	16	0.000	S
PURAQ vs. RELGION	7.771	15.51	8	0.456	NS
PURAQ vs. R_ROOM	18.902	18.51	8	0.015	S
PURAQ vs. R_FLAT	16.973	12.59	6	0.009	S
PURAQ vs. INCOME	20.673	21.03	12	0.015	S
PURAQ vs. HHDSIZE	23.501	21.03	12	0.024	S

***S** = Significant **NS** = Not Significant at 0.05 alpha levels.*
***Grouping Variable**: PURAQ*

From the table, three of the variables examined (SEX, MARSTAT and RELGION) are found not significantly related with PURAQ at 0.05 levels. Therefore, they were excluded in further analysis carried out using stepwise multiple linear regression models. The summary of the regression models conducted to ascertain the level of the implication is shown in Table 3.

Table 3: Regression Summary on Influence of predictor variables on land use changes in Akure

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	.605[a]	.393	.356	.533	.393	3.511	8	316	.001

***Predictors:** (Constant), HHDSIZE, EMPSTAT, INCOME, R_ROOM, EDULEV, R_FLAT, AGE, OCCUPAT.*
***Dependent Variable:** Original Purpose of Land Acquisition (PURAQ)*

The multiple linear regression of R = 0.605 show a positive relationships between socio-economic variables examined and the original purpose of land acquisition (PURAQ) at 0.01 significant level. Thus, the general effect of these variables in predicting the changes in PURAQ variance is given by the coefficient of determination of R^2 = 0.393. This simply implies that 39.3% of possible changes in the original purpose of land acquisition (PURAQ) in the study area are caused by the accumulation effect of the eight socio-economic variables found significantly related with original purpose of land acquisition in the study area.

The result of two-tailed ANOVA test conducted to examine the overall significance of the regression parameters in validating the hypothesis of the study shows that the calculated F-change value of 3.511 is greater than the t-test value of 2.31 at 0.05 significant levels. Therefore, the null hypothesis that says 'Socio-economic variables have no significant implication on land use changes in Akure' is rejected. This opinion agrees with the view of Babawale (2013) and Olamiju (2014) who affirmed that 1.3 billion people who live in abject poverty around the globe are 'handicap' of making meaningful impact on land use changes.

This is because they are always at disadvantage and socio-economically incapacitated. They are always limited by the level of their income to actively engage in such activities related to land uses. It is therefore believed that as level of income and other socio-economic parameters improve, so is the possibility for residents gaining more potential to invest in land use activities in various dimensions.

Impact of Akure Urban Expansion on Adjoining Communities

At the urban fringes, the impact of the sprawl was examined on eight adjoining communities randomly selected at about 5-10km commuting radius round the city as shown in Figure 3. The impact was investigated using descriptive statistics as illustrated in Table 4, Figures 4 and 5. As shown in the table, over 95% of sampled respondents recognize urban impact on their communities while less than 2% could not perceive any impact. Various problems emanated from the expansion as observed by the respondents ranges from lack of labour for farm work (as identified by 62% of the sampled respondents) to conversion of rural lands to urban land uses (24.0%). It also includes congestion on few available facilities in the communities (7.0%) as well as incessant crimes in the adjoining communities (5.4%).

Table 4: Impact of Urban Expansion on LUC in Adjoining Settlements

Variables	Frequency	Percentage
Notice of Influence of Expansion		
- Yes	126	97.7
- No	3	2.3
Total	**129**	**100.0**
Problem Emanated from the Expansion		
- Incessant Crime	7	5.4
- Conversion of lands to urban land uses	31	24.0
- Lack of labour for farm work	80	62.0
- Congestion on few available facilities	9	7.0
- Others	2	1.6
Total	**129**	**100.0**
Accessibility to Urban Services		
- Roads	45	34.9
- Electricity	51	39.5
- Water supply	4	3.1
- Schools	18	14.0
- Clear Communication Network	11	8.5
Total	**129**	**100.0**

The major areas of influence as shown in Figure 4 centres on increase in level of civilization (37.2%), followed by high cost of living (25.6%), increased in housing demand (20.2%) as well as provision of urban facilities (16.3%).

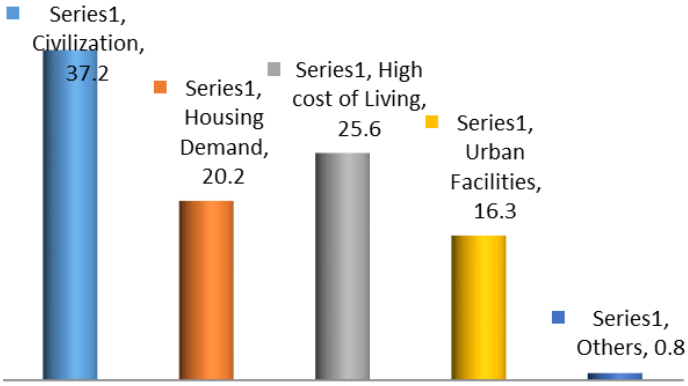

Figure 4: Area of Influence of Urban Expansion on the Adjoining Settlements

The level of accessibility to urban services in the adjoining settlements was equally examined to ascertain the availability of essential infrastructural services in them. As shown in Figure

5; electricity has the highest level of accessibility in all the eight selected settlements as indicated by 39% of the sampled respondents. This was closely followed by roads (35%), and then schools (14%) as well as clear communication network (9%). Only 3% has accessibility to water supply, essentially in places like Oba-ile and Ilara-mokin.

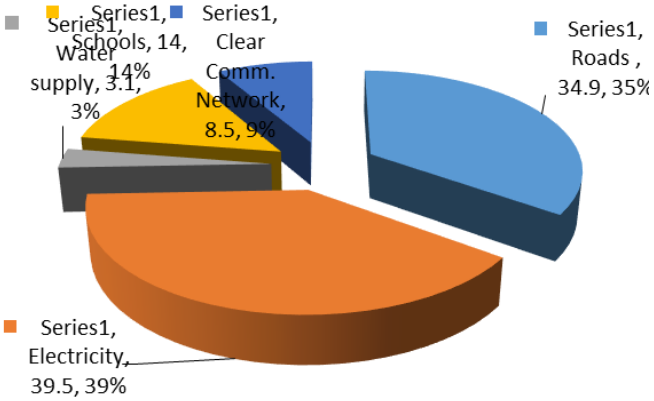

Figure 5: Accessibility to Urban Services in the Adjoining Settlements

In most of these settlements, house rent increased continously on regular basis as well as land prices due to urban expansion emenating from the city centre. This has served as advantage and opportunity for land owners and landlords to increase thier levels of income as well.

RECOMMENDATIONS AND POLICY IMPLICATION

The growth experienced in the city in the last three decades has been alarming and worrisome; and the trend seems to be continuing. However, the choice is not whether or not to allow growth to continue but the major issue is to have working plan to control the growth with a view of mitigating the consequences. With population growth and interface development increasing rapidly in Akure, the study suggests effective zoning method of lands allocation to various urban services and projects meant for city development. This should be supported with adequate monitoring scheme by the Development Control Department. Also, the age-long master plan of the city should be subjected to review and efficient implementation to guide the development of the city in a sustainable manner.

The existing land use in the study area is more of residential with other complimentary urban components punctuating the whole area. Findings show that most of the buildings are aged and dilapidated. In some parts of the city, especially in the core area; most of the old buildings are being removed and changed over to new ones. However, in the course of changing some of the buildings, the uses are always at variance with compatibility standard. They rather constitute nuisance than complementing the planning and environmental standards. In this regard, it is recommended that adequate monitoring be made by Development Control Department and other stakeholders in urban management to ensure compliance to planning standard. This should start from plan approval stage to erection and completion of structures.

To reduce the level of encroachment into natural vegetation in the course of expansion, it is also being suggested that vertical expansion be encouraged in the form of story buildings, high scrappers, and the likes. It is believed that this will reduce the rate of land consumption and improve the structural quality as well as aesthetic value of the environment. In this regard; the concepts of Smart Growth, Compact City and Urban Growth Boundary operated in most cities in United States and Europe can as well be adopted in the study area to provide effective policy framework to check undue expansion and incompatible land uses.

The existing Master plan of Akure was produced in 1980 and thus-far has become inactive, old and superseded. Hence, it needs to be reviewed while a more comprehensive Regional plan to guide the spatial growth and development of the entire region is requested. These

plans are to be administered by a constituted board which will be responsible for the maintenance of orderly and aesthetic environment as well as the preparation and implementation of planning schemes in the region in conformity with the state plans. This will go a long way to assist in regulating land uses for sustainable development of the study area.

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Environmental Impact of Petrol Retail Outlets in Selected Local Government Areas of Osun State, Nigeria

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ABSTRACT

Petrol Retail Outlets (PROs), popularly called Petrol Stations, provide motorists with Premium Motor Spirit (PMS) or petrol, similar petroleum by-products, other automobile consumables and related services. This study investigated the impact of the existence of PROs on adjoining land-use in six (6) Local Government Areas (LGAs) of Osun State, Nigeria. The objectives were to identify the locations of PROs in the study LGAs, assess the condition of the identified PROs and obtain residents' assessment of the impact of proximal PROs on their environment. With the aid of multi-stage sampling technique, forty-two (42) PROs and three hundred and ten (310) residents around the PROs were selected to elicit data using an interview guide and close-ended multiple-choice questionnaire respectively. Among other findings, it was discovered that about half of the respondents in the study area felt that the PROs were at least "good". Furthermore, part of the study area had history of fuel spillage into underground water source for residential use while problems such as noise pollution and traffic congestion are aggravated at the period PMS scarcity. Strict compliance with physical planning standards by both the approving authority and the developer, suspension of approval of PROs in some communities and sensitization of PRO operators on crowd management (at the period of petrol scarcity) are some of the recommendations made to mitigate the impact of PROs on neighbouring communities. It is hoped that risk to man and the environment will be minimized by the implementation of recommendations.

Keywords: Environmental Impact, Petrol Retail Outlets, Planning Implication, Pollution, Traffic Congestion

INTRODUCTION

According to Mohanka *et al* (2008), man, like other living creatures, lives in, depends on and influences the environment. His awareness of his environment has grown considerably over time. On global level, they further affirmed that increasing population pressure, urban development, industrialization and ever growing technologies are creating newer demands on every facet of the environment. With the global population having exceeded the seven billion mark and half of which now live in cities, the pressure on the environment has never been greater (Coleman, 2011; UN-DESA, 2014).

Barthwal (2002) cited the often referenced Munn (1979) which defines Environmental Impact Assessment (EIA) as an activity designed to identify and predict the impacts on the bio-geophysical environment and on man's health and well-being of legislative proposal, policies, programmes and operational procedures, and to interpret and communicate information about the impacts. In modern times, private developments have come to be included in those items that must undergo impact assessment.

Petrol Pumps are often referred to as Retail Outlets (ROs), which are the major facilities for dispensing petrol to consumers for fuelling internal combustion engines (Hindustan Petroleum Corporation, 2014). They equally provide other petroleum products, goods and services that are useful for proper functioning of automobiles. As desirable and necessary as the PRO is, it has become an albatross, not in itself but due to lack of appropriate policies to

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guide its development or poor implementation of such policies. Economic consideration by PRO operators without recourse to environmental implications has "fueled" proliferation of PROs particularly in Nigerian cities, thereby aggravating the situation. This calls for concern.

Most researchers in this context have focused on locational analysis of the distribution of PROs. For example, Ibikunle (1997) in his work on the locational efficiency of petrol filling stations in Osogbo analyzed the locational pattern of the petrol filling stations in the city relative to areas they serve. This was informed by the need for firms to conduct studies of market-area development and evolution in order to develop their customer tracking capacities. Similarly, public sector authorities also needed such studies to be able to scientifically formulate viable goals, objectives and targets in their urban planning activities. Alabi (2004) worked on "Assessing the Locational Pattern of Filling Stations in Saki Town, Nigeria". He stated that most petroleum product marketers in Nigeria see the sale of petroleum products in a filling station purely as a lucrative business venture, resulting in the daily upsurge of filling stations and their haphazard location at sites considered marketable while neglecting compatibility and suitability based on regulations and standards.

However, not much investigation has been conducted on the environmental implications of PROs particularly in the southern part of Nigeria. This is the focus of this paper. The residents' perception and observation have been relied on in this research to ascertain the impact of existing PROs in the study area on the health of residents and the environment. It is assumed that residents, to a reasonable degree, could inform on possible threats or otherwise to their health and the environment by their perception and observation.

LITERATURE REVIEW

Conceptual Issues

The built environment is a man-made surrounding that provides a setting for human activities ranging in scale from personal shelter and buildings to neighbourhoods and supporting facilities and infrastructure. It is a material, spatial and cultural product of human labour that combines physical and social elements; an artificial surrounding so extensive and cohesive that it functions as an organism in the consumption of resources, promoting physical activities and active living in the urban environment (Emmanuel and Ayo-Odifiri, 2013; Wikipedia, 2015). It is also viewed as "the human-made space in which people live, work and recreate on a day-to-day basis" (Roof & Oleru, 2008). Many built environments have existed long before the advent of cautious planning, the introduction of which has tremendously witnessed a paradigm shift in the organic system of settlements. It is important to note that the built environment exists within the larger natural environment and makes use of the elements of the natural environment to develop.

Environmentalism is the advocacy for the preservation, restoration or improvement of the natural environment; especially the movement to control pollution (Merriam-Webster, 2015). It is equally defined as concern about and action aimed at protecting the environment (Oxford, 2015). An environmentalist is an advocate of environmentalism. A major objective of environmentalism is to reduce, if not eliminate, the negative impact that the development of the built environment could have on the natural environment. Natural-Habits (2009) highlights the relationship between environmentalism and sustainable development. Undoubtedly there is a connection between environmentalism and sustainability though sustainability touches more than just the environment.

Sustainability encompasses environmentalism to a certain degree as it is one of the critical factors to ensure sustainability of natural resources through environmental conservation and preservation. Environmentalism is aimed at controlling pollution and protecting biodiversity

by focusing on balancing various natural systems by becoming more earth friendly. But sustainability, in contrast, represents the idea that human society should operate by utilizing industrial and biological processes that can be sustained indefinitely. It requires that the processes be cyclical rather than being linearly oriented. As a basic concept, by embracing three core aspects namely environment, economy and social equity, sustainability focuses on creating a better world without compromising the ability of future generations to meet their needs. In all, sustainability focuses on protecting the environment, increasing the livelihoods of local communities and developing social equity. It is a way of doing business in harmony with the environment, improving livelihoods in a fair and ethical way and driving community development.

To achieve sustainability, physical planning has the target of achieving a conducive, safe and healthy environment in the process of development and redevelopment. In an all-embracing stakeholders involvement (in the principle of participatory planning), citizens and land use agencies can decide that a proposed development is environmentally unsuitable for a specific location, or they can require changes to make a proposal more suitable. This makes the representation of local residents very vital in the decision making process for locating communal facilities. Such facilities include but are not limited to PROs or service stations. Also, the involvement of Environmental Impact Assessment is critical at this point to inform the decision makers of the likely impact of the proposed PRO on the neighbouring community. The impact envisaged is largely in the form of pollution. Pollution on the whole is caused principally by human activities, though it can also be a natural process. It is classed according to the receiving agents of air as emission, water as effluent and land as dumps and disposal (Ukpong, 1994). Mba (1996) identified the major sources of water pollution in Nigeria to include industrial plants, decomposed domestic waste, solid mineral mining activities and petroleum mining operations.

Petrol or Premium Motor Spirit (PMS) or Gasoline is a by-product of fractional distillation of crude-oil or petroleum. Fatunmbi (2004) says that humans have used crude-oil in one form or another since at least the biblical times. Crude oil is an exceedingly complex substance, composed of literally thousands of different kinds of organic molecules and may vary greatly in composition across the world, depending on the age of the oil, which consists mainly of hydrocarbons. Petrol is used in generating power in internal combusting engines of automobiles and machines that provide electricity for domestic and other uses. Retail outlets are the major facilities for dispensing petroleum products to consumers. These retail outlets are very common in cities along major roads and streets, at jetties and public watersides. A retail outlet is also expected to have a mechanical workshop. Petrol is usually dispensed from Underground Storage Tanks (USTs) through pumps or dispensers. USTs and mechanical workshops are major sources of pollution, which need to be contained and controlled. Some other forms of pollution are indirectly created by the activities of PROs.

METHODOLOGY

Based on data obtained from Osun State Ministry of Lands, Physical Planning and Urban Development (OSMLPP&UD), which was updated by the researchers and a projection of the residents' population figures provided by the Osun State Field Office of the National Population Commission (NPC), Table 1 was generated for this study.

Multi-stage sampling was employed to carry out this research. In the first stage, the three (3) senatorial districts in Osun State were taken as strata. Each senatorial district comprises ten (10) LGAs. In the second stage, two (2) of the LGAs in each senatorial district (representing 20%) were selected in a purposive manner due to the peculiar urban character they exhibit. These are Osogbo and Olorunda LGAs in Osun Central; Ilesa West and Ilesa East LGAs in

Osun East; and Ede North and Ede South LGAs in the Osun West forming the sample frame for the study. Osogbo and Olorunda LGAs are located in Osogbo town, Ilesa West and Ilesa East LGAs are located in Ilesa town while Ede North and Ede South LGAs are in Ede town. For the actual data gathering, 42 PROs (representing 25%) of the 168 PROs in the six (6) purposively selected LGAs mentioned above were randomly selected for investigation while 304 residents (representing 0.02%) of the 1,515,875 population of same LGAs were selected for questionnaire administration to investigate the impact of the PROs on their environment. However, an adjusted total value of 310 respondents was employed (out of necessity) as sample size (See Table 2).

Table 1: *Projected Population Distribution of Residents and PROs in the Study Area*

Senatorial Districts	Selected LGAs	Population of Residents	Population of PROs
Central	Osogbo	578,632	59
	Olorunda	226,920	38
West	Ilesa Eest	310,000	13
	Ilesa Wast	260,400	20
East	Ede North	63,870	25
	Ede South	76,035	13
	Total	**1,515,857**	**168**

Sources: *OSMLPP&UD, 2015; NPC (Osun State Field Office), 2015*

Table 2: *Determination of Sample Size for Questionnaire Administration*

Osun State Senatorial Districts	LGAs	Total PROs	25% of PROs (A)	0.02% of Population (B)	Population per PRO (B/A)	Adjusted Pop. for Questionnaire Administration
Central	1. Oshogbo 2. Olorunda	97	24	165	6.9 approx. 7	7X24 = 168
West	1. Ilesa East 2. Ilesa West	33	8	72	9	9x8 = 72
East	1. Ede North 2. Ede South	38	10	67	6.7 approx. 7	7X10 = 70
Total		**168**	**42**	**304**	**-**	**310**

The Directorate of Petroleum Resources (DPR, 2010) as cited in Adisa (2011) stipulates a minimum distance of 100 metres from PROs to public and residential buildings as physical planning criterion. But such standard depends on the number of petrol pumps, amount of fuel drawn from them, traffic intensity, structure of the surroundings, and weather condition. However, Blamah *et al* (2012) in their study on "Locational Impact Assessment of Gasoline Service Stations in Karu, Abuja, Nigeria" found that residential, commercial and public/semi public buildings within a distance of 150 metres to the investigated service stations were at risk of hazards that emanated from them. On this premise, a copy of the questionnaire was administered in each of the targeted buildings within 150 metres radius around all selected PROs.

Interview guide and close-ended multiple-choice questionnaire were used to obtain primary data from the PROs and the neighbouring residents respectively. These instruments were complemented by direct observation and use of digital camera. Trained field assistants were engaged to elicit the required data between 8am and 6pm in a specific week from Monday to Saturday. Some of the offices which were visited to obtain secondary data include the Osun State Ministry of Lands, Physical Planning and Urban Development (OSMLPP&UD), Osun State Capital Territory Development Authority, Osun State Waste Management Agency, Federal Ministry of Lands, Housing and Urban Development, and the Department of Petroleum Resources (DPR) of Nigerian National Petroleum Corporation (NNPC). Data were analysed and presented using descriptive statistics with the aid of computer-based Microsoft Excel 2007.

FINDINGS AND DISCUSSIONS

Relevant Socio-economic Characteristics

The monthly income of most residents around investigated PROs is concentrated within ₦20,000 – ₦50,000. This is the range for a total of 64% of the respondents as could be observed from Table 3. Furthermore, a total of 61% of same respondents are civil servants and traders. This implies that the bulk of these residents are either salary earners (from government ministries and parastatals) or traders whose monthly earnings or profit cluster around an average of ₦35,000. This agrees with the fact that the study area consists of major cities dominated by government offices and complementary trading activities to meet the need of the population. As observed, only few higher income earners live within the busy sections of the town with concentration of PROs. The rest would prefer to live in a more serene environment. In the occupational distribution, farmers, students and retirees are fewer in these areas due to preference for outskirts with sufficient and needed farmland and a serene environment.

***Table 3**: Income and Occupation of Respondents*

Monthly Income (₦)	**Frequency**	**Percentage**
10,000 or less	27	9
10,001 – 20,000	37	12
20,001 – 30,000	68	22
30,001 – 40,000	64	20
40,001 – 50,000	69	22
50,001 – 60,000	22	7
60,001 – 70,000	6	2
Above 70,000	17	6
Total	**310**	**100**
Occupation	**Frequency**	**Percentage**
Civil service	99	32
Trading	88	29
Farming	35	11
Artisan	34	11
Schooling	28	9
Retired	26	8
Total	**310**	**100**

Assessment of the Condition of PROs

In this context, the condition of a PRO mainly refers to the amount of space on which the PRO is located, the functionality of fuel dispensers and likelihood of UST leakage. These, to a large extent, determine the enormity of negative impact on the neighbouring community. A total of 58% of respondents in Osogbo (the state capital) rated the existing PROs as being *at least* good while the least percentage (11%) viewed them as "very good" (Figure 1). But in Ede, a total of 39% of respondents felt the PROs were *at least* good while 50% of respondents in Ilesa were of the opinion that the PROs were *at least* good. The disparity in the views and assessment observed across the cities (coupled with the highest percentage in favour of Osogbo) is not unconnected with the status of Osogbo as the state capital with the highest concentration of PROs in the state and which is expected to have the biggest and finest PROs (Table 1). In general, a total of 52% of respondents in the study area felt that the PROs were *at least* "good" (Table 4). This is still close to the middle mark. Therefore, it could be inferred that about half of the PROs are in good condition while the other half are not.

***Table 4:** Overall Assessment of Condition of PROs*

	Very Good		**Good**		**Fair**		**Poor**		**Total**	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Response Across the Study Area	44	14	117	38	97	31	52	17	310	100

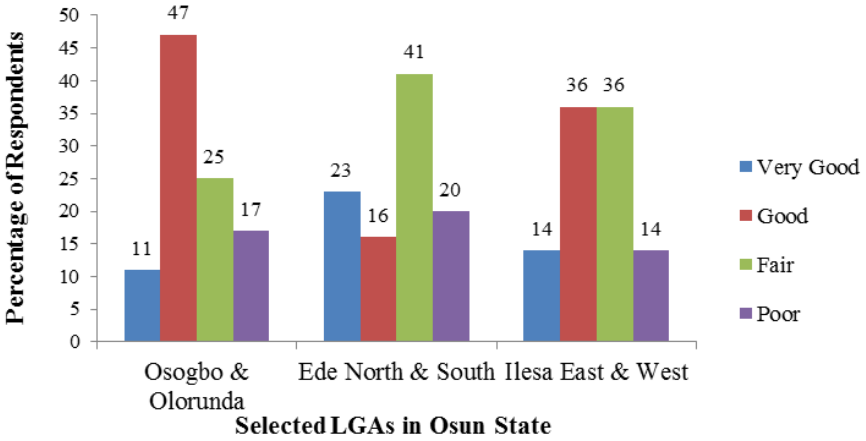

Figure 1: Assessment of Condition of PROs

Perceived Problems Caused by PROs

Various problems were identified by respondents. The least of such problems were notable health problems (such as nausea and respiratory problems), petty crime and automobile accidents. Traffic congestion and different kinds of pollution were identified as dominant problems (Table 5). It is difficult to conclude on which of the various types of pollution is most prominent across the study as they are interrelated in one way or the other. The indications for leakages are connected to problems of air and water pollution since they result in these forms of pollution. It was reported that such leakages occur when tankers come to supply petroleum products to the PROs coupled with leakages from USTs. This has resulted in noticeable pollution of wells which supply water for domestic consumption in the area.

It was equally reported that only 19% of the PROs carry out regular leakage and pressure tests on their station while the rest either never did or only seldom perform such tests. The indication for traffic congestion reveals a problem in itself but is equally related to noise pollution (in form of verbal altercations) caused by customers trying to purchase petrol (and sometimes kerosene). It is also a precursor to certain automobile accidents noticeable in the vicinity of some PROs in the study area. The mention of petty crime brings another dimension to security issues in connection with the presence of PROs; that which is different from the findings of Faro (op. cit) which indicated that lighting (in the night) and provision of security personnel by PROs provide a measure of security to neighbouring residential community. However, pick-pocketing, particularly during fuel scarcity cannot be ruled out. Some of the problems highlighted above were also discovered by Faro (op.cit).

Table 5: *Frequencies for Perceived Problems Caused by PROs*

LGAs	Traffic Congestion	Leakages	Air Pollution	Water Pollution	Noise Pollution	Petty Crime	Diseases	Auto Accident
Osogbo & Olorunda	34	37	22	17	32	13	4	10
Ilesa East & West	20	18	9	8	14	6	2	5
Ede North & South	18	12	6	2	16	3	0	2
Total	**72**	**67**	**37**	**27**	**62**	**22**	**6**	**17**

Perceived Problems during Fuel Scarcity

Dominant problems observed by respondents during petrol scarcity periods are traffic congestion, noise pollution and air pollution (Figure 2). This agrees with earlier indications. In the case of traffic congestion, major obstruction to traffic is caused by commuters who

park along the road for hours in anticipation of PMS supply to particular PROs and even during sales in such PROs. On single carriage roads, this problem is even more pronounced. Furthermore, as pointed out earlier, the noise pollution is related to the traffic generation and the presence of several customers at the PROs at this period while the odour from continuous dispense of petrol constitutes the observed air pollution. The slight indication for water pollution does not reduce its importance. However, the situation is not really worse than the normal times since any extra spill is mostly evaporated and if the condition of the USTs have not worsened.

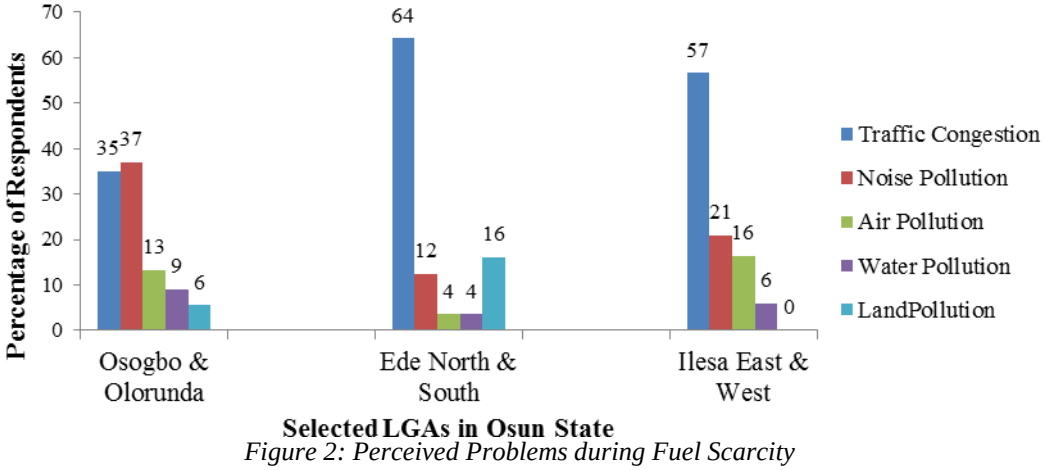

Figure 2: Perceived Problems during Fuel Scarcity

Observed Effects of Leakages into Water

Across the study area, the dominant noticeable effects of leakages into underground water from the PROs are bad odour and bad taste with indications for coloration in some cases (Figure 3). This was felt in homes or areas which relied mainly on wells (either directly or piped into apartments). Based on responses from the PROs, leakage tests carried out have revealed incidences of leakage from USTs of PROs in the study area. Though 57% of the PROs reported not to have had such experience after tests were conducted, the rest had recorded incidences of occasional or seldom leakages of the petroleum products sold by them. This equally implies that certain PROs have poor quality, damaged or worn out USTs. Some of the respondents did not observe any form of pollution in the domestic water supply. This "no change" scenario is significant across the selected LGAs or cities. This is due to the fact that some of these residences make use of public water supply from the State Water Corporation. The highest percentage (39%) of those in this category falls within Osogbo, the state capital while such indication is lower in Ede and Ilesa; still revealing the privilege associated with the state capital.

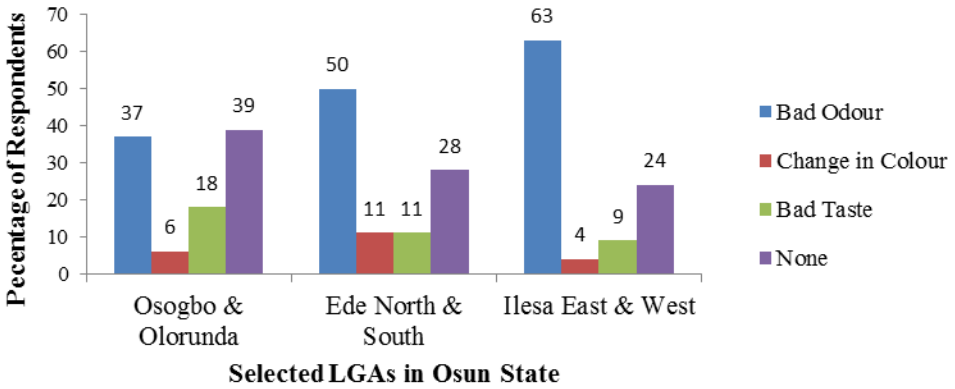

Figure 3: Observed Effects of Leakage on Water

RECOMMENDATIONS AND CONCLUSION

This study has provided information on the condition of PROs in major cities of Osun state, Nigeria. It has also revealed certain environmental problems associated with the existence of PROs coupled with the situation experienced during fuel scarcity and effect of leakages from USTs into underground water.

PROs are essential service stations for meeting needs of automobile users and generating power for domestic and business uses. Based on findings of this study, there is need to still reiterate the importance of adherence to standards in the building and maintenance of PROs. The negative impact of PROs on the environment which consequently affects the health of residents of surrounding communities has been ignored over the years. The proliferation of PROs based on economic motive without consideration for environmental safety is pronounced. The incessant approval of permit to build more PROs has not been justified on the basis of a higher demand or need. Therefore, the Town Planning Authority, which is the approving authority, must put a limit or temporary stop to approval of PROs in certain communities. The need to enforce repair or replacement of bad USTs of petroleum products in PROs that have failed leakage tests is very vital to save the environment and residents around such PROs. The Directorate of Petroleum Resources (DPR) must perform its responsibilities in this wise. The Ministry of Environment also needs to carry out routine checks and tests to ascertain pollution levels around PROs and to ensure compliance with standards and maintenance of quality and quantity of required facilities.

In Nigeria, the problems caused by petrol scarcity require a complex and holistic approach to addressing the cause(s) of the scarcity. Meanwhile, sensitization of PRO operators on crowd management during the period of petrol scarcity will go a long way in addressing the complaint of noise pollution. Organizations such as DPR could provide such training. The Federal Road Safety Commission (FRSC) will need to help manage traffic around certain PROs at times of scarcity to maintain smooth flow of traffic in affected areas. Environmental NGOs have in recent times carried out sensitization on achieving a safe environment with particular focus on the need to produce and use environment friendly products. The NGOs also need to create pressure groups that would insist that government carries out its responsibility in the control and monitoring of PROs.

Furthermore, the need for the academia to continue to provide necessary data and information on the existence of PROs, their conditions, types of impact and associated risks will ever remain germane to the maintenance of a safe human environment. Over time, this is expected to provide a time series data on how the existence of PROs has fared in the debate towards achieving sustainable development. It will provide information on whether the situation has improved or not.

It is believed that taking such steps as recommended above and engaging other strategies that are connected to minimising the impact of PROs on the environment will go a long way in improving the status quo in Nigeria as a whole.

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The Trauma of Domestic Solid Waste Mismanagement in Akure Urban Region, Nigeria

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ABSTRACT

Solid waste is the most conspicuous of all waste generated in human communities. The mismanagement of this waste has a direct bearing on the quality of life and urban environment. This study assesses the situation in Akure urban region in Nigeria. Two thousand eight hundred and eighty one (2881) residential buildings in four residential neighbourhoods of Akure represent the research population. Using systematic random sampling technique, questionnaires were administered on the main producer of waste(woman) in each household at every 10th building interval. Thus,it gives a sample size of two hundred and eighty eight (288) respondents. Simple descriptive statistics such as frequency counts and percentages as well as Pearson's Product Moment Correlation test were used to analyze data. Analysis of data revealed that; open refuse dumpsite was the major means of waste disposal in Akure as majority of the residents did not have designated refuse collection points in their vicinity. This unwholesome practice brings offensive odour and breeding of various types of insects and infectious organisms that made malaria and typhoid fever prevalent in the study area. Rapid population growth and area extent of the city, indiscriminate dumping of waste, and shortage of fund as well as shortage of skilled and unskilled personnel have also incapacitated the effectiveness of waste management board. Some practicable recommendations were made based on findings.

Keywords: Akure, Solid Waste, Urban Region, Waste Management

INTRODUCTION

Waste has become a major problem in our societies today; it is a potential threat to public health, it scars the environment and it can be a block to the economic development of an area because of the negative images it presents (Gadget, 2011). Waste is generated universally and is a direct consequence of all human activities. As rubbish or materials not needed and economically unusable without further processing, "it originates from a wide range of human operations, such as industry, commerce, transport, agriculture, medicine and domestics activities" (Ajibade, 2007).Wastes are generally classified into solid, liquid and gaseous. The United States Environmental Protection Agency defines solid waste as any useless, unwanted or discarded material with insufficient liquid content to be free flowing (Chukwuemeka*et al*, 2012).Liquid wastes are commonly discharged into sewers or rivers, which in many countries is subject to legislation governing treatment before discharge.Gaseous waste is normally vented into the atmosphere either with or without treatment depending on composition and the specific regulations of the country involved. Waste is a factor of what is provided and consumed and the problem arising from it is of concern about protecting the quality of the natural environment.

Ita (2003) opines that waste is any material that lacks direct value to the producer and must be disposed. Similarly, waste is any material that is thrown away as unwanted (UNICEF 2006).Waste may be classified in many different ways, considering its origin (domestic, industrial, commercial, clinical, construction, nuclear, agricultural) or its properties (toxic, inert, inflammable). Without suitable treatment such waste becomes a source of contamination to the environment at large leading to air pollution (acid rain or traffic pollution), water pollution and oil pollution (Microsoft Encarta Premium Encyclopedia Suite, 2004). Increase in human population and income leads to an increase in demand and production of goods (Varian, 2010; Blanchard, 2009) and the resultant waste discharge to the environment. If waste is not properly managed it threatens environmental quality and public

Lawal, O. L. & Basorun, J. O. (2016). The Trauma of Domestic Solid Waste Mismanagement in Akure Urban Region, Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1667-1676

health (Asase*et al*, 2009). The amount of waste produced by human activities is increasing in most part of the world, and is accompanied by problems of disposal.

Of all waste generated in the world today, solid waste is the most conspicuous which can be easily noticed by people (Eugene and Animasaun, 2011).The quantity and type of solid waste generated depends upon the function which a city performs, its economic status and the level of technological development (Imoh and Emmanuel, 2011). Cities and towns are increasing in number, area extents, population sizes, and functions. It is not unlikely that the large population coupled with the inability of the city governments to provide adequate infrastructure, and the living habits of the inhabitants is compounding the issues of wastes, (Aderogba, 2012).The problem of solid waste is a universal one as it exists in every society. Waste management problems only appear more serious in developing economies because of poor management framework.

Akure, the capital city of Ondo State in Nigeria has been experiencing expansion in terms of population density and explosion,thus, resulting to phenomenal increase in waste generation. Domestic waste constitutes the highest percentage of waste generated in Akure (Fakere*et al*, 2012). These domestic wastes are synonymously residential waste within the context of this study. It has a direct bearing on quality of life and urban environment.The objectives of the study, therefore, are to: (i) identify solid waste disposal methods in the study area; (ii) assess the role of government and the effectiveness of Waste Management Agency in handling solid waste in the area; (iii) investigate various health and other environmental hazards associated with solid waste disposal; and (iv) examine the current challenges plaguing solid waste disposal and management in the study area.

LITERATURE REVIEW

Waste, from the common knowledge is anything that lacks utility; an object or substance that the owner either voluntarily or involuntarily relinquishes ownership of. It is a potential hazard by virtue of its nature and composition and so its management is a hazardous activity. By implication, waste does not possess perfect-market goods quality (Ossai, 2006).Nigerian waste generation is on the increase at an estimated rate of about 0.5 – 0.7% per annum, with current figures ranging from 0.4 to 0.8 ton per capita per annum (Akinjare, 2011). Waste complexity is also increasing with biodegradable waste currently accounting for over 50% (Ossai, 2006). This amounts to over 50milion tons per annum average waste burden on the nation with less than 10% waste management capacity (Adedira*net al*, 2014). The 21st Century Nigeria is expected to witness technological growth, increased urbanization, private sector controlled economy and environmental awareness. These changes shall be accompanied by increased waste yield and complexity, more public demand for protection from environmental affront and consequently more integrated development policies with increased control of waste management. Waste management problem has increased at an alarming rate in Nigeria in direct response to rising population growth and industrialization (Ajibade*et al*, 2005).

Waste generation has been encouraged by rapid increase in population, changes or improvement in wages, massive expansion of the urban areas and the changing lifestyle or better standards of living as well as improvement in technology (UNICEF, 2001). Increase in population and income brings about increase in the production of goods and services and the resultant discharged of effluents into the environment. The alarming rates at which human beings generate waste constitute a great problem to the governments as well as individuals in large urban areas especially in developing countries like Nigeria. This is because residues of products used are not always destroyed but discarded and these contribute greatly to land pollution (Adedibu, 1983). As the population of Nigerian cities continues to soar, the problem

of waste management is at the fore of discussions in both public and private fora. Most of these discussions focus on how to effectively manage waste to curtail problems that may emanate, especially in respect of human health and provide for cleaner sources of energy from waste. Basically, solid waste can be classified into different types depending on their sources.

Source	Typical waste generators	Types of solid wastes
Residential	Single and multiple family dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g bulky items, consumer electronics, white goods, batteries, oil, and tires) and household hazardous wastes.
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants.	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes and special wastes.
Commercial	Stores, hotels, restaurants, markets and office building	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes and hazardous wastes.
Institutional	Schools, hospitals, prisons and government center	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes and hazardous wastes.
Construction and Demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt
Municipal Services	Street cleaning, beaches, landscaping, parks, recreational areas, water and waste water treatment plants	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches and recreational areas; sludge
Process (manufacturing)	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing	Industrial process wastes, scrap materials, off-specification products, slay, tailings
Agriculture	Crop, orchard, vineyard, dairies, feedlots, farms	Spoiled food wastes, agricultural wastes, hazardous wastes (e.g pesticides)

Source: Puja, 2015: Solid waste management: types, sources, effects and methods of solid waste management.

The above sources and types of solid waste require effective waste management. That is,waste management in terms of the collection, transportation, processing, recycling or disposal of waste materials (Ajadi and Tunde, 2010). It can also involve the systematic control of generation, storage, collection, transportation, separation, processing, recovery and disposal of solid waste (Rogdgers, 2011). Uchegbu (2002) agrees it is a planned system of effectively controlling the production, storage, collection, transportation, processing and disposal or utilization of waste in a sanitary, aesthetically acceptable and economic manner.Developed countries exercise the best management practices in waste handling and disposal while the less developed countries including Nigeria, generally lack adequate means to handle and dispose-off many wastes in an environmentally safe manner (William and John 1996). One of the major problems facing growing cities in the developing world is that of coping with the wastes generated. Cities are very much battling with the increasing challenges of solid wastes in particular and the battle is seemingly not being won. An estimated 20kg of solid waste for instance, is generated per capita per annum in Nigeria; which is equivalent to 2.2 million tons a year (Dunlap, 2002). This means that as population continues to grow and urban areas continue to expand, it is expected that more waste would be generated in the country over the years. Cities are centers where industrial productions are concentrated. They are also centers of high consumption and consequently waste generation.

One of the visible problems facing most cities in Nigeria is disposal of huge quantities of solid waste that accumulate in urban areas as a result of modernization (Malumfashi*et al*, 2011). In the foreseeable future, the government may not be able to solely undertake the

service of waste management because of the geometric increase in population accompanied by alarming rate of waste generation, dwindling financial resources and reduced allocations to waste management sector. This, therefore, makes private sector participation desirable. The sector can provide the needed capital for investment in municipal solid waste (MSW) management (i.e. collection and disposal of solid waste) and their involvement can help to increase efficiency. An integrated approach in MSW management as suggested by Ahmed and Ali, (2004) and Baud and Post, (2001), should involve all stakeholders (e.g. government, private sector and residents). This will help to reduce solid waste problems and promote sustainable waste management in developing countries (Animasaun andEzebilo, 2011).

MATERIALS AND METHOD

Research Locale

Akure is a traditional Nigeria city in Yoruba region of the country that existed long before the advent of British colonial rule (Afolabi, 2008). The city is located within Ondo State in the South Western part of Nigeria. Akure is a medium- sized urban centre which became the provincial headquarters of Ondo province in 1939; the capital city of Ondo State and Akure Local Government headquarters in 1976. These dual political roles of Akure have since acted as impetus to the influx of people into the city (Olujimi and Olamiju, 2011). Akure is located approximately 700 kilometers South West of Abuja, the Federal Capital of Nigeria and about 350 kilometers to Lagos the-former capital of Nigeria.

Akure lies on latitude 7^0 15^1 North of the Equator and on longitude 5^0 15^1East of the Greenwich meridian. It stands on the altitude of about 370 meters above the sea level (Ondo State Government Agro-climatological and Ecological Monitoring Unit, 2007). It shares geographical boundary withOwo Local Government Area in the east, Akure North and Ifedore Local Government areas in the north, Ile-Oluji/Okeigbo Local Government Area in the west and Idanre Local Government Area in the South.

Method

Survey design method was utilized for this study. In view of the extended geographical coverage of the city, this study was limited to four (two public and two private) residential neighbourhoods in Akure. It employed the use of a well-structured questionnaire to examine the methods and processes of solid waste disposal and managementin selected residential neighbourhoods in the city. With the aid of satellite imagery of Akure obtained via Google Earth coupled with reconnaissance survey, the numbers of buildings in the four selected residential neighbourhoods (Ijapo Estate, Shagari village, Apatapiti and Oke-Ogba) were determined to represent the research population.

Table 2:*Selection of respondents across the selected neighbourhoods in Akure*

S/N	NEIGHBOURHOOD	RESEARCH POPULATION	SAMPLE SIZE (10%)
PUBLIC RESIDENTIAL NEIGHBOURHOOD			
1.	Ijapo	688	69
2.	Shagari village	861	86
Sub-Total		1549	155
PRIVATE RESIDENTIAL NEIGHBOURHOOD			
3.	Oke-Ogba	579	58
4.	Apatapiti	753	75
Sub-Total		1332	133
GRAND TOTAL		2881	288

Source: Author's computation, 2014.

There are two thousand eight hundred and eighty one (2881) residential buildings in the study area. Using a systematic random sampling technique,10% (288) buildings were selected for resident's interview at every 10^{th} interval across the study area. In each selected building, questionnaire was administered on a respondent who is a woman in a household, preferably

married and above age 18. The domestic roles of women in cooking, cleaning and procurement of household items qualify them as a potential waste generator.The sample proportion is justifiable considering the homogeneity of population and similarity in the methods and processes adopted in waste disposal and managements.Data obtained from the research were collatedand analyzed using the computer Statistical Package for Social Science (SPSS) Version 16.

RESULTS AND DISCUSSION

This paper was specifically designed to examine the methods and processes adopted in domestic solid waste disposal and management by the inhabitants of Akure. In achieving this, methods, processes of solid waste disposal by the inhabitants of Akure were investigated; the role of Government in solid waste disposal and management was examined and resident's satisfactions with government's efforts were ascertained.

Method of solid waste disposal

Investigation carried out revealed that 21.8% of the respondents disposed their waste in dustbin, 26.7% in a centralized public container (receptacles), 44.7% in an open refuse dumpsite and 3.8% by incineration method.Apparently, most of the solid wastes are disposed on open dumps land not minding the fact that improper disposal of solid wastes is harmful to human health. As cautioned by Abul (2010), disposal of solid waste on land without careful planning and management is injurious to the environment and human health.

Refuse collection points

Across the study area, 48.7% of the respondents argued that there is no designated refuse collection point in their streets, 11.1% opined that there were between 1 and 2 points while20.1% claimed to have between 3 and 4 as well as 5 collection points and above respectively. The information above clearly shows that refuse collection points are not adequate and equitably spread across the study area.The extant refuse collection points cannot optimally cater for the volume of solid waste generated, hence, the prevailing huge uncollected solid waste with varying degree of harmful human and environmental problems. In the opinion of Ichimura (2003), poorly handled or undisposed solid waste in a particular area has a profound risk on the environment and human population.

Effectiveness of Ondo State Waste Management Authority (OSWMA) in waste management

From the field survey, 39.6% of the respondents were of the opinion that the Ondo State Waste Management Authority is not efficient in its service, but to 21.6%, the Board is fairly efficient;19.4% felt that the Board is effective and very effective respectively.One can deduce from the above that the level of effectiveness of the Board is not in line with best practices. The numbers of unhealthy open refuse dump sites discovered in the study area lay credence to this position. The common open dump sites are a reflection of lack of well-coordinated refuse collection sites. Traditionally, in most urban centres in Nigeria, wastes are disposed in uncoordinated open areas (Ogedengbe and Oyedele, 2006). Dumping of refuse in open areas causeshealth and pollution problems as wastes disposed in such area will encourage the growth of organisms that can transmit diseases to people living in such environment. Of the numerous open dumpsites discovered in the area, OSWMA has proscribed only one. The proscription became necessary because the site was unofficial and wastes disposed on the site are not aesthetically pleasing to the eye as it constitutes serious nuisance to the general well-being of the inhabitants.

Fig 1.*Refuse dump site proscribed by OSWMA at Shagari village Akure*.

Factors responsible for Domestic Solid WasteMismanagement

A number lot of factors, no doubt, must be responsible for domestic solid waste mismanagement in the area. From the perspective of the residents, 18.4% of the residents were of the view that rapid population growth and increase in the areal extent of the city was the major factor inhibiting seamless waste disposal management, 21.5% attributed it to shortage of fund, 25.4% to indiscriminate dumping of waste and 34.7% to failure of OSWMA to evacuate waste. Evidently, government intervention in waste disposal management was abysmally low.The phenomenal increase in the volume and range of solid waste generated as well as the expansion of population and areal extent of thecity may render the effort of theWaste Management Authority ineffective as the volume of solid waste generated in the city continues to increase at a faster rate than the ability ofthe authority to cope with its financial and technical resources constraints. This assertion conforms to the observation of Ogwueleka (2009), that solid waste management in Nigeria is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal. Consequently, waste management in many cities fails to meet minimum acceptable standards with grave adverse effects on the urban environment, public health and quality of life (Ogedengbe and Oyedele, 2006).

Health and Environmental trauma associated with improper waste disposal

Solid waste if not properly managed can be hazardous to the environment and public health. About 46% of the respondents have been diagnosed and treated for malaria fever in the last one year, 28% for Diarrhea or Dysentery, 21% for Typhoid Fever and 5% Cholera. These may not be unconnected to defective waste management practices in the area. In a related study carried out by Fakere *et al.,* 2012, malaria fever was identified as the major disease associated with improper waste disposal. Tapas (2012) maintained that uncontrolled solid waste creates a lot of problems. These wastes frequently end in drains, causing blockage which upshoot in flooding and unhealthy state. The open burning of waste causes air pollution; the yield of burning includes dioxins that are hazardous to public health. Uncollected waste degrades the urban environment and acts as a breeding ground for vectors such as flies, cockroach and rodents that transmit or increase diseases such as typhoid, cholera, dysentery, plague, tuberculosis, encephalitis, typhus etc. Fire on disposal sites can cause major air pollution, causing illness and reducing visibility, making disposal sites dangerously unstable, causing explosion of smokes and possibly spreading to adjacent property. Burning rubbish or incineration releases hurtful gases some of which may contribute to global warming.

Means of improving environmental sanitation/ waste management

In a bid to bring about responsive environmental sanitation/waste disposal management, 9.0% of the residents suggested that public awareness and enlightenment programme on

waste management should be instituted, 37.5% opined that the number of refuse collection sites should be increased coupled with prompt evacuation of waste at the various sites, 26.4% called for the enforcement of sanitation laws while 27.1% advocated for public and private partnership in waste disposal management. The increment of refuse collection site as advanced by the residents cannot adequately solve the problem of solid waste as the city will continue to witness the influx of population that will ultimately lead to the increase in the areal extent of the city. As such, there is need for collaboration between government and private sectors in solid waste management as suggested by Akinola and Salami (2001) for more effective waste management. This measure will not only bring about effective solid waste management but it will also allow for a healthy environment for productive living.

Relationship between the factors responsible for Domestic Solid Waste Mismanagement (FRDSWM)and the means of improving Environmental Sanitation (MIES) in the Area

Using Pearson Product Movement Correlation Statistics, data obtained from various factors responsible for domestic solid waste mismanagement were correlated against that of the means of improving environmental sanitation in the area. This was done to reveal; the relationship that exist between these variables and the level of significance of such relationship (see table 3). Table 3 revealed that there is a strong relationship between factors responsible for domestic solid waste mismanagement and means of improving environmental sanitation. This is so because FRDSWM had 0.902 correlation coefficient with MIES at 0.01 level of significance.

Table 3: Correlation between factors responsible for Domestic Solid Waste Mismanagements and means of improving Environmental Sanitation

		Factors responsible for domestic solid waste mismanagement	**Means of improving environmental sanitation**
Factors responsible for domestic solid waste mismanagement	Pearson Correlation	1	.902**
	Sig. (2-tailed)		.000
	N	288	288
Means of improving environmental sanitation	Pearson Correlation	.902**	1
	Sig. (2-tailed)	.000	
	N	288	288

****. Correlation is significant at the 0.01 level (2-tailed).**

The Ondo State Waste Management Authority Official Report

Records obtained from the Planning Department of Ondo State Waste Management Authority (OSWMA) showed that it was established in 1999 when the then State Government realized the need to address the problem of wastes in Ondo State. The scheme started in Akure metropolis (the State capital) and later extended to other towns and villages in the State. The main objectives of setting up the Authority are to:

i. rid the state of refuse pile up, environment blight and epidemic development;
ii. set guidelines and organize waste scavenging and recycling;
iii. ensure and cause the removal of waste in the environment in order to enhance healthy living; and
iv. promote waste to energy and waste to wealth activities.

The functions of the Authority are to:

i. complement or take part in the organization, monitoring and supervision of environmental sanitation campaigns so as to generate adequate awareness of the need for effective storage, collection and disposal of waste in Ondo State;

ii. rid the state of refuse through regular collection from individual houses, establishments, institutions and other designated areas for disposal to avoid refuse pile up, environmental blight and epidemic development;
iii. Collaborate with Local Government and other Agencies within and outside the state for actualization of its functions;
iv. ensure that every owner or occupier of a premises, household/commercial shops or stalls operate to the satisfaction of the Waste Management Authority; provide and maintain at least one portable covered refuse bin, the size and structure of which shall be approved by the Authority's officials for the collection and storage of refuse in their premises;
v. establish and maintain approved sanitary landfill sites within the state for the disposal of waste;
vi. keep record and collect user's charges or rates on the weight of waste disposed-off and collection of tipping fees at landfill sites;
vii. set guidelines for waste scavenging and recycling in order to generate revenue;
viii. ensure and cause the removal of sludge in individual, industrial and institutional premises or the environments and dispose of the same in a designated disposal site;
ix. inspect, ensure and enforce the provision of toilets at individual residences, commercial, institutions, industrial place etc; and
x. enter into contractual agreements with approved private agency where necessary for the actualization of the functions of the board, provided that such agreements is in line with the regulations of the board.

Disposal of Waste by the Authority

Solid waste collected from the study area is transported to a landfill site on acquired land along Igbatoro-Imafon road, Alagbaka, Akure for disposal. The landfill site is an organized dumpsite, fenced and secured with security guard and office complex. The engineering design of the site is standardized to ensure that the machines and equipment used for waste recycling is in place.

In spite of these impressive objectives and functions of the board, facilities available are grossly inadequate to cater for the teeming inhabitants of the city. Factors, such as phenomenal increase in population, volume of solid waste generated and areal extent of the city, inconsistency of government policies, shortage of skilled man power, poor funding, and management have incapacitated the effectiveness of the waste management authority.

CONCLUSION AND RECOMMENDATIONS

Cities are known to be engines of economic growth where solid wastes have become recurring features. To ensure sustainable management and improved quality of cities, there is an urgent need for environmental education and effective domestic solid waste management.Proper and timely management of waste leads to a sane environment while improper management adversely affects the environment and general well-being of the city dwellers. This paper has discovered that most of the residents of the study area disposed their waste in an open dump because of lack of designated refuse collection points in their vicinity. The phenomenal increases in population, defective waste management practices as well as inadequate data on per capital waste generation have made the services of waste management board grossly inadequate as most areas of the city are left unattended to with attendant health and environmental related trauma

Domestic solid waste can successfully be managed by the interplay of various factors as no single factor can bring about holistic management. All-inclusive management can be actualized through the establishment of refuse collection points at strategic locations in the

area. This represents a service system that will enable residents disposed their waste properly and promises prompt evacuation of waste at these collection points. Enforcement of environmental legislations by theWaste Management Board should be encouraged. Government services appear defective, hence, the need for a synergy between Ondo State Government and the private sectors. Public-Private Partnership (PPP) in solid waste management should be encouraged as a major driving force forservice delivery for a healthy living in the environment.

Government through theWaste Management Board and other Agencies should educate the public on the attendant problems associated with the indiscriminate dumping of waste in the open space. A Monitoring and EnforcementBoard (MEB) should be put in placeto regulate human activities in the environments. Through MEB, the public can be educated on modern waste management practices, give information on the volume and type of solid waste generated, and identify areas that have been denied government attention. Information obtained should be analyzed and to advise government regularly on the appropriate measures to be taken to allow efficient and effective waste management practices.

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Comprehending the Role of People in Urban Redevelopment in Indian Cities

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ABSTRACT

Most of Indian cities are in transition and are facing spatial development challenges. On one hand, the cities are developing new suburban areas with relatively better-built infrastructure and services; while on the other hand, the once primary and bustling central areas are succumbing to awful degeneration. To address the later scenarios, the government of India and state governments have lately laid emphasis on the urban renewal, redevelopment and regeneration through different schemes and missions to revitalize these areas and the cities as whole. However, the success of the schemes and most importantly, the revitalization of degenerated areas have produced mixed results. One of the prominent challenges of limited success of the interventions is the lack of fruitful participation and engagement of the stakeholders in the urban redevelopment and regeneration process. This exploratory research examines the challenges of stakeholders' participation, which leads to the partial success or total failure of such projects in Indian cities. The study develops a conceptual model based on systems concept. The model highlights a culture of fruitful stakeholders' participation and their responsible engagement for the success of the urban redevelopment and regeneration projects at local level. It is indicated that causal feedback relationships among various components of such projects and their inter-linkage with stakeholders would able to assist to diagnose and minimize the concerned areas of conflict and also augment the areas of fruitful engagements so that not only the redevelopment and regeneration processes will be successful, but also the cities can be reinvented by its people.

Keywords: Cities, Redevelopment, Regeneration, Stakeholders, Urbanism

INTRODUCTION

More often, what ails Indian cities is a question that always beckons. The moment answers to the question is offered, another common question that pops up is "what need to be done to improve the scenario". Is it that India is in the right direction in the development/ redevelopment of cities or something is lacking? According to many practitioners and academicians engaged in the urban development in India a basic issue emerges that we try to resolve our urban development problems without understanding the roots of the problems. We do not understand our cities, our urban problems and our people. Let us discuss an example of an important city in Eastern India as an illustration. The city is as old as of 1000 years and the urban culture is not very urbane as is understood in the Western world or in some of the larger and so called more modern cities of India. Unlike the individualistic and cosmopolitanism culture of the other modern cities, it is based on the age-old neighbourhood living system. It has certain physical and spatial constraints for future developments. However, as one of the most important cities of the region, it continues to grow and so do all its problems.

The irony in the development process of the city is that the most important question that comes to the mind of the most important person in the decision making process at certain period of the time of the city development- is that "how to beautify the city". Unfortunately one of the authors of this article was the person to whom the question was asked. And worse, the question was supported by two learned top leaders in the urban planning profession in the State. Now, let us understand how relevant the question is and from where it has come and who had the understanding of the issue. The question comes from a person who is not an

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urban development professional, but holds the key position to take decisions that dictate the fate of the city. The question of beauty is not the real challenge that the city faces, although that is the focus of the decision makers. The city is contending with multiple challenges related to infrastructure, economic life and social disintegration.

If the issue is analyzed, we will find that the city needs to be functional before cosmetic / beauty related solutions come into play. If the city is functional and we do take care of our environment, then it would automatically become aesthetically appealing or as in the words of people beautiful. The next question is how we make the city functional, particularly if the city has degenerated significantly and languishing with a variety of problems. The answer although looks very intricate and complicated, yet very simple. Possibly the reinvention of our cities by its own people is one of the important solutions to be explored. What is reinvention of cities and how is it to be done by its people? To understand this, let us take the analogy of our individual houses. If we observe that when our houses is non functional or provides some kind of constraints because of certain spatial, environmental, demographic or cultural problems, we try to reinvent it by the process of reconfiguring the spatial layout, changing the functions of various elements of the house, redeveloping by additions or modifications or at times totally altering the whole function of the house itself to provide it a new meaning. Why do we do this alteration and how do we do this? The basic premise we consider in such a case is that we understand the house was performing its functions as envisaged without much concern at a certain point of time or when it was build. When it started creating constraints to whatever reasons it may have, we try to relook it from both physically, socially and emotional point of view and try to alter or improve its conditions to its best possible condition within the economic and emotional limits. This process leads to the improvement in the social, economic, environmental and emotional values of the house. When we talk about emotional value, it is to understand that everything has an emotional value and other values are mostly dependent on it. If we do not understand our house then possibly we will go wrong in its redevelopment or regeneration process. Thus, the important aspect that crops in this argument is that the person(s) who are emotionally attached to it, who take this decision of the redevelopment or regeneration process and whose emotions influence the redevelopment or regeneration process is critical. In the case of a house, it is the household or family, which is critical and therefore the family members are the most important persons to take decisions. Similarly, in a city redevelopment, renewal or regeneration, who is expected to lead to reinvention of the cities? It is the people who have the most stakes over its change process. They are the most important people to decide the development or redevelopment of their city. The neighbourhood, part of the city or the city as a whole and its environment need to be shaped according to their functional and emotional needs.

Do we give enough importance to this aspect while thinking of our city redevelopment or regeneration process? Theoretically it is partly yes and partly no. However, in practice, it is an absolute no. Let us examine this argument. The 74th amendment act of constitution (amendment of Constitution of India, 1992) empowers people to take decision and rather govern their own urban development. The constitution has paved the way for local governments for self governance at the local level. Municipal councils or Municipal corporation councils govern the affairs of the cities at the local level through a democratically election process. The local governments or councils are the representative of the people and they have the right to the governance of their cities and empowered to take appropriate decisions on behalf of people. Furthermore, people are consulted at the planning stage of any city development/ redevelopment process and feedbacks are taken before finalizing the plan. On this supposition, the system looks to work well. In contrast, let us examine if this system

really happen. The council or local governments although are set up constitutionally, it is highly visible that most of their decisions are taken based on the pull and push factors[i], which observed to happen in other parts of the world as evidenced from literature (Llinares, Page, Llinares, 2013; Matkin and Frederickson, 2009; Stone and Sanders, 1987). In some instances the individuals representing in the council sway the decisions although they have conflicts of interest. Conflict of interest in Indian conditions is not strictly defined. Political hegemony takes precedence over scientific logic and rationality (Beck, Thompson, Ney, Gyawali, and Jeffrey, 2011; Llinares, Page, Llinares, 2013; Matkin and Frederickson, 2009). The council is also at times is not well advised of about decisions by the professionals- may be due to various personal and professional reasons, such as individual affiliation to the decision makers, fears of loss of job, personal benefits, lack of actual knowledge or skills, rejection of professional advice, or the likes. Above all, the stakeholders or the people at large are essentially not parts of the decision making process. Although the system of feedback from the people or stakeholders do exist and sometimes practiced, it is done at a very late stage where their wishes or arguments do not hold much significance and are also not given enough priority. Besides, in some cases there are peoples' committees at various levels from neighbourhoods, area to city levels, and also at various professional levels within chambers of commerce, industry, culture, whose advices are sought. However, those committees do not have much authority and are basically advisory in nature without much significance in the decision making process. Moreover, those committees are also characterized by conflicts, fractions and self motives, thereby do not contribute much to the democratic decision making process of the development or redevelopment of the cities as envisaged by the constitution (Stone and Sanders, 1987).

It is thus construed that in the current scenario, stakeholders' participation is minimal in urban renewal process in India. Therefore, in this paper, the authors have made an effort to examine the current model of stakeholders participation in city development/redevelopment process and propose an improved model for participation within the constitutional frame work for the development of cities in general and regeneration in particular to reinvent the cities. For this purpose review of relevant literature and a qualitative survey research method were employed. The next section of the paper discusses about the approach followed for this investigation, the current system and argument for a new model and findings and discussions. The findings and discussion section include proposition of improved feedback model for stakeholders' participation, the model structure and framework, and selections, structure and functioning of the jury in the system. The paper concludes with an argument that there is a need for a new model with more inclusivity and fruitful engagement of the stakeholders in the decision making process. Also, the new model with feedback mechanism among the stakeholders despite certain limitations will better suit to a populous and democratic country like India to reinvent its cities.

APPROACH OF THE INVESTIGATION

The investigation was carried out through review of relevant published and literature and documents followed by qualitative survey and discussions with various stakeholders in city development process in India. For review of literature data bases like Scopus, ProQuest and Science direct were searched. Relevant published articles were selected after initial screening and critically reviewed. Besides, published and unpublished documents and archival records relating to urban development process and municipal administration were reviewed. The survey was conducted among the stakeholders by using qualitative survey method. For this purpose, two cities such as Cuttack (Municipal corporations) and Bhubaneswar (Municipal corporations) and one town Dhenkanal (Municipality) in Odisha state located in the Eastern

part of India were selected as case study areas. A set of stakeholders from the three urban areas that include local leaders, urban development professionals, members of chambers of commerce, contractors involved in urban development works, entrepreneurs, academicians, bureaucrats, municipal council members, political scientists were selected and approached for their willingness to participate in the survey. Discussions with the about 20 willing participants were made though semi structured interview process. Besides, discussions with more than 50 citizens either in groups and individually were made following random sampling and through unstructured interview process. The discussions were compiled in the snowballing process over a period of time during the between year 2011 and 2013. The data collected were compiled and qualitatively analysed.

THE CURRENT SYSTEM AND ARGUMENT FOR ANEW MODEL

The 73rd and 74th amendment of Indian constitution in 1992 strengthened the case for people's participation in development at local level. There is regular local urban governance system in place in urban areas of the country. The local governments more often are responsible for and oversee most of the urban developmental works within their jurisdictions despite the overlapping of organizations. An examination of the current structure (Figure 1) reveals that the structure and system is quite simple. The municipal government is placed at the third tier of the governance system of India. It is a democratically elected government entrusted with the decision making and execution of the local level developmental works with constitutional authority, policies and guidelines set up by the state governments and the central government. Thus, the local municipal government's is the lynch pin between the governments at higher levels and the people at the city level. The municipal council / government are assisted by a set of professionals for decision-making and execution. Municipal governments also depend on the financial support from the state government or central government through appropriate procedure in addition to own resources for the development of urban areas. However, the municipal councils are not solely responsible or entrusted with the development of the urban areas. Other urban development authorities with specific functions and responsibilities have been created in the urban areas. The urban development authorities, such as authorities, boards, commissions, regional development trusts, and corporations, are mandated to work in collaboration with the municipal authorities. They derive their authority from state governments and function directly under them. However, the collaboration does not exist in reality. The two entities tend to be at conflict with each other and in so doing complicate the development process.

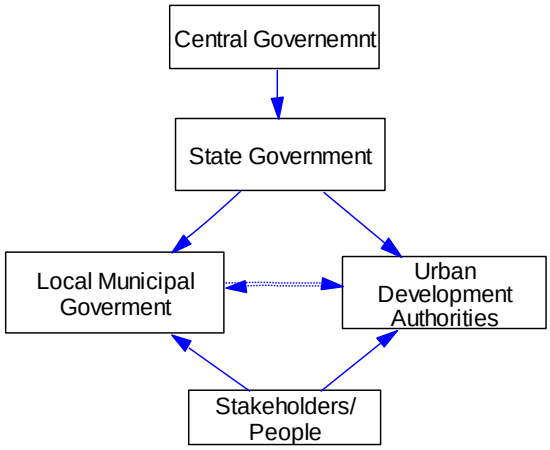

Figure 1. Current system of governance and stakeholders' participation for development or redevelopment of cities

When such conflicts manifest, constitutional authority provided to municipal authorities is undermined and also their work purview is constrained to certain extent and the inter-linkage is observed to be very weak contrary to the strong coordination and collaboration expected from both entities. Besides, these two separate entities without clear terms of reference and mandate are made responsible to the stakeholders and are expected to liaise with them for any developmental work. However, it is observed that the relationships of both these organizations with the people at the local level are only one way with top down approach Rarely the stakeholders concerns are listened to or feedbacks are appropriately considered in the decision making. Further, the large numbers of citizen groups, if they are available seem to prevent their coordination although some are able to influence local politics particularly through their contract (Beck, Thompson, Ney, Gyawali, and Jeffrey, 2011; Das and Sonar, 2015; Matkin and Frederickson, 2009; Vogel, 1999) both positively and adversely. Worse, the sway of individuals or persons in authority, and their whims complicate the matter. For example, India has a somewhat authoritarian civil service system (observation of authors supported by political experts and many common people surveyed although many may argue against and disagree), and because of the authority given to the incumbent civil servants at critical positions of decision-making, often they have the final say in decisions[ii]. Although, the civil servant's role is mostly advisory and concerned with facilitation, regular administrative and management of affairs, yet their critical positioning in the system allow them to sway the decisions[iii]. This is corroborated by a few experts in the city development and political scientists the authors discussed with and according to them

> "*… if the incumbent civil servant is authoritarian and has a sense of superiority, he restricts the role of professionals, and the less informed local leaders get swayed by such civil servants. The stakeholders and common people's accessibility to decision making is also restricted*".

Add to it, the intervention of judiciary in the name of grievance redress does not help the situation. In the current system, anybody who feels aggrieved by any kind of decision by the local governments or any other organization or individual relating to such developmental issues can knock the door of the judiciary and stops the development process partially or in total indefinitely The net implication is inappropriate development/ redevelopment of cities without the consent of the stakeholders or people, wastage of space, time and resources.

Thus when a urban redevelopment/ renewal/ regeneration scheme or process is initiated like Jawaharlal Nehru Urban Renewal Missions (JNNURM), Urban Infrastructure Development of Small & Medium Towns (UIDSSMT) and erstwhile schemes such as Integrated Development of Small & Medium Towns (IDSMT) at the local level be at its planning or implementation stage, they meet the same doomed fate of failure or partial success. A reality check and reflection of the schemes would suffice this argument as how many of the small and medium towns have been regenerated. Why the government has extended the term of the JNNURM mission without much reflection? Here the experts from urban development professionals and local leaders can be noted.

> "*….many of the development or redevelopment schemes in the small or medium towns have ether not taken off the ground or if started then they have been done in a piece meal manner and have little success. Most of them are languishing because of conflict, delay in planning and implementation issues"*.

Thus, although the constitution has provided the leverage to empower people to take their own decisions and be an integral part of the development in general or redevelopment/ regeneration process in particular, the obvious limitations of the current system restricts or

bars the fruitful participation and engagement of stakeholders/ people in such process. Therefore, it needs reflection and re-enactment of an appropriate model for fruitful stakeholders/people engagement, which would aid reinvention of Indian cities.

FINDINGS AND DISCUSSIONS

Improved feedback model for stakeholders' participation

According to Matkin and Frederickson (2009), politics and administration of urban areas often emphasize pluralist competition among political and business elites; Beck et al. (2011) argue that common people more or less are not heard in the decision making or any planning endeavours. However, Boaz, Chambers, and Stuttaford (2014) argue for a rights based approach that provides a framework for developing more meaningful approaches that move beyond public participation. Therefore, in a pluralist and democratic society like India, there is a need to move away from the political hegemony as well as move beyond the simple participation in terms of occasional consultation with local leaders or with a few people in the community. Besides, the argument in favour of a new or improved system is that the current top down approach of governance even within the urban local governance system; the non assimilation of perceptions of stakeholders; the manipulation of unscrupulous prospective beneficiaries with a sole aim of short term gains, are major barriers in contemporary redevelopment of cities in India (Das and Sonar, 2015). This situation calls for a new model with the devolution authority and responsibility and feedback mechanism. This also corroborates the arguments that the better expressed those choices are, the greater the input groups have in the local policy-making process. Also, public choice views emphasize the constraining (Jailly 2008, Tiebout, 1956), and limiting (Peterson, 1981) influence of market forces on local politics, as well as highlight the competitive mechanism for its impact on the offering of public goods. In this regard a governing coalition, which is stable having small size and homogeneity of interest (Stone, 1989), and its ability to learn is fundamental to the success of the local development or redevelopment at the aggregate city or lower level such as area or neighbourhood level (Beck et al., 2011; Das and Sonar, 2015). Further, the experts with the understanding of the local politics argue for a new model with decision making authority equitably lying directly with the stakeholders or people. According to them

> "*....the local governance system has failed to take people into confidence in decision making of their developmental works. The common men have become more informed, aware and responsive and can take the responsibility of their own well being more prudently and rationally than the people in authority under the current system".*

The model structure and framework

Based on the aforesaid premise, it is understood that the existing system is not effective enough to deliver expectations. Therefore, an improved model is proposed. Figure 2 presents the improved model for effective stakeholders' participation. The model is build on the basis of systems archetypes and causal feedback mechanism while considering the resources and limiting conditions, such as forces which cause delay and disturbances in both decision making and implementation.

At the apex of the system, remain the central government followed by the state government and municipal government in India. It is envisaged that there shall be two way communications between the central and state government, and between state government and municipal government as in the current system. However, in this system the municipal government shall remain as the pivotal agency for all the development issues at the urban area level. As the pivotal agency, the municipal government will have strong causal feedback

relationship with local people and urban development authorities involved in the development and redevelopment process. The municipal government will be directly responsible for the people at the local/city level. The urban area development authorities, if any, are interlinked to the municipal authorities and will remain responsible to it as a feedback relationship. The stakeholders are directly linked to the city development authorities, and city development authorities are responsible to the stakeholders as feedback relationship through municipal authorities. In this process, the municipal government and city development authorities will remain interlinked, responsible and accountable to each other as well as to the people. This process in fact will eliminate the present concern over the proper people's participation in decision-making and implementation and also duplication of work, shedding of the responsibilities by the authorities and conflict over the jurisdictions. As the city development authorities remain responsible and directly linked to the municipal councils, it will reinforce the local self governments as envisaged by the 74th amendment act of the constitution.

In this regard, there exist counter arguments and concerns. One of the major concern as noted by the chairman of a municipal council is that

> *"…when there is a governance system with democratically elected people's representatives in place, what is the need of such a feedback relationship with the stakeholders having accountability and responsibility".*

Also, a large number of participants in the decision making may create more conflict and confusion and cause delay, or may totally disturb the whole process as well[iv]. Add to it, the city development authorities are basically under the purview of the state governments, and how do they come under the municipal council without much structural change in authority and power system of the state governments. Besides, if that happens then there will be a major shift in the authority and accountability system having other governance and financial implications, which may add to the confusion.

Conversely, the argument against these concerns here is that stakeholders' participation in the decision making does not go against the policy of participation and spirit of the constitution. In fact, the constitution has envisaged the enlightening of the people and inclusive decision-making. Thus, when the elected political representatives at the local urban area level are unable to agree about stakeholders needs, and the administrative authorities are unable to uphold the spirit of the constitution, it is imperative that the stakeholders should step in to decide their well being. Besides, such a framework is in congruence with the principles (theories) of social organisation and governance where each group of stakeholders distils certain elements of experience and wisdom that are missed by the others and each provides a clear expression of the way in which a significant portion of the populace feels. Each group will have a fair say and possibility of being heard and responded to by the other groups; as a result a common solution may be arrived, although may not be by consensus rather through concessions. Consequently, each group will have significant presence in the decision making process without being overtly marginalising or eclipsing the other and most possibly in a just way (Beck et. al. 2011; Das and Sonar 2015; Thompson, 2008; Verweij, and Thompson, 2006).

However, there is a need for small, rational and informed group who should appropriately represent the stakeholders and be a significant part of the decision-making (Stone, 1989 Giffinger et al, 2007; Shapiro, 2008; Van Soom, 2009). Therefore, this model envisaged that there should be a small group of representatives selected from the stakeholders who will play significant roles in both decision-making and implementation. The group of selected stakeholders will be known as the jury. The jury would be pivotal in the systemic decision

making process for all the redevelopment/regeneration works and function with a strong feedback mechanism with the stakeholders, city development authorities and the stakeholders. The functioning, selection and structure of the jury is as follows:

Selections, structure and functioning of the jury in the system

The selection and structure of the jury is critical to its successful tenure. It should be selected from the people invited by the municipal government for the particular project. For example, the selection can be for a redevelopment scheme of an area of a city. The municipal government will prepare a list of stakeholders and people from the city based on their stakes on the project. An appropriate number of people (say 500 people or 1% of the total population, which ever less) will be invited based on a random selection process from the list of the stakeholders (which should include all the categories of stakeholders) already compiled by the municipal government based on census figures that shows the demographics of the urban area. The invitees shall be provided with all the information about the project concerned before hand to remain prepared for the meeting. Once the people/ stakeholders are available in the meeting on the scheduled day, a jury consisting of a small group (say 12 members) shall be selected by stratified random sampling process with an option of rejection of a nomination based on conflict of interest. That means if someone has certain conflict of interest with the project he or she will be withdrawn from the nomination and will be replaced by another person. The chairman/mayor of the municipal council shall act as the chairman of the meeting for the selection of the jury and a sitting judge from the District/sub-divisional courts as the case may be, shall be nominated by the District judge to oversee the jury selection process. The judge will also act as the arbitrator in case of conflict. The mandate and duration of functioning of the jury will remain until the particular decision is made on that particular occasion. However, once a person has acted as jury member he or she will not be repeated consecutively.

Once the jury is selected, it will be taken away immediately to a venue where they would hold their decision making process. The jury members will be kept away from every one until the decision is taken to avoid any kind of influence. They will be provided with all the necessary technical and professional information and support which shall aid in the decision making. One of the jury members will be selected by the members to act as the chairman of the jury. All the members will have equal voting rights. They will be allowed to deliberate on the issue elaborately before taking the decision. The final decision will be taken based on the unanimity or at least with two third majorities. The whole process will be done under the vigilant observation of a sitting judge nominated by the process as mentioned earlier. The decision taken by the jury will then be conveyed to the city development authorities that in turn convey to the municipal government for ratification. The municipal government will then inform about the decision to the people or stakeholders. In case any decision is not arrived at by the jury, then the process will be repeated from the beginning with a new set of stakeholders and a new jury. If such processes failed three times then the decision with simple majority will be accepted or if the jury is still divided then whole project shall be discarded. The same process can be followed for selection of implementation agencies such as contractors or consultants instead of the current process of selection by the development or municipal government. Further, the decision will remain binding to be followed and will be remained protected from any judiciary and/or administrative interventions unless otherwise there is any technical flaw in the conduct of the process, duly reported by the observers to the district judge, who in turn forward the report to the municipal government.

Thus, the stakeholders and the jury are linked to the decision-making process or implementation of redevelopment project of the city through the causal feedback loops. The stakeholders and municipal government, urban development authorities and implementation

agencies will remain responsible and accountable to each other and the stakeholders will have the right to query issues for the purpose of clarity and ownership of decisions.

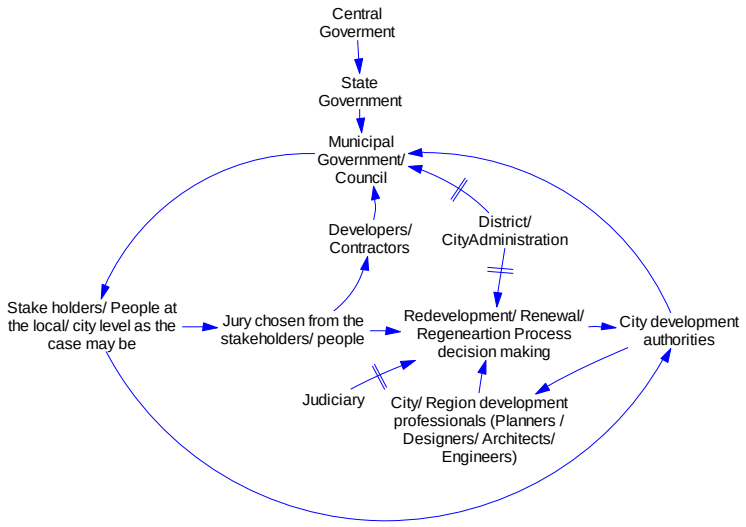

Figure 2. The improved model for stakeholders' participation in the city development

CONCLUDING REMARKS

The existing urban redevelopment/regeneration system and the proposed model have both positive and negative attributes. As such, the concept of a healthy community is closely related to the new urbanism and emphasizes that local government has a critical role to play in determining quality of life, environmental quality, and equitable benefits of social and economic development (Allister, 2004; Bobby, 2005; Hancock, 1993, 1995; Hancock & Duhl, 1986; Lombardi, 2011; Komminos, 2002; Giffinger et al, 2007; Hyeon-Suk Lyu, 2008; Shapiro, 2008; Van Soom, 2009). The present system is simple and also the constitution of India had given the local governments the authority to take decisions democratically without prejudice. However, experience has shown that the process has major flaws and the development or redevelopment work at the local urban level suffers. The decisions have been largely influenced by major lobbyist who exists in a shadow form in the political system; conflict of interest has not been properly controlled; the voices of common citizens observed to be feeble and remain unheard by the authorities. Moreover, there is no such feedback relationship with the municipal government other than the election, which comes at particular intervals. Therefore, if error of judgement happens or a mistake is done by the council or individuals intentionally or without intentions, though may be condoned, but the damage that would cause to the physical, spatial, environmental and socio-economic development of the urban areas or the damage that would cause to the stakeholders in particular or common people in general will remain for long. Thus, under the current system, despite the democratic set up of local self governance, constitutional empowering of the people has not been achieved in real terms and needs a new framework.

It should ne noted that the proposed model also has some limitations or complications. In particular, the authority of democratically elected local governments seems to be challenged. The development authorities may be under confusion with their hierarchical linkage to state governments and local governments. The whole decision making is dependent on a jury selected from a set of invited stakeholders. The stakeholders and jury may not have the technical and professional abilities to take important decisions and may not also be well informed. The selection of the jury may not work as it is envisaged. The judiciary and administrative interventions have been kept out. The majority of the stakeholders may not

agree with the decision of the jury. The jury may not come up with any concrete decisions. Besides, it may add to the cost and could be very time consuming.

However, in spite of the limitations the highlight of the improved or new model is that the stakeholders or common people irrespective of cast, creed, gender, race, and education have the right to take decisions for the development of their area and the planning and decision making shall become inclusive and multi actor based (Scot, 2007). As a chairman of chamber of commerce and industry of a town says

"*.....in this era of information and advanced technology every single stakeholder or citizen is well informed and is capable of taking rational decisions. Particularly the common men have more concern about the development or redevelopment works than the elected representatives or development authorities. There needs to be a better accountability and feedback mechanism which shall aid in proper decision making. Who could do it better than a common man like a shopkeeper, entrepreneur, teacher, doctor or even cobbler and rickshaw puller, who care more about his place of work and environment for the basic necessity of his livelihood?*"

Any stakeholder or person belonging to the area or city can be selected as a part of jury. This brings inclusivity and a sense of belonging to the people in the concerned urban area. The elected council members, the influence of lobbyist or authoritarian civil servants with attitude of superiority and high intellect will have minimal influence on the decision making. The prevention of judiciary and administrative intervention on the decisions taken by the people limit the delay in the development. Further, the whole process strengthened the spirit of the 74^{th} constructional amendment act and empowers the common man in reality. However, this may need some sort of change in power system and may require some amendments in the constitution, which is very critical and time consuming. It also needs the wisdom and acceptance of the already elected representatives and incumbent civil servants who would not want to see their authorities curtailed. The argument here is that we all understand that cities are our future and engines of growth. Indian cities appear to be in complete disarray spatially, physically, socially, economically and environmentally. Reinvention is of necessity and not a luxury today. Urban redevelopment/regeneration and renewal processes are integral to this reinvention. The delay or failure of the urban development or redevelopment schemes/programmes shall worsen the already disarrayed situation. Therefore, the fate of Indian cities cannot be left to the wishes of a few hands in the name of democratic set up. The system has worked for long enough to make us understand that there is a need for change.

As an end note it will be worthwhile to remark that one example of such success is Vancouver city in Canada. If a city like Vancouver could succeed in its social and economic construction through the complex linkages that tie agents to their environment, where the power arises from strong popular control and local democratic and participatory values, the group interactions produce and co-produce community development and provide an open yet stable, socially progressive yet fiscally conservative and pro-development city, why our cities can not follow such success (Jailly, 2008). Therefore, if we want to reinvent our cities with responsive citizens we must accept changes and if needed, the constitutional recourse be considered to empower people rightfully and allow them participate in the decision making and implementation process in real terms. The improved model proposed here may have its limitations, yet it will better suit to a populous and democratic country like India to reinvent its cities.

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Investigating Slum Household Living Conditions in Aso Pada Ward, Mararaba, Karu L.G.A. of Nasarawa State, Nigeria

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ABSTRACT

This study was conducted to provide local, up-to-date and reliable information concerning condition of selected slums in the suburbs of Abuja. This was with a view to minimizing over-reliance on non-indigenous information on slums which was inadequate for formulating or modifying local policies intervention programs. Usually, the difference in socio-economic status of citizens and the geographical variance influences patterns of slum settlements such that general or global information may not suffice in policy formulation. This study assesses housing conditions, water supply and sanitation, and security of tenure of dwellers in Aso- Pada ward. The study design methods includes literature review, reconnaissance and household surveys. This research is explanatory; hence, a non-probability purposive sampling technique was used. In order to select respondents for the questionnaire survey, the seven polling units of Aso Pada ward were considered. These are Kodupe Primary School, Tudun Wada Primary School, Kudu Luvu- OP, Koya- OP, Jen Kokoro- OP, Ebba- OP, Aso- OP; and also based on the 2006 population and housing census guidelines that says an Enumeration Area (EA) is made up of between 250- 500 people. The identified polling units were stratified and the respondents randomly selected from each stratum. Empirical data were obtained through questionnaires and interviews with 300 household randomly selected using a 5% sample population size and also through focus group discussions (FGD). Results showed that more than half of the respondents did not have proper land titles, houses were overcrowded and in dilapidated conditions. Other findings also indicate that 92% of the respondents were reluctant to develop occupied building due to lack of security of tenure of occupied plots, and a remaining 8% developed their buildings to standard as prescribed by local building codes within the study area. This was attributed to the fact that they possess secure tenure of their plots.

Keywords: Empirical data, Household survey, Housing conditions, Stratified randomly selected, Slums

INTRODUCTION

Providing local, up-to-date and reliable information concerning slum conditions would be of great benefit in prioritizing areas to improve and generate strategies that would address specific urban slum problems. Studies show that 3 billion people live in urban areas, almost 1 billion of them in slums; and worst hit is Sub-Saharan Africa where 72% of urban inhabitants live in slums (Catherine, 2011). The number of the urban poor living in slum will continue to increase, if appropriate measures are not taken. According to UN-Habitat as cited in Negera (2012), the number of slum dwellers worldwide continues to grow at a rate of 10 percent every year; as a result, future urban development will show further expansion, sprawling of slum and spread of urban problems if no remedial action is taken in the incoming years. With these enormous slum problems, the developing world mainly depends on global information on slums which is, in general terms, inadequate for formulating or modifying policies for designing different intervention programmes at local level because of aggregation and geographic variability (Lemma, 2005). This challenge of local level information on slums can be locally mitigated if slum studies are produced quickly and accurately, entire cities can also be assessed and slum areas prioritized for improvement or more detailed studies carried out (Parham, 2012). To proffer solutions to problems of local level information on slums, this study was conducted and slum conditions were investigated in Aso-Pada, Karu Local Government Area of Nasarawa State, Nigeria.

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LITERATURE REVIEW ON SLUMS

The purpose of this section is to provide a conceptual background, mode of formation and characteristics of slum settlements. It will also highlight certain factors responsible for slums development in Nigeria and the global perspectives from various authors.

Definition

Slum has many connotations and meaning is seldom used by the more sensitive, politically correct, and academically rigorous fora (Lemma, 2005). Urban slums were defined as urban settlements, neighbourhoods, or city regions that cannot provide the basic living conditions necessary for their inhabitants to live in a safe and healthy environment (Jordan, 2015). It is often not recognized and addressed by the public authorities as an integral or equal part of the city. However, the UN-Habitat (2002) gave an operational definition of slum as a contiguous settlement where the inhabitants are characterized as having inadequate housing and basic services; and also defined a slum household as a group of individuals living under the same roof in an urban area who lack one or more of the following: Sufficient living space; Durable housing; Access to adequate sanitation; Easy access to improved water in sufficient quantity at affordable price; and other infrastructure and Security of tenure.

Slums Formation

According to (Negera, 2012) Slums develop in phases in relation to the prevailing circumstances, gives three basic stages of slum development which include Infancy Stage, Consolidation and Saturation Stage.

i. **Infancy Stage -** is the initial occupancy stage where patches of vacant land like on steep sided land, swamps, near river banks, hazardous areas, conserved areas, etc. become available to the slum dwellers. It could also occur on suitable lands and possibly emerge from decayed formal areas; because of job insecurity, slum dwellers prefer to live on hazardous areas than to live on suitable land of faraway places i.e. Aso Pada the study area
ii. **Consolidation Stage** – is the intermediate stage between infancy and saturation stages. At this stage, there is fast outward expansion and available land will be reduced by filling up additional building.
iii. **Saturation Stage** – is the stage at which the expansion stops as the vacant lands get filled up. At this stage overcrowding is highest and lowers the living standards of slum dwellers i.e. Aso Pada

Causes of Slums Formation

Slums are a product of many factors globally. (Davis, 2006) in his book "Planet of Slums" enumerated factors that resulted in mass production of slums in different parts of the world to include Mechanization of agriculture in Java and India; rapid urban growth in the context of currency devaluation and state retrenchment. However, (Negera, 2012) is of the view that the causes of slums formation are issue-related in nature and key among them are:

i. Urbanization which has population growth, rural to urban migration and globalization as major components;
ii. House and land related issues with main elements as high rental house, few affordable houses, high land value, inefficient land provision, dysfunctional land market, hazardous area or vacant land;
iii. Governance and policy related issues with ineffective housing policy, poor land management policy, institutional and legal failure, lack of political will and corruption;

iv. Social Related Issues which has its components as poverty, ignorance, low income, urban inequality and lack of opportunity.

Arima (2001) and Lemma (2005) believe that the current situation of slum proliferation in Africa can be partly attributed to the absence of studies that empirically link the prevalence of slums with possible driving forces at either the city or National level.

Causes of Slums Formation in Nigeria

Urban planners and other experts in the built environment attribute continuous formation of slum settlements in most Nigerian cities to a number of factors. Ineffective implementation of housing and urban development policies, push and pull factors urbanization and poverty, socio-cultural attitude, rural to urban migration, unemployment and bad governance are among other causes of slum formation in the country. In many Nigerian cities, buildings have been and are being constructed without approved layouts, springing up of illegal structures and disappearing of open spaces, apparent lack of good access roads in some parts the cities which are a product of poor implementation of existing development control and land use laws by states and local planning authorities (Aluko, 2011). Some authors believe that slum settlements develop as a result of push-and-pull factors. Yussuf, Bako, Omole, Nwokoro and Akinbogun (2014) found out that push factors such as high rents, loss of employment, forced eviction, political/communal/personal conflicts and pull factors like proximity to work place, transport facilities, low cost of living, cheaper rents/lands were responsible for slums formation in some parts of Lagos city. Sanusi (2011) discovered that development of informal (slum) settlements particularly in Minna Niger State, Nigeria had been occasioned by housing inadequacy, high urban population growth, inefficient city governance, poor urban development control, low human development, poverty results into self-housing development and illegal housing development especially residential development on ecologically unstable land, marginal land such as up-hills, flood prone areas. Another reason that slums develop in developing countries like Nigeria according to some authors is bad governance. Morakinyo, Ogunrayewa, Koleosho and Adenubi (2012) assert that governments often fail to recognize the rights of the urban poor and incorporate them into the planning, thereby contributing to the growth of slums because people are coming to the cities far faster than the planning process can incorporate them; in the interim, they build shack before government has a chance to learn of their existence. Some authors opine that urbanization has been contained in the developed world through development of critical infrastructures, but in the developing nations little has been done with respect to this. According to (Morakinyo, 2012), governments of developing countries don't have planning tools to deal with rapid urbanization, or the tools in place are not sufficient to address the reality on ground, instead they take a hostile approach towards urbanization believing that providing urban services to the poor will attract urbanization and cause the slums to grow, unknown to them however, the majority poor come to the cities looking for work, not water or services. The Centre on Housing Rights and Evictions (COHRE, 2014), decried that the Federal government of Nigeria at various occasions had pledged to provide adequate housing for growing populace, yet it had failed to fulfill its promises which had led to the proliferation of slum communities in and around most major Nigerian cities. But Zubairu (2014) blames the inability of state and local governments to minimize growth of slums in their respective domains, in Minna the Niger State Capital for example, there has been a steady increase in size and density of slum settlements across the city where the number of slum settlements keeps growing from 9 in 1993, 16 in 2003 and 21 by the year 2013. In Nigeria, some authors are of the view that rural-to-urban migration plays a role in slum formation. Akinwale et al (2013), found that majority of slum dwellers in Lagos Nigeria migrate to the city due to prevalence of poverty and unemployment in their various places of origin.

Background and Statement of Problem

Slum development in and around major towns, and cities of the world is becoming a growing urban phenomenon especially in developing countries. Perhaps, due to either failure of government, urban development policies, poor implementation of existing development control and land use laws, urbanization, urban poverty, rural-to-urban migration, or socio-cultural attitude of the natives of some communities towards governments physical development policies. Whether slum settlements develop in the core or on the peripheral parts of towns or cities, they are formed on either legally/illegally sub-divided lands, individually acquired lands, public vacant lands or lands belonging private corporate organizations.

The Research Problem

Ideal urban neighbourhoods can be situated in almost all parts of towns or cities either on public lands, privately acquired lands, or lands belonging to the native of a particular community. Regardless of the location, the development of such urban settlements especially those to be situated at the periphery of the towns or cities as part of the future expansion of those towns or cities are optimally guided by established urban physical development policies. The instruments employed to execute these urban development policies are usually the urban plan and the local plan. While the former deals with future physical form and the structure of towns and cities, the latter concerns with the detailed layout of the various local areas (zones) contained in the urban plan. It is a common complaint among residents of some settlements in Aso- Pada that slum conditions have been manifesting spatially. This study will investigate slum conditions and their causes in Aso- Pada, Karu Local Government Area, Nasarawa State, Nigeria.

The Justification

According to (Sanusi, 2011) informal (slum) settlements particularly in Minna, Niger State, Nigeria had been characterised by housing inadequacy, high urban population growth, inefficient city governance, poor urban development control, low human development, poverty which has resulted into illegal housing development on ecologically unstable land i.e. land such as up-hills, flood prone areas. Aluko (2011) blamed poor implementation of existing development control and land use laws by states and local planning authorities in many Nigerian cities for lack of good access roads in some parts the cities building construction without approved layouts, springing up of illegal structures and disappearing of open spaces. However, the problem of slums development is becoming worrisome and on the increase; and if causes of slum development in various urban settlements in Nigeria i.e. Aso Pada are not investigated, their peculiar physical and socio-economic characteristics cannot be effectively understood to mitigate further occurence.

According to Negera (2012) there is need to understand the slum development process considering the multiple faces of slums and their multidimensional nature specially between and within countries and cities. Parham (2012) also advocates conducting local slum studies that will address specific problems to provide reliable and up-to-date information on slums which are uncommonly available in other countries. Aso Pada was considered based on its peculiar slum characteristic features which ranked lowest as compared to other identified slums within the urban settlements of the greater Karu Urban Area.

Aim and Objectives of Research

Research Questions

i. What are the living, housing, water and sanitation conditions in Aso- Pada?
ii. Why do the inhabitants choose to reside in the slum areas?
iii. What are the challenges and problems that the slum dwellers face?

iv. How can the problems be mitigated for the improvement of lives of the people in slum areas in Aso- Pada?

Aim

The aim of this study is to assess the slum household living conditions in the study area with a view to providing local and up-to-date information on slum conditions that address specific urban slum problems.

Objectives

To achieve this, the objectives are to:

i. Identify locations of slum settlements in Aso- Pada ward, Mararaba, Karu Local Government Area of Nasarawa State.
ii. Observe the physical condition of the identified slum settlements, Aso- Pada.
iii. Examine the living conditions of slum dwellers in Aso- Pada.
iv. Provide recommendations for improvement of their living conditions.

Basic Assumptions

In other to achieve the objectives of this research work, the following assumptions were made:

i. The uncontrolled urban expansion and resultant spontaneous development as a result of population growth in Aso- Pada ward is enough evidence based on observation to categorise the area as a slum;
ii. The uncontrolled urban expansion and high population has led to unplanned and crowded housing conditions that over stretch reliance on sanitary facilities, building with low quality materials are typical characteristics of slum areas as can be relied on from literatures.

From the above statement, we can see a significant relationship between slum development and population growth in Aso- Pada of Mararaba district in Karu local government area.

STUDY AREA

The Karu Urban Area is an urban area in central Nigeria. The urban area is majorly located in the Nigerian state of Nasarawa, but with some parts stretching into the boundaries of the Federal Capital Territory (FCT). It has an area of 40,000 hectares (400 km²) and a population of some 2 million. It is one of the fastest growing urban areas in the world, with a growth rate of 40 percent recorded annually. The Abuja demolition of informal settlements in previous years has led to mass movements of people into the suburbs. As a result, settlements in Mararaba has experienced unprecedented urbanization, increase in demand for and rapid development of infrastructural facilities, social services and housing, changes in land tenure, increase in real property development and value, economic, social and political activities which are each contributing significantly to rapid sprawling of the area. From west to east, the urban area includes towns like Kurunduma, New Nyanya, Mararaba, New Karu, Ado, Masaka and newer, fast-growing towns such as One Man Village (which contains over 1 million people) and Gidan Zakara. Since the beginning of the 20th century, these districts have grown together into a large urban area and a major commercial centre of central Nigeria. (Source: www.en.wikipedia.org/wiki/karu_Urban_Area, retrieved 2015)

Sample Area

Greater Karu Urban Area (GKUA) has both urban and rural settlements. The major urban settlements within the greater Karu are Mararaba, New Karu, New Nyanya, Masaka and Uke.And in conducting this survey, we attempted to compare other settlement which have

been overtaken by new urban development and engulfed by the larger ones such as Zhenwu, Luvu, Kuchikau, Kodepe, Aso Pada, Ado, Koroduma and One Man Village. Aso Pada depicts a worst state of condition and exist in the periphery of Mararaba, Latitude 9^{o} $02^{'}$ $43.12^{''}$N, Longitude 7^{o} $36^{'}$ $18.40^{''}$E. It has developed over time due to the relocation of the Federal Capital Territory (FCT) from Lagos to Abuja and also the quest for accommodation by the growing population. The Abuja demolition of informal settlements in previous years has also led to mass movements of people into the suburbs, see fig. 2.

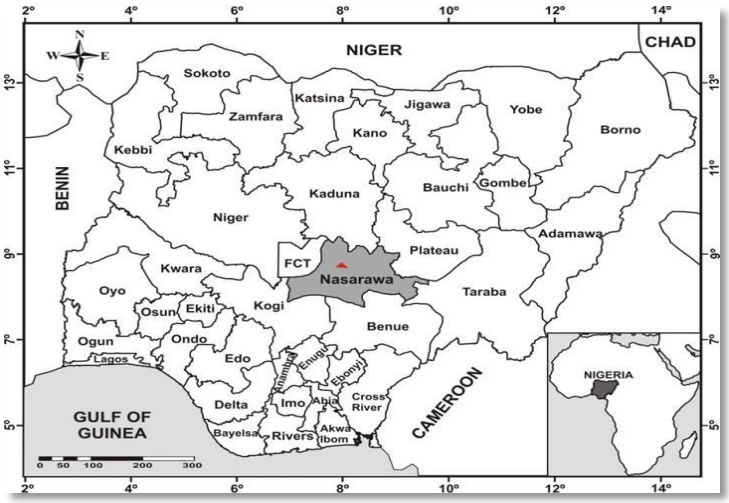

***Fig. 1**: Nigeria showing Nasarawa State **(Source**: NAGIS, 2015)*

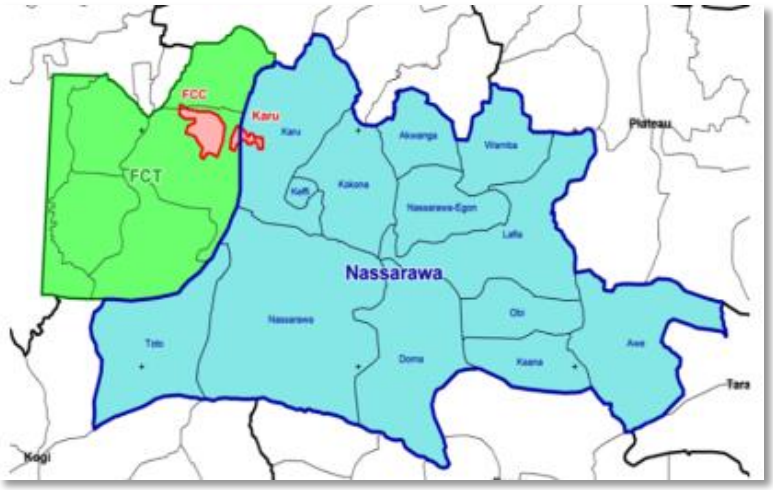

***Fig. 2**: Nasarawa State showing Karu L.G.A **(Source**: NAGIS, 2015)*

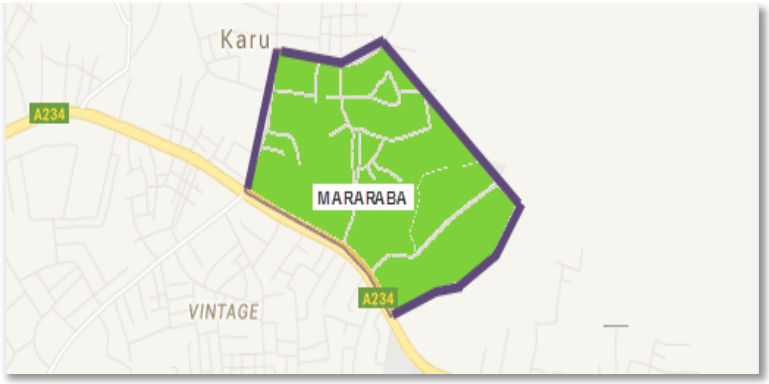

***Fig. 3:** Mararaba Boundary **(Source:** Google Earth)*

Sampling Frame

Currently the exact population of the area is not known as the National Population Census (NPC, 2006) undoubtedly grossly underestimated the population of the settlements. However, claims by Manok (2008); Karu LGA; Nasarawa State Urban Development Board (NUDB); land registration and demand for facilities, opined that the population of the planning area is about 4 million inhabitants. In order to select respondents for the questionnaire survey, the seven polling units of Aso Pada in Mararaba district were considered. These are Kodupe Primary School, Tudun Wada Primary School, Kudu Luvu- OP, Koya- OP, Jen Kokoro- OP, Ebba- OP, Aso- OP; and also based on the 2006 population and housing census guidelines which says an Enumeration Area is made up of between 250- 500 people. 300 questionnaires were administered representing a 5% sampled population of identified polling unit's. The units were then stratified and respondents randomly selected from each stratum.

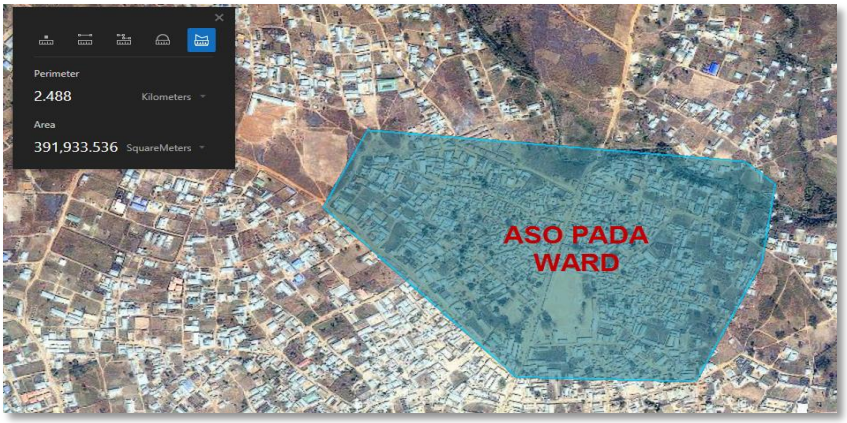

Fig. 4: *Satellite Imagery of the Study Area- Aso Pada* ***(Source:*** *Google Earth)*

METHOD OF STUDY AND ANALYSIS

The approach adopted in this study is a case study. A case study is "a methodology that is used to explore a single phenomenon in a natural setting using a variety of methods to obtain in-depth knowledge" is capable of accommodating different research techniques and is normally used when it is required to obtain in-depth knowledge with regard to a particular phenomenon Gayan, Bingunath and Dilanthi (2011). The data collected for this study was analyzed using descriptive and inferential statistics. A case study is preferred when research questions take the form of "how" and "why" Gayan (2011). A basic assumption was used in correlating the relationship between slum development and population growth in Aso Pada of Mararaba district in Karu local government area. Percentage was used to highlight the nature of the housing problems in the area. However, when a research is using case studies, it is difficult to make generalizations according to (Soy) in Romanus (2013). Therefore findings from the study will be supported with literature reviews to make it viable for generalizations. The investigation will involve field survey where data will be obtained from heads of households in the study areas.

Scope and Limitations

The scope of the study is limited to slum living conditions of dwellers in the proposed case study area (Aso- Pada of Mararaba district in Karu Local Government of Nasarawa State, Nigeria). The study on slum living conditions in the area is the first of its kind that will focus on physical and socio-cultural indicators. What peculiar trends will there be in terms of the physical conditions and socio-cultural status of the residents of the study area. These questions will be answered by this study.

DATA ANALYSIS

Housing Adequacy

Figure 5 shows that 48.3% of the respondents have 5-10 persons/ household, about 25% have 5 persons/ household, 11% have 4 persons/ household, 6.7% have 3 persons/ household, 5% have 2 persons/ household, 4% have 1 person/ household. The fact that 48.3% makes the highest is an evidence of high population index resulting in the quest for accommodation leading to slum formation in the area.

Access to Adequate Water

The findings from the field survey indicated the absence of pipe borne water supply leaving the inhabitants of the area with no option that to buy water for drinking and other domestic use from water vendors and from people who have sunk in boreholes for commercial purposes. Majority of the respondents said the water are usually not sufficient for their domestic use.

Access to Adequate Sanitation

The finding from this section reveals that the houses in the study area lack access to basic sanitation facility, very old in structure and condition. 49.3% of the respondents said they are made to share one toilet in a compound that accommodates more than six to ten household in the same compound, 41% have two toilets to share in a compound and relative 9.7% of the respondents do not even have a toilet leaving them with options of going to open spaces within the study area, bush and streams.

Structural Quality/Housing Conditions

This section reveals that the houses in the study area are old and in dilapidated conditions with old roofs and cracked walls. 56% of the respondents have their roofs to be leaking, 44% said their roofs were in good conditions and not leaking. A chunk population making 73.7% attest to the fact that their walls are cracked which pose a threat of collapse and habitats for reptiles i.e. lizard, 26.3% said their houses do not have cracked walls.

Occupancy Ratio

The following sections outline the household occupancy ratio profile of the respondents in this study. The population distribution of respondents as shown in the figure above explains the expected average household size to be 7, the population covered as analyzed from respondents is 2059, the total number of habitable rooms/ household is 462, the standard occupancy ratio is 2.5, the expected population as compared to the average household size and number of habitable rooms is suppose to be 1155, above all the spillover population in the survey area is 904. This indicates that the study area is over populated and there are insufficient rooms to carter for the spillover population causing an over stretch on the available social amenities and infrastructure. Most of the respondents attest to the fact that their income cannot afford them descent accommodation making it difficult to live elsewhere than this area. This conforms to the view that poverty, population increase and demand for cheap accommodation is a factor manifesting the development of slums as was observed in Aso- Pada, the study area.

CONCLUSION AND RECOMMENDATIONS

In conclusion, a common landholding pattern in the identified slum settlement, Aso- Pada ward is that the land is owned by one large landowner, often a family. According to local residents, a substantial portion of the land occupied today was purchased from these families and the buyer after buying from the land-owning families never carried out any form of regularization- a process through which planning and regulation authority formalyy institutional processes. Most of the ills of traditional tenure found in the study area can be

traced to or stem from tenure insecurity due to uncertainty. This research found that approximately majority of the respondents in Aso- Pada ward currently live in this slum as a result of tenure status. The overall environmental quality since the threat of forced eviction fosters a negative attitude among residents towards improving their environment. Most of the developable lands have been significantly developed illegally even the residual pockets of marsh and poorly drained plots are rapidly being filled too with all kinds of structures. This characterizes a poverty trap from which the poor find it extremely difficult to escape. The interplay of all these factors has tended to maintain these groups in a vicious circle of poverty and insecurity.

RECOMMENDATIONS

There is the need to generate data on slum development locally in developing countries like Nigeria. This is crucial to the well being of its citizenry, in other to achieve some level of consistency in generating such vital information, research at local level on slums should be encouraged so that suitable methodologies can be developed to that effect. However, a lot can be achieved in the area of identification, classification and slum upgrading in Nigeria. Other ways that can aid the generation of these data are:

i. Planning and public regulation agencies should be strengthening to enforce planning regulations across the various levels of government from bottom to top- local-state-national.
ii. Efforts should be made by the Government and Non Governmental Organization in the provision of water and basic sanitary facility in the study area;
iii. Planning and development control instruments should be enforced in ensuring that local building codes are adhered to;
iv. Land acquisition process should be made less stringent to allow the common man access to proper land title;
v. Affordable housing provision should be given the necessary attention to check overcrowding;
vi. There is the need to encourage behavioral change through campaigns and awareness in the study on the proper ways of managing solid waste and environmental degradation.

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APPENDICES

Data Analysis

Housing Adequacy

Household Size	Frequency	%
One person/ household	12	4
Two persons/ household	15	5
Three persons/ household	20	6.7
Four persons/ household	33	11
Five persons/ household	75	25
Five-Ten persons/ household	145	48.3
Total	300	100

Fig. 5: *Household Size*

Number of Bedroom per household	Frequency	%
One Bedroom/ household	222	74
Two Bedrooms/ household	30	10
Three Bedrooms/ household	21	7
Four Bedrooms/ household	18	6
Four Bedrooms+/ household	9	3
Total	300	100

Fig. 6*: No. of Bathrooms in Household*

Number of Windows per room	Frequency	Percentage %
One window/ Bedroom	197	65.7
Two windows/ Bedroom	103	34.3
Total	300	100

Fig. 7*: No. of Windows per Household*

Separate Space for Kitchen	Frequency	Percentage %
Yes	78	26
No	222	74
Total	300	100

Fig. 8*: No. of Windows per Household*


Plate 1&2: *Housina Conditions in the studv*


Plate 3&4: *Environmental Condition of the study area*

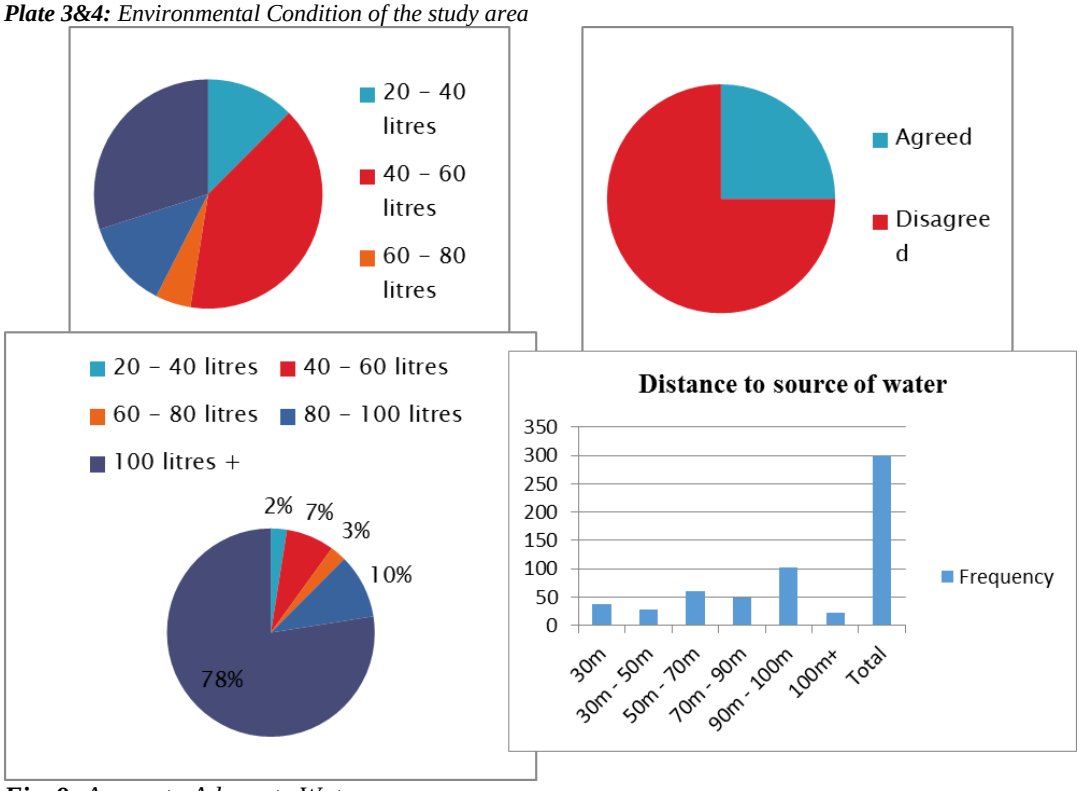

Fig. 9: *Access to Adequate Water*


Plate 5&6: *Main Source of water in the study area*

4.2.3 Access to Adequate Sanitation

Number of Household per Building	Frequency	Percentage %
One Household/ Compound	55	18.3
Two Households/ Compound	21	7
Three Households/ Compound	18	6
Four Households/ Compound	72	24
Five Household/ Compound	53	17.7
Six – Ten Households/ Compound	81	27
Total	300	100

Number of Toilets per Building	Frequency	Percentage %
One Toilet/ Compound	148	49.3
Two Toilets/ Compound	123	41
Three Toilets/ Compound	-	-
Four Toilets/ Compound	-	-
No Toilet/ Compound	29	9.7
Total	300	100

Plate 7,8,9&10: *typical toilet & bathroom facilities in the study area*

4.2.4 Structural Quality/Housing Conditions

Roof conditions	Frequency	Percentage %
Roof leaking	168	56%
Roof Not-leaking	132	44%
Total	**300**	**100**


Plate 11&12: *Structural Quality of Houses in the study area*

Cracks on the walls	Frequency	Percentage %
Cracked walls	221	73.7%
Non-cracked walls	79	26.3%
Total	**300**	**100**

4.2.5 Occupancy Ratio

SLUM	HHs Covered	Average HH Size	Population Covered	Total Habitable Room	Standard Occupancy Ratio	Population Expected	Spillover Population
ASO A	300	7	2059	462	2.5	1155	904

SUB-THEME SIX

Architecture and National Development

Effects of Globalization of Information Technology Communication Facilities on Architectural Practice in Nigeria

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ABSTRACT

The world today is witnessing the breakdown of territories in all countries and all the countries are coming up into a conglomerate call the global village. This globalization was not brought about by accident; it was as a result of advancement in technology which has succeeded in bringing all the countries of the globe together. This nature of the world has influenced so many professionals practice including architecture. This study examines effects of globalization information technology communication facilities on the architectural practice in Nigeria. It employs the use of both primary and secondary data for the study. The primary data were obtained through the use of questionnaire. The study considers only firms headed by registered Architects in Lagos, Ibadan and Abuja as listed in the register of Architects registration council of Nigeria (2012). Secondary data sources were obtained from the publications of Architect Registration Council of Nigeria (2012), which listed 388 firms entitled to practice in Lagos, Ibadan and Abuja Nigeria. The study sreveals that computer ranked first on the list of available information technology facilities in the firms with mean score of 3.2. The list available shows that Internet facilities, with a score of 2.57 and very few firms had websites. It appears that most of the firms were not global, as the presence of the firms on the web is an indicator of globalization of the firms. The study revealed increased performance in the practice of architecture in Nigeria, brought about by the effective use of information and communication technology as opportunities of globalization. The study concludes that the advent of globalization has brought a lot of ease and effectiveness to the practice of architecture in Nigeria.

Keywords:

INTRODUCTION

Globalization has influenced so many businessesand professions among which includes the practice of Architecture which aims at taking responsibilities for the design, construction and supervision required for the accommodation of the members of the society in efficient and sanitary surroundings at home and at work(Martins,1995). Architectural practice which officially started in Nigeria in 1960 has responded to the call of globalization and has gone far beyond what it used to be in the 19th and 20th centuries (ogundiran, 2006). The practice of Architecture (in Nigeria) has gone to a class where architects are required to move at a pace of the world business practice evident in the adoption and use of information and communication technology, inter-boarders outsourcing etc ,for international services so as to address how best the architectscomplement competitive advantages that can be gained from the world wide operations (Knox and Taylor, 2005).

The advent of globalization in the practice of architecture in Nigeria is a consequence of the pressure of globalize architecture which sprang up from two sources: global culture of commerce and the global culture of design (Lewis, 2002). This study examined the availability of information technology facilities, application of internet facilities, existence of website and electronic mail addresses of architectural firms in Lagos, Ibadan & Abuja as case study and the effective use of these information and communication technology will provide opportunities for globalization of architectural practice.

Globalization and Architecture

Globalization culture has little or no provision for indigenous ideas. In fact, it aims at competing critically with whatever products or culture that is prevailing in the home

Adegbehingbe, V. O. & Ogundiran, I. A. (2016). Effects of Globalization of Information Technology Communication Facilities on Architectural Practice in Nigeria. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1702-1709

countries. Globalisation is not meant to be friendly, rather it is an aggressive free world of the survival of the fittest. It has no human face. Exposing the nation's destiny to full global world would end up in neo-colonisation.The inability to carry out the use of other options of building materials is simply because of the extensive acceptance of cement as the only binding material for building components. Stabilised bricks have the capacity of reducing the cost of building by 40%. Yet, it is yet to be popular simply because the training of architects only refers to the use of cement and its products. Most curricula of building components and method hardly emphasise the use of stabilised bricks and yet this is the most relevant technology affordable to majority of Nigerian populace. Projecting from a research conducted by (Awotona, 1983), it was discovered that in Lagos, the Nigeria centre of excellence, only 42.3% of the residential buildings could be considered as good based on the minimum building standards. 17.4% are described as 'fair' while 40.3 are 'bad'. This is a clear indication of the true position of things today.

The Nigerian population growth rate of about 3.5%/annum is particularly very high. Most disturbing is the inequality in the growth of this population, as many of the major urban centres have doubled their population within the past three decades, while the rural population are continuously depleted. It is on record that the federal capital of Nigeria, Abuja is the fastest growing city in the world. This simply implies that the city is fast developing into an urban slum. There is no corresponding growth in infrastructures and physical developments thus creating more urban challenges.These are some of the peculiarity in Nigerian situation that requires specialarchitectural training. Nigerian cities and urban centres are growing phenomenally in area and population without planned direction due to the strain and stress of urbanisation and modernisation. This is reflected in the colossal deficiencies in housing, growth of urban slum, congestion of traffic, concentration of industries, social disorders and economic distress to mention but a few (Olateru-Olagbegi, 1982, Daramola, 2004).

The characteristics of Architectural firms and practices.

Architectural firms have been described as having a number of characteristics which in Emmitt (1999) opinions are ones which distinguish them from other types of business organizations. According to Winch and Schneider (1993), architectural firms provide a service, they are regulated by professional bodies, they are creative, and dependent on one particular industry, which is the building industry.

Architectural Firms as Service Firms

The majority of architects have been described as working in the building design, information and site inspection business (Sharp 1991). More specifically, architectural firms are concerned with providing service to a client which usually results in a product – the finished buildings (Emmitt 1999).

Architectural Firms as Professional Firms

The activities of the architects, architectural technologists and building surveyors are all regulated by their professional institutions and bound by respective code of conduct. Although the professional institutions were originally set up as a means of protecting their members' interests, some of their professional rules have limited the manner in which their member can trade, for example by restricting the manner in which they may advertise their services. The professional institutions are often perceived by their members as restricting the manner in which they can trade. Registered firms must comply with the relevant professional institution's code of conduct, otherwise the firm is free to act in any legal way it choose (Sharp 1991).

Architectural Firms as Creative Firms

Architectural firms are commissioned by clients to provide individual solutions to unique problems; they are primarily concerned with generating and maintaining creativity, an activity that many architects claim they would like to spend more time on in the modern office.Blau (1984) found that architects had a strong identification with work that was creative despite the fact that they worked in highly specialized or very technical areas. It has been observed that design is only a small part of an architect's job in-practice, much of their time are spent on issues relating to the construction of buildings, legal and financial considerations, the administration of individual jobs and personal management. When analyzed many of individual daily activities are concerned with issues generally referred to as management, yet it has been argued that management is a mystery to many design professionals, unsure whether it refers to business affairs or to bureaucratic control of the firm (Kaderlan 1991).

Architectural Firms as Building Industry Dependent

Architectural firms have a special relationship with one industry – building. This is not a homogeneous industry but is made up of many disparate strands. Buildings is essentially an industry of assembly (Emmitt 1999), regardless of the amount of prefabrication offsite, there are always factors unique to individual contract which makes it vary from one another within the same overall principles (Bennett 1981). Furthermore, buildings are fined to a particular location which means that materials and labor have to be taken to the site; thus building can never be a manufacturing process. Building is a complex problem because of the many different skills required during the different stages of the product's life cycle, requiring inputs from different areas at varying times.

Impacts of Globalization on Architectural practices

In his study of the impacts of globalization on the architectural practice in Kuwait, Mahgoub (2012) identified five aspects of globalization as economic, political, technological, social and cultural systems necessary for understanding the concept.

The global market place liberated professional services and labour, building materials and construction methods, trade and investment from the limitation of national boundaries. It allowed the free flow of materials and services across border and boundaries.

The impact of global politics on everyday life is apparent. Political events in one country affect other countries almost instantaneously. On the positive side, the rise of human rights awareness pointed on issues of the right to housing; housing of marginalized populations, and housing for the poor.

Telecommunication and information technology has produced a need for a new type of technological infrastructure, building types and design requirements. The electronic technology produced new breed of intelligent and smart buildings. The impact of the internet on architectural practice is evident in new trend of international firms to establish branches in different parts of the world utilizing the time difference to keep their business running 24 hours a day. For example, the easy transfer of drawings and documents aided in the globalization of architectural offices and projects is speeding the production and development of projects. Transportation technology affected urban and city planning theories and produced changes in understanding space and proximity. Building technology suggested new methods of construction and materials that require new methods of expression.

The traditional living/working habits that resulted in the separation between work and home during the 20th century, are giving way to new and revived forms of homework environment and mixed use planning that existed centuries ago.

Relationships between groups and individuals are influenced by ease of interaction and communication over the internet, permitting ‘’virtual’’ social interaction with people all over the globe. The internet offers information and knowledge about other societies that used to take long time to disseminate. The lifestyle of fast food chains, luxurious shopping centers, and other commodities is available all over the world today. The culture of the ‘global village’ disregarded cultural differences and increased similarities in lifestyle around the world throughthese icons of globalization.

The Opportunities of Globalization for Nigerian Architecture:

The use of computer in architectural practice in Nigeria has gained prominence. Globalization has impacted the practice of architecture in Nigeria with the use of electronic mail (e-mail) and other internet facilities. The use of Computer Aided Design (CAD) packages has facilitated faster and effective ways to present design concepts and co-ordinate with other professionals far away without being physically present. With wider and versatile use of the computer the architects in Nigeria are working as analysts, 3D presenters, furniture developers, hospital specialists, architectural historians, interior designers, landscape designers and urban designer. The latest version of Auto CAD series among others have proven to be essential tools that have contributed positively to the practice of architecture in Nigeria.

The Threats of Globalization for Nigeria Architecture:

Non-Sustainability or Urban Sprawl

Globalization has impacted so much on the practice of architecture in Nigeria and the results are evident in the physical aspect of the built environments. Simply put, most of the global-style developments in Nigeria are not sustainable. Most developments in Nigeria urban centers require large pieces of land, which are rare, resulting in the loss of a large amount of open space in the city, or new development spread outside the inner city, thus creating urban sprawl. The new sprawl of developments is often environmentally insensitive due to large amount of impervious surface previously or meant for green area, as in the case of Gwarimpa 3rd Avenue in Abuja, where the resulting commercial development are neither pedestrian friendly nor connected by pedestrian systems of the community.

Non-Cultural Designs and Construction

It was also discovered that the practice of architecture in Nigeria is gradually losing respect or appreciation for cultural or indigenous construction. The new development in Nigeria can no longer be identified by their construction or contextual characteristics.Most or all buildings in Nigeria are being built in international style. With fabulous photographs in slick magazines and professional journals, Nigerian architects scan and pane the globe sharing high-style concepts rendered in stylish materials. Glass, aluminium, stainless steel, copper, titanium which may not be easily accessed locally are now imported with ease having neglected our cheap local indigenous materials. Stabilized bricks have the capacity of reducing the cost of buildings by 40% (Daramola, et al.2012)

Architectural Anarchy

Architectural anarchy is another outcome of the manifestation of globalization in Nigeria. Anarchy, defined as lawlessness, social and political disorder caused by absence of government control. Architectural anarchy in the case of Nigerian practice of architecture arose from the negligence of the basic principles of architectural unity such as rhythm, balance, harmony, and contrasting the design and layout of buildings. The result of the research carried out by Bello et al (2007) in Ogbomosho revealed as the following manifestation of anarchy among others: Sitting of industrial buildings in the midst of

residential and public buildings, filling station in the midst of residential areas, and inappropriate location of religious houses within residential areas.

RESEARCH METHODOLOGY

The data for the research were obtained through primary and secondary sources. The primary data were obtained through the use of questionnaire. This study considered only firms headed by registered Architects in Lagos, Ibadan and Abuja as listed in the register of Architect registration council of Nigeria (2012).

Table1: No of Registered architectural firms in selected towns (Lagos, Ibadan & Abuja) in Nigeria

S/N	Town	No of Registered Firms
1	Lagos	206
2	Ibadan	54
3	Abuja	128
	Total	388

Source; Adapted from ARCON, (2012)

Samples of firms were selected from cities where the firms were mostlyconcentrated in Nigeria.

This study was limited to architectural firms and did not include all types of architectural practices. This study considered only firms headed by registered architects, (ARCON, 2012). This study was carried out at the level of firm rather than the individuals of the firms.The study adopted survey method. The firms studied included in the study population were those that are registered with the Architects Registration council of Nigeria, and are practicing in Lagos, Ibadan & Abuja. The primary data collection involved an extensive study of the architectural firms to obtain only the profile and technological data of the firms. Secondary data sources were secured from the publications of the Architects Registration Council of Nigeria (ARCON,2012) listed three hundred and eighty eight firms entitled to practice in Lagos, Ibadan and Abuja Nigeria as shown in Table 1.

The sampling method that was most adequate for the study was hybrid of two methods-purposive sampling and random sampling. This involved first purposively selecting the cities, where architectural firms were most concentrated in Nigeria, and then randomly sampling within the cities.

The study took its purpose samples from three cities, where architectural firms were most concentrated in Nigeria (Lagos, Ibadan, &Abuja). In order to obtain random samples within each of these cities, the sample frame that was used was based on the Register of Architectural Firms entitled to practice in Nigeria (ARCON,2012). Random sampling gave the individual firms in the cities equal probability of bearing selected.

Table 2 : The calculated appropriate sample sizes

City/Town	Sample Frame	Calculated Appropriate Sample Size
Lagos	206	110
Ibadan	54	32
Abuja	128	73
Total	388	215

Each sample was then selected randomly.

This study focused on principals/senior partners of firms, from whom information was sought about information technology usage of firm. This study took a cue from the studying by Symes et al, (1996) where the firm was used as the unit of analysis.

The instrument for collecting data was by questionnaire and was administered to principals or senior partners of firms. The questionnaire were combination of closed and open-ended questions.

The technological data included number of computers in firm, frequency of use of the internet to exchange information, and the application to which information technology is put.

The quantitative data were analyzed using descriptive statistics. Tables were used in presenting the results. Data was collected with the aid of six field assistants who were Practicing Architects in towns they administered the questionnairebetween June 2014 to August 2014, and various responses were analyzed by means of statistical package for social scientists (SPSS version13).

A total of 117 questionnaires were returned duly completed. The distribution of questionnaires relative to the duly completed forms is detailed out in table3.

Table3: Distribution of Questionnaires to Architectural Firms in Lagos, Ibadan &Abuja, Nigeria

Location	Sampleframe	No of Questionnaire	No of duly completed quest	% of duly completed questionnaire
Lagos	206	110	63	57%
Ibadan	54	32	16	50%
Abuja	12.8	73	38	52%
Total	388	215	117	54.42%

Table3 above shows the distribution of architectural firms in the three cities in Nigeria and also present the proportion of the responses to the questionnaires distributed. The responses were very low due to the fact that most of the firms using the addresses indicated in the Register of Architectural Firms in Nigeria(ARCON 2012) had moved from those locations. In addition, some firms were reluctant to fill the questionnaire claiming that they were very busy.

The study examined the availability of Information Technology facilities, application of interest facilities, existence of website and electronic mail addresses of firms.The firms were asked to indicate how available IT facilities such as the computers, the intranet, the internet were in their firms. The scoring for each firm for all the facilities were added, to arrive at the level of the availability of the IT facilities for each firm.

The total scores ranged from 2 to 18. Scores from 2 to 8 were coded as almost non-existent, 9 to 14 were coded as fair availability, while scores of between 15 to 18 were coded as high availability. Table4 shows that IT facilities were highly available in 40% of the firms, available 30.8% of the firms almost non-existence in 29% of the firms.

Table4: Ranking of availability of Information Technology Facilities

Facility	**Mean**	**Rank**
Computers	3.52	1
Intranet	2.71	2
The internet	2.57	3

Table4 shows that computers ranked first on the list of available information technology facilities in the firms with mean score of 3.52. Next in ranked was the intranet with a mean score of 2.71. The least available in the firm was the internet, which ranked last with a mean score of 2.57. This conform to the study carried by Amole(2006);Oluwatayo(2009).

FINDINGS AND DISCUSSION OF RESULT

The study found that information technology facilities were highly available in most of the firms. The most available of the facilities were computers, while the least available were internet facilities. The level of the use of the internet for basic tasks in most of the firms was moderate. The internet was mostly used for sourcing information, and correspondences with other professionals.The internet was least used for communications in the office.

The study found that most of the firms where decisions were highly centralized used the internet for designing and drafting. In addition, while most of the firms had electronic mail addresses, very few firms had websites. It appears that most of the firms were not global as the presence of the firms on the web is an indication of globalization of the firms.

The information technology driven firms are characterized by availability of the computer and the use of the internet to carryout basic tasks such as design, drafting and correspondences with staff in the office. The comprehensive local firms had the internet and the intranet on most staff desks in their offices, but they had no websites. The firm had a wide range of services and fairly used the internet for basic tasks in the offices.

Table 5.0 Ranking of the Application of Internet Facilities

Task	Mean	Ranking
Sourcing information for design	2.69	1
Correspondence with other professions	2.56	2
Graphic presentation	2.48	3
Correspondence with clients	2.37	4
Designing / drafting	2.21	5
Correspondence with staff in the office	2.19	6
Project management	1.93	7

The result shows that most of the architectural firms moderately used internet to carry out office tasks. The architectural firms mostly used the internet for sourcing out information, which can then be global in their operation. The firm least used the internet for project management.

Websites and Electronic mail addresses

The sampled architectural firms were asked if they had websites. The study shows that more than half (60.75%) of the firms did not have websites, only few (38.24%) of the firm had websites, while 1.01% of the firms were not sure they had websites. This is significantly different from the study carried out by Amole(2006) & Oluwatayo(2009).. This study now shows that there is an improvement in the use of Information Technology Communication facilities, which tend the firms to embrace globalization.

The study further shows that most of the sampled firms (89.37%) have electronic mail addresses, while few (10.63%) did not have any electronic mail address. This is a decline, when compared with the study carried byAmole (2006), & Oluwatayo (2009),while the study shows that more architectural firms had electronic mail addresses than those that had websites. It appears that the architectural firms adopted more of the mailing facilities than the internet provision. This result confirm the findings of the Amole(2006) & Oluwatayo(2009).

Tables 6: Possession of websites and electronic mail addresses

Possession of	% Ranking
Website	60.75
Non sure	1.01
Non possession of website	38.24
Possession of electronic mail address	89.37
Non-possession of electronic mail	10.63
	100

RECOMMENDATIONS AND CONCLUSION

It is recommended that while we embrace the opportunities brought by globalization, it should not be given blanket acceptance in the architectural practice in Nigeria. Globalization should not be the major emphasis in architectural practice, just like Daramola et al (2012) suggested for architectural education. 'Nigeria should not be seen as local but be encourage for further development through the emphasison the indigenous architectural grammar '(Uji 1991, Daramola et al 2012). They made it known that housing standards in any country is a product of the building technology as well as the available economic resources to execute it. Why then do we have to practice the architecture of copying from the magazines what we cannot sustain and when we have cultural heritage that we need to protect?

In conclusion, the practice of architecture in Nigeria while earnessing the opportunities brought about by the information and communication technology benefits of globalization to the fullest, strict caution must be exercised in the protection of our own tradition and cultural identities. Our architecture must be tailored toward the indigenous an climate functional needs of the Nigerians.

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Contextual Harmony between Traditional Architecture and City Identity in Ebonyi State, Nigeria

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ABSTRACT

A city is a unique organism which has its' own identity formed and affected by the people, social, natural and anthropogenic factors among others. In order to create or sustain the identity, all building types have to be designed in contextual harmony, representing and respecting the character of the place in accordance with the lifestyle of its people, the materials for construction available, and technical possibilities open to them. The architecture of Igbo people emphasizes on the supremacy of spirituality, community and family lifestyle. This resilient indigenous architecture had been influenced severally by western culture via religion and colonization, yet they contain valued cultural heritage. This study investigates the Igbo architecture and suggests the need to revive it on public buildings. Public buildings houses the facilities that constitute an important part of the community's quality of life and most time reflect the state of technology and organizational resources of a place, therefore making it the best focus for the study. The public buildings in the cities of Ebonyi state were examined with regards to their conformity to the communal context of house design of the people. The paper also discusses the benefit of maintaining the identity to promote the city image thereby making it attractive for tourism purpose and also contribute to the economic development of the state. Findings show that the people of Ebonyi state are culturally inclined but the architecture of the public buildings does not conform to the cultural lifestyle of the people. Therefore, the paper suggests that architecture designs of these public buildings should take the culture, religion and festivals of the people into cognizance.

Keywords: City Identity, Ebonyi state, house design, public buildings, traditional architecture

INTRODUCTION

Igbo architecture generally revolves round the use of both natural and artificial resources. Their geographical location is believed to be responsible for this inward-looking philosophy. In the tradition of the Igbo people of Ebonyi state, the construction and architecture of houses incorporates a balance with nature and an emphasis on the supremacy of spirituality, community and family life through the fusion of family gathering and worship spaces, as well as sacred spaces allocated for deities in the household. This tradition that can broadly be categories under religion and communal lifestyles are always expressed and represented in their buildings architectural designs. Like in other parts of Africa or even the world over, their patterns of architecture reflects the cultural, environmental and defence needs of the people at any given period.

The philosophy and religious believes that have been established in their architecture, are embedded in the historical, culture and the real identity of the people. This identity has suffered influences of westerners since the 15th century (1472 to be specific) when western architecture was first introduced by the Portuguese who expanded the slave trade in the region, first as trading infrastructure, and then as colonial administrative facility (Elleh, 1996). The Colonial architectural policies that came to be in the early 20th century were a tool of mass displacement and a system of segregation. The European colonialist believed that Igbo architecture are inferior, and their culture as an anachronism that must be eradicated and replaced with better European ones (Chukwuemeka, 2009).

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Although the Igbo indigenous architecture survived in many communities among certain categories of people, the valued cultural heritage of the people is fast fading away as the western architecture keeps penetrating every development in the study area. Chukwuemeka (2009) opines that the thought and effort that are put in the design and building of a house contain personal, social beliefs and practices as well as specificity of the owner's input, therefore, there is need to understand the architecture of the Igbo people as regards their cultural believe and religious meaning of construction type in other to sustain this architecture. This is needed to explicate the identity that is manifested in their traditional buildings and the history behind the architecture, thereby substantiates the need to revive the architecture through its use in public buildings design in the area. Public buildings are built to accommodate the needs of the community, and some play major roles in determining the location, intensity and timing of future development. These facilities also contribute to community's quality of life and are always strategically located depending on their function. Its major merit in reflecting the state of available technological and organizational resources of a place makes it the focus of this study. The subsequent discussion focuses on the design philosophy of the Igbo people of Ebonyi extraction explaining the trend of their architecture from tradition to post-colonial era.

DESIGN PHILOSOPHY OF THE EBONYI PEOPLE

The Study Area

Ebonyi State is in the South-Eastern region in Nigeria. It is inhabited and populated primarily by Igbo people. Its' capital and largest city, Abakaliki, is located 64 kilometres (40 miles) South-East of Enugu. The state lies between 73 degree North Longitudes and 5 degree 4 East Latitude, with land mass approximated at 5,932 square kilometres. The state was created in 1996 and shares boundaries in the North with Benue State, East with Cross River, South with Abia and West with Enugu. There are nine (9) primary dialects spoken in Ebonyi State, these are: Afikpo, Mgbo, Izzi, Ezaa, Ikwo, Kukele, Legbo, Mbembe and Oring. These languages are all subgroup of the Igbo language and are commonly spoken throughout south eastern Nigeria.

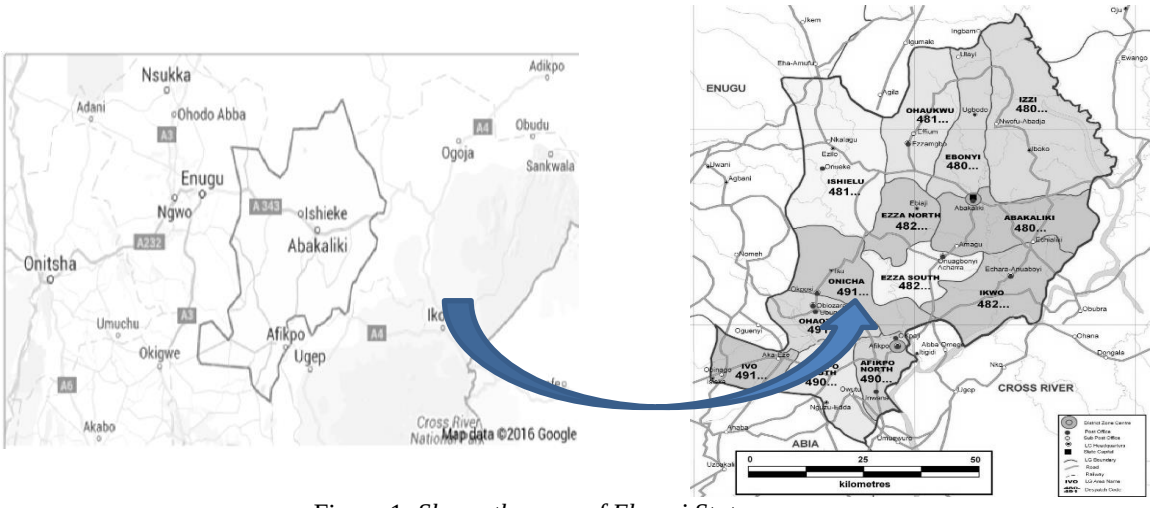

Figure 1: *Shows the map of Ebonyi State.*
Source: www.google.com/map data, 2016.

Based on 2005 census, Ebonyi State has an estimated population of 4,339,136 people and the inhabitants are spread across 5,935 square kilometres. The state is predominantly dominated by the Igbo's with other minority ethnic group from neighbouring state.

The Primitive Architecture of the Igbo Community

The traditional Igbo building architecture provided warmth, shelter and defence against animals and unwanted intruders. This is a direct reflection of what cave environment provides its inhabitants. The Igbo ancestors' first settlement were in the caves prior to the development of house building culture (Chukwu, 2015). Similarly, the house was fashioned to provide these basic necessities of life for the inhabitants and it was designed after the architectural structure of contemporary caves whose walls were usually virtually round in shape and covered with thatched roof. The settlement layouts, building structures and aesthetics represented the physical manifestation of a spiritual worldview, a balance with nature and respect for community membership and centrality. Forde and Jones described a typical Igbo settlement pattern to

> "*Consist of loose clusters of homesteads irregularly scattered along cleared paths radiating from a central meeting place of the village and/or village group, which contains the shrines and groves of the local earth deity or other chief spirit and also serves as the market*"

Therefore, in a typical Igbo society, two distinct areas were discernible – the public quarters (*ama*) and the kindred (*ezi*) (Chukwu, 2015).

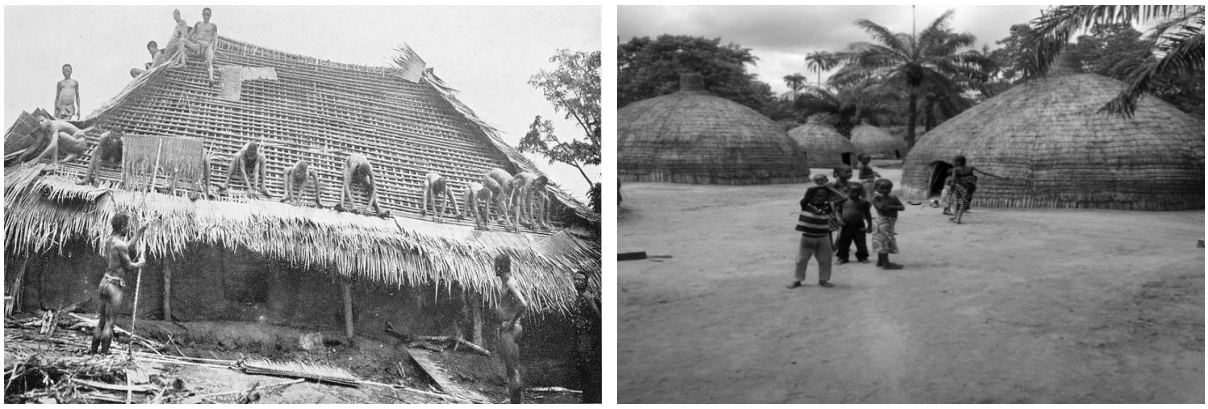

Figure 2: Showing the primitive architecture of the Ibo`s
Source: www.google.com/ibo culture

The kindred houses individual compounds built alongside other buildings of a family enclosed by a large wall. The main entrance was usually a gate. The number of houses in a given compound depended on the number of wives married by the man owning the compound. The major material used in building Igbo houses include mud, timbers, and raffia/palm stems (used for the support of the walls and roof). Homes were also places of creativity; women typically adorned the walls with painted designs, demonstrating an appreciation for artistic expression. The public quarters (*ama*) housed the assembly building and the shrines of the various deities of that community. These were always situated at the center of the community for public gatherings, discussions and meetings, as well as other community interactions. Today, such places are been referred to as "public spaces," and these areas were hugely important to the idea of bringing people from different parts of the area together.

The material for construction also generated from their culture and religious believe. They believe that the material made available for them was a gift from the mother earth god called "ALA", and this material is used easily with the help of a spiritual being (CHI) that gives rain in season and stops it at time of use. This believe and material association reflects in their architecture till today as local building traditions have been retained within modern urban

housing development in primarily Igbo-speaking areas of South-eastern Nigeria mostly for places such as social and cultural gathering in their residences.

Dike ancient war tower was one of the traditional architecture, made with indigenous materials that have stood the test of time (Fig 3). It is a 20feet tall multipurpose pyramid tower built by Dike Madueke, which aided the people to thwart the plans of their enemies. The interior of the tower has three deck, spy holes all around it and with the aid of ladder people climb from one deck to another. The ground floor of the tower is the most spacious and acts as a refuge for women and children, considered the most vulnerable in war time. The tower had recently been reduced in height to enable maintenance and preservation. It has survived years of weathering due to its special indigenous architectural skill that went into its construction. It takes a high degree of specialized language in order to communicate these architecture ideas; language that involves terminology of the concepts of geometry, measurement and logistics. The lack of active written records also means that people had no choice but to really know what it was they were doing and also know how to communicate that knowledge to others that they were working with, otherwise, they would not be able to produce these works. The existence of the skill for this type of construction is not likely to exist these days.

Figure 3: Shows the Dike ancient war tower
Source: http://www.logbaby.com

The Western Influence

The Igbo architecture and settlement design brought together an intersection between environmental architecture and design with spirituality and community centeredness. It also ensured a minimal environmental footprint. Admittedly, these were low-cost, simple technology methods, but households still effectively adapted their living structures to the tropical climate, especially the heat. Meanwhile, City consciousness and urbanity have become integral components of the Igbo society. All the cities in Igbo land have experience a fast growing development population. The receptivity and the amenability to change and access to western education, culture, Christianity and capitalism by the Igbo people resulted in the alteration of the Igbo architecture. The Portuguese in1472, began to expand the slave trade in the region through 15th, 16th, and 17th centuries and introduced Western architecture, first as trading infrastructure, and then as colonial administrative facility (Elleh, 1996).

The 20th and 21st centuries also witnessed an unprecedented influx of the people into the Western world perhaps in search of greener pastures. More so, as a result of cultural diffusion experienced both by the home front due to colonial incursion, neo-colonialism and by the Diaspora who presently are in serious romance with the western culture, much of the traditional practices have undergone serious modification. The alteration was gradual as the early western architecture utilized indigenous material for construction but their design features, such as opposite-window setting for cross-ventilation, extended roof to form awning, and inner demarcations, were of European or European hybrid conception (Ottenberg, 1959; oraegbunam, 2011)

Another imprint of western architecture is made manifest in physical structures such as roads, streets, hospitals, building architecture, house furniture and home facilities, and so on. Yet, in spite of the above foreign influence, certain traditional practices are quite resilient. In the neighbourhood, some traditional Igbo communities live in dispersed settlements. The Igbo village, which is a small face-to-face society, is still easily recognizable. The people embrace Christianity in large numbers, but their way of living and attitudes towards life is still conditioned by their traditional worldview.

The entrance of Western influence through the political, social and economic consolidation by the British not only strongly influenced architectural and urban design methods of places in Igbo land like Ebonyi, in particular, the emphasis on building settlements into urban centres, putting economic activity and industrialization at the center of urban life, served to dislocate traditional values of community centrality and an agricultural focus. Rather than an open community space at the center of town or a settlement, African cities have developed central business districts modelled after Western styles. Economic activity and money-generating opportunities have replaced people and social interaction as the center of community life. The massive conversion toward Christianity reduced the communal respect for the deities, and as a result, the emphasis on an allocation of physical space for religious purpose in the home environment using traditional material and methods of development.

PUBLIC BUILDING IMPACT FACTOR

Public and quasi-public facilities are built to accommodate the needs of the community, and some play a major role in determining the location, intensity and timing of future development. These facilities also constitute an important part of the community's quality of life and houses the social practice of the people. The City is host to a wide range of public buildings and facilities, including City Hall, fire stations, water wells, electric power substations, telephone and cable transmission lines, schools, and libraries.

The Public Buildings and Facilities Element provide background information on various structures and facilities operated by public and quasi-public agencies in the City and reflects the state of available technological and organizational resources. The element reviews these buildings and facilities in light of the issues of land use compatibility, aesthetic impacts, and functionality. It is also meant to provide sufficient information to assure coordinated, long-term planning that keeps pace with the growing community. In Ebonyi state, their social practice and traditional festival are taken place at the public building in the state. The design of these public building are not in conformity with the expected traditional design.

Figure 4: Showing the cultural festivals of the Ebonyi people
Source: www.google.com/ibo culture

The major social practices among the Igbo is the naming of the new born that involves some ritual activities, the *Okuku Onye Uwa* ceremony, and *Abam n'Obi* ceremony. For an Igbo child, the ceremony of being named is the starting point of being socialized into the membership of the community. Those who live well-spent lives die in socially approved ways, are given correct burial rites. The two major traditional festivals observed every year are the masquerade and the new yam festivals. The masquerade is a very important and colourful celebration and features the omata Ekpe and Ogbodu masquerade. Across various communities are festivals that can be repackaged to draw national and international attention. The Ojiji new yam festival in Izzi draws back more people to the town more than the Christmas and New Year festivities. In time past, the open space or town square were venues for these events and the venue were always designed culturally to fit the occasion (Fig. 4). Development has taken over the open spaces, they are now replaced with public halls and complexes. Taking the Akanu Ibiam conference hall in Abakaliki and the WDC conference hall (figure 5) as a case study, these buildings were oriented towards western architecture which disallows most of the things that add flavour to the traditional events. For instance, local wrestling cannot be performed on hard floor finishes, group dancing competition which is always done within circle of people is not compatible with fixed chair arrangement, shooting of local gun to the air as display of hunting prowess among others are evidently impossible in these type of event halls. The culture and style are altered and the flavour missed. However, the buildings lack the taste of the traditional culture and it is not in conformity with norms and religious belief of the people.

Figure 5: Showing the popular Akanu Ibiam International conference hall and WDC conference halls
Source: Authors archive

THE PROPOSED AFTERMATH

Social Sustainability

Social sustainability encompasses notions of equity, empowerment, accessibility, participation, sharing, cultural identity, and institutional stability. It seeks to preserve the environment through economic growth and the alleviation of poverty (Basiago, 1999). In the most basic sense, 'social sustainability' implies a system of social organization that alleviates poverty. In a more fundamental sense, however, social sustainability establishes the nexus between social conditions (such as poverty) and environmental decay (Ruttan, 1991). The theory of social sustainability calls for economic growth constrained by the requirements of social equity. It was posited that in order to link these, an enabling environment must be created that optimizes resource use, prioritizes resource allocation, and fosters equitable resource distribution (Basiago, 1999).

Indigenous materials are representations of the region's climate and culture. It is characterized by its' potential for comfort, functional, durability and energy efficient and it satisfies modern standard of living (Gardi, 1973). Indigenous materials promotes creativity and experimentation on the part of the builder while helping to reduce the demand on scarce natural resources. Using indigenous material can aid in the production of housing that is both monetarily affordable and environmental friendly, and most importantly, culturally oriented. Indigenous materials have the potential to save cost through reduced material cost, create job for under-employed and local contractor thus fostering social sustainability. Many indigenous materials are present in Ebonyi state, among which are: laterite brick made from clay, bamboo, straws, woods, palm fronds, stones and rubbles; but mostly not harnessed. The neglect of these materials had effect on its' improvement, although lots of researches had been done (Okpoko & Okpoko, 1999), implementation had been minimal in Nigerian present architecture. Figure six (6) shows a typical building constructed with laterite bricks and a recreation area constructed with bamboo. These show that the potential of these materials is almost inelastic. Creative use of these materials if properly harnessed can sustain the dwindling architectural style of the people.

Figure 6: Showing a house made with laterite bricks and a recreation garden constructed with bamboo
Source: www.goole.com/bamboogardens

Brand Identity for Ebonyi

The spread of a global culture and lifestyles is very fast, compared to previous times, and it emanates from an identifiable center (Taylan and Ümit, 2008; Ayna, 2011). Due to new communication technologies and media, culture has become a commodity, produced, offered and marketed, and so it has become an image. The world is becoming a single social space held together by the cultural transportation of semantic systems and symbolic forms (Hannerz, 1998; Ayna, 2011). Research findings from Anholt (GfK Roper Nations Brands Index and City Brands Index, 2005) shows that the way a country or place is perceived can make a critical difference to the success of its business, trade and tourism efforts, as well as

its diplomatic and cultural relations with other nations. Anholt (2005) posits that, "in today's globalized world, every city must compete with every other city for its share of the world's tourists, investors, talent, cultural exchange, business visitors, events and media profile. Arguing a case for the application of branding principles in the marketing of places, Peter van Ham suggested that "a state just like a company requires a strong brand.

To rise above the clustered political landscape, a state must be able to define and promote its vision while arguing the need for Canada to rebrand itself, Ferguson (2001) writes that, no state wants to be anonymous. The goal, rather, is to have a brand that makes winning friends and influences easy. Countries in the developed world have since realized the importance of strategic destination branding campaigns as a competitive advantage in the drive for investment and tourism dollars. This is not surprising for as Randall (2004) has once also posited that:

> "*The image we have of another country says a lot about how we view it as a tourist destination, a place to invest or a source of consumer goods.*"

This views supported Braymer's suggestion in the paper "*Branding a Country* (Braymer, 2003)" that Countries will compete daily with neighbours or block regions for tourism, inward investment and export sales, There's only so much business that can go around.

Having the indigenous architecture stains the entire cities in Ebonyi will create a concise brand on the city which could attract tourist, investors and export sales to the city (Chi and Qu, 2008). This in turn will improve the standard of living of the people in Ebonyi state which also equates to enhanced development in all of their communities. The land is filled with untapped treasure among which are fertile farmlands, rich salt deposits, vast deposits of solid minerals, and thriving quarry sites. The major cities that make up Ebonyi State include Afikpo, Uburu, Nkalagu, Ishiagu, Okposi, Amasiri, Onicha, Abakaliki, Eba Unwana and Onueke with a conservative population of well over two million people. This large population, with a sizeable number being agrarian, no doubt, is a factor to be reckoned with by any eagle-eyed investor especially in the Agriculture sector. Unwana beach, Ndibe beach, Oferekpe beach, Afikpo beach are some other side attraction for visitors to have fun. The Afikpo beach is usually a beehive of activities at weekends and public holidays as fun seekers gather there. This is a tourist potential that government should focus more on or encourage investors to upgrade it.

The major roads in the city which are very accessible and adorned with an array of beautiful flowers. Abakaliki Golf Course, located along Ezza Road, and the lawn tennis court are good leisure spots. The stadium hosts regular sports activities, especially football. The Ojiji new yam festival in Izzi can be made to look like the Offala festival of Onitsha, Eyo festival (Lagos), the Argungun fishing festival, the Durbar, the Ikeji festival (Imo state) or the Lebokun festival (Cross River State) where major companies notably the communication companies like MTN and Airtel sponsor and promote events.

Indigenous Material Treatment

The performance of indigenous building materials over long period of time, in all climates, and for all structural conditions is still not completely understood, nor worked out. Local building materials hold a promise of cultural environment, ready availability, low energy costs, aesthetics and simplicity of equipment requirement in the exploitation and utilization. They also have the potential to enhance a sustainable construction practice. Mud (Apiti), Grasses (ahiha), Bamboo (Achara) are some of the common building materials present in Ebonyi state. Generally, in Igbo land, it is widely used mostly in their private houses either at the recreation part of the design or the religious building. Bamboo is a sustainable and sturdy

building material that regenerates very quickly with the fastest growth rate reaching 100cm in a 24hr period. The use of bamboo includes building construction (as both exterior and interior design elements), and it is heartier than oak, much stronger than steel, flexible, light weight, and has water resistance properties. Other available construction materials in Ebonyi are Palm frond (Igu-Nkwu), Leave (Akwukwo), Wood (Osisi).

In the modern world today, wood is highly used for wall because of its workability, strength; durability of wood when sawed into converted timber. A skeletal form of building is set up and timber is arranged to fill the surface of the skeletal form. It can be arranged vertically or horizontally and if well-constructed, it can give a very strong and beautiful wall component. Wooden ceiling have advantage of reducing heat emission into the building because it is a poor conductor of heat, and it is also been laminated to improve its life span. Indigenous building materials have potential for being adopted as alternatives to conventional building materials even though it has been found to suffer persistent discrimination. There have been some research into their use, but implementation of the results of such researches has been limited by lack of patronage and social bias. Some of the reasons found to have contributed to this persistent discrimination include doubtful durability and life span, poor social acceptability, as well as the lack of well-established standards for these materials. It is therefore recommended that research findings on the characteristics of indigenous building materials, especially on the failings and innate characteristics be improved upon and architecture designs of these public buildings should take the culture, religion and festivals of the people into cognizance.

CONCLUSION

It has been proved from body of literature that Ebonyi people are culturally endowed. Therefore, their culture should be exhibited to the visitor via public buildings by making use of their available indigenous building materials and adoption of their method of construction. Daramola, Alagbe and Aduwo (2011), supporting Adeyemi, (2000) opines that emphasis should be laid on the crystallization of variations of concepts and ideas to reflect the past to research and re-identify the lost glory. Variations derived from traditional culture would be more authentic and long lasting than variations arising from official fiats or imposed conditions and concepts. The areas of potential benefit of incorporating indigenous building materials in building construction as it depicts cultural environment include: reducing costs of construction since materials found locally will be used thus eliminating costs associated with manufactured products and transportation, the development and propagation of indigenous technology and the provision of employment. These will invariably contribute to the economic growth of the nation, and provide source of research for both students and professionals of construction disciplines.

Celebrating the culture of the people and their way of life that include but not limited to branding to a state or community promote tourism, strengthen the national or regional identity, promote new work ethics, respect and self-respect, to mention a few. Initiatives should be taken by co-operatives, non-governmental organizations (NGOs) and government agencies, to promote the awareness on indigenous building materials in order to popularize their use. Also, by promoting the use of indigenous building materials, it will provide employment for the unskilled workers and income for the community where the indigenous materials are being harvested. It will create a forum to improve local technology by imbibing the western technology.

There are potential benefits associated with the use of indigenous building materials for building construction, but they are yet to be fully explored. Engineers, architects and builders

will require retraining to think in terms of these materials; standards and specifications need to be established; pricing and subsidy structures will have to be changed to give encouragement to the production of indigenous materials; most difficult of all, the general public, those who build or decide what is to be built, need to be re-educated to think in terms of building with indigenous materials rather than what has become conventional or fashionable to use.

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Land Use Impact and Environmental Health Hazard of Abattoir Location in Ilesa, Osun State, Nigeria

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ABSTRACT

Abattoirs are facilities available in most towns and cities for killing animals and supply meat for human consumption all over the world. Its waste has a complex composition and is harmful to the environment. This paper focuses on environmental health hazard and land use impact of abattoirs location in Nigeria, using Ilesa in Osun State as a Case Study. Data on the noxious effects were collected at four different abattoirs locations in Ilesa. 161 respondents were sampled in the direction of wind within 50 meters of the selected abattoirs. Stratified sampling was employed for selecting houses interviewed with the use of questionnaire. The paper observed the environmental quality of the abattoir and views of both operators and residents as well as the causes of environment pollution which includes air pollution and water pollution. The results of the investigations were later analyzed using Pearson's Product Moment Correlation to determine the level of correlation between the abattoir wastes generated and health of the residents. It was concluded that the waste have adverse effect on residential land use. This study recommended that the abattoir wastes should be be recycled to produce biogas, fertilizers, medicine, glue, photograph and plates for human use instead of causing environmental hazard on people.

Keywords: Land Use, Abattoir, Health Hazard, Environment, Pollution

INTRODUCTION

Abattoir has been known as one of the facilities in our neighborhood which must be managed in a proper way. Abattoir has been defined as premises approved and registered by controlling authority for hygienic slaughtering and inspection of animal processing and effective preservation and storage of meat for human consumption (Alonge, 1991).

Slaughter and processing activities of animal's sometime result in environmental pollution and disruption of ecosystem functionality contribute impurity in the form of wastes. In many part of the world, human activities impact negatively on the environment and biodiversity. Some of the consequence of man-made pollution includes transmission of diseases by water borne pathogens, eutrophication of natural water bodies, and accumulation of toxic chemical in the soil, destabilization of ecological balance and negative effect on human health.

Meat processing facilities produce solid, liquid and gaseous waste. Liquid and solid wastes tend to be worrisome due to the high content of putrescible organic matter, which can lead to the depletion of oxygen and disruption of water eco-functionality and a preponderance of diseases-causing organisms. The meat processing wastes come from stockyards, abattoirs and packing plants e.t.c; all these contain blood, fats, protein, gut content, heavy metals, antibodies hormones and other substances (Awulu and Itado, 1991).Abattoir wastes contain several pathogenic species of bacteria which affect animal and human health (Coker et al, 2001).

In many developing nations such as Nigeria, many abattoirs dispose off their waste directly into streams and rivers and also use water from the same source to wash slaughtered meat (Adelegan, 2002). The situation is not different in Ilesa, Osun State, where most liquid and gaseous wastes are released to the immediate environs of the abattoirs. In some instances, the solid wastes are deposited with other urban wastes, some distance from the abattoir. Efforts have been geared towards curbing the menace of pollution around the world, particularly by

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the United Nations Organization, such as United Nations Environmental Programme (UNEP). There are many international conferences and protocols to this effect; Rio de Janeiro Conference of 1992 in Brazil was one of the major efforts, collating previous environmental issues and bringing them to the fore.

Many researchers had considered various dimensions, in looking into the ways and the extents in which the location of abattoir affect our land uses and the quality of lives of individuals. In this paper, the need for the upgrading of the existing abattoirs in Ilesa at Omi-Eran, General Hospital area, Araromi and Irojo abattoirs is very crucial and important since those existing abattoirs are of poor standard with inadequate facilities. The need for the examination of the activities of the principal officers associated with abattoir operation such as health officers, veterinary officers and waste management officers should be examined. This paper aimed at examining critically the harmful effects of unhygienic environment and put forward recommendations for maintenance of those abattoirs. This was done by identifying the types of waste generated in the abattoirs, examination of the procedures for managing the waste, assessment of social-economic characteristics of the residents around the abattoirs and finally, investigate and determine the chemical composition of both solid and liquid waste from the abattoirs and their side effects on land use and human health.

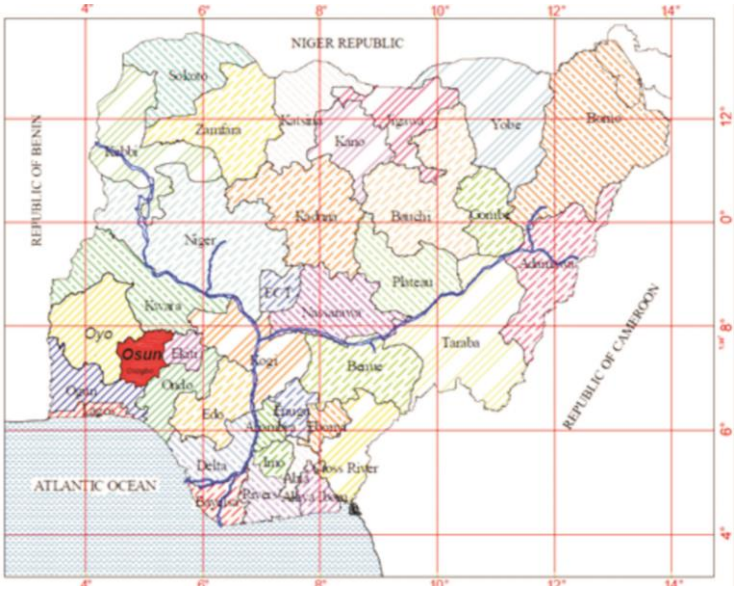

Fig. 1: Map of Nigeria showing Osun State
Source: *Ministry of Lands and Physical Planning, Osogbo, Osun State, May, 2015*

STUDY AREA

Ilesa is located on latitude 7.39*N* of the equator and on longitude 4.38*E* of the Greenwich meridian and it is about 32 kilometers away from Osogbo, the capital of Osun State, Ilesa is 119 kilometers away from Ibadan, the capital of Oyo State and 85kilometers away from Akure the capital of Ondo State and about 97 kilometers to Ado-Ekiti the capital of Ekiti State. It serves as the Zonal headquarters for the Ijesa people who are found in Ilesa and the four other local governments of Obokun, Atakumosa West and East and Oriade Local Government Areas. Ilesa Township covers a landmass of about 144 square kilometers. It is strategic node and the main gateway from Osun state to Ondo and Ekiti State respectively. Many roads connect Ilesa and other parts of the state. This facts and the presence of telephone and postal facilities enhance easy communication with other towns within and outside the state. Ilesa was split into two local governments in 1997 namely Ilesa West and East local governments. Before 1967, Ilesa was the Divisional headquarters of Ijesa division

comprising Ijesa north, Ijesa south and Ilesa urban district council. This made the government to establish branch offices of the various ministries including that of work, transport and mines at the city centre which also has commercial and residential areas.

The people of Ilesa are mainly farmers, planting crop like plantain, yam, cocoyam, cassava, maize and varieties of vegetables. Cocoa which is one the cash crops of the country and the mainstay of the Nigeria economy before the discovery of petroleum cover a greater part of the arable land. Other cash crops include Kolanuts and Oil palm. However, a large number of people also engage in trade such as weaving, tailoring, blacksmithing, bricklaying, block making and butchering.

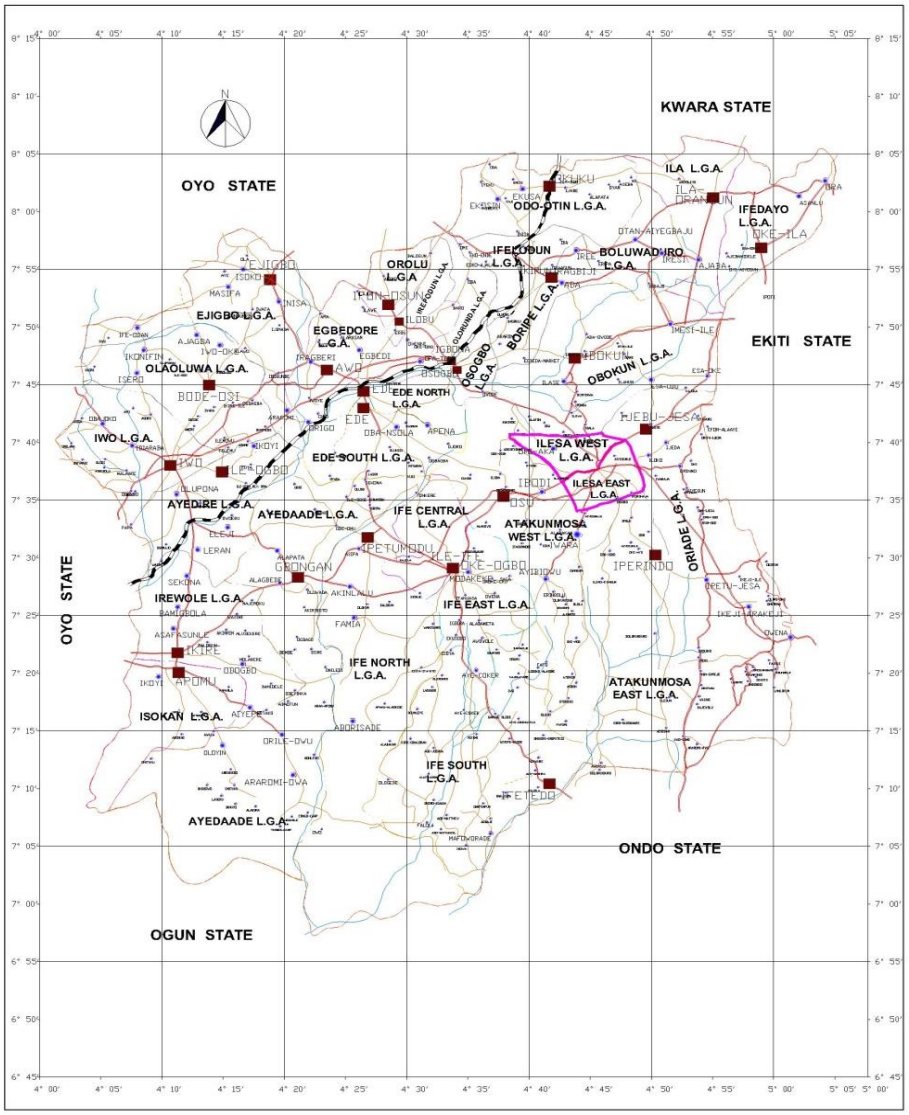

Fig. 2: Ilesha within the Context of Osun State
Source: Ministry of Lands and Physical Planning, Osogbo, Osun State, May, 2015

LITERATURE REVIEW

In Nigeria, nearly every town and neighborhood is provided with slaughter houses or slaughter slab. Edward (1979) recommended that abattoir should be built on firm gently sloping land and it should be away from other building, residential areas and factories. He further suggested that the site for abattoir should be well away from town boundaries. According to Alonge (1991), an abattoir is a premise approved and registered by the

controlling authority for hygienic slaughtering and inspection of animals, processing and effective preservation and storage of meat product for human consumption.

Abattoir Act of 1988 also defined abattoir as any premise used for or in connection with the slaughter of animals whose meat is intended for human consumption and include a slaughter house but does not include a place situated on a farm. These animals include Cattles, Sheep, Pigs, Goats, and other acquires animals. The killing of animals for community consumption is inevitable in most nations of the World. The public abattoir had been traced to Roman civilization and France in 15th and 16th centuries, public slaughter houses were among the public facilities. In Italy, a law of 1890 requires that public abattoir be provided in all communities of more than six thousand inhabitants.

Abattoir wastes and effluents vary from day to day depending on the numbers and the types of stocks being processed (Toye, 1985). Abattoir operations produce a characteristics highly organic waste with relatively high levels of suspended solid, liquid and fat. The solid waste includes condemned meat, undigested intestine, bones; liquid waste is usually composed of dissolved solids, blood, gut contents, urine and water. Animal food is always microbiologically contaminated by organisms living naturally or entering it from the surroundings, such as those resulting from processing operations.

Edward (1979) noted while writing on slaughter facilities for tropical condition that abattoir may be situated in urban, rural and nominated industrial sites and that each has advantages and disadvantages. The advantages of the rural site according to him out-weighted those of the other sites and recommended rural location be chosen where possible. He recommended that abattoir should be built on firm gentle sloping land away from other buildings in residential area and facilities. He further suggested that the site for abattoir should be chosen away from town boundaries. Edward (1979) further reports that the slaughtering of animals in abattoir of developing countries was carried out in unsuitable buildings by untrained slaughter man and butchers that were unaware of sanitary principles, hence waste generated by abattoirs are potential environmental quality problems.

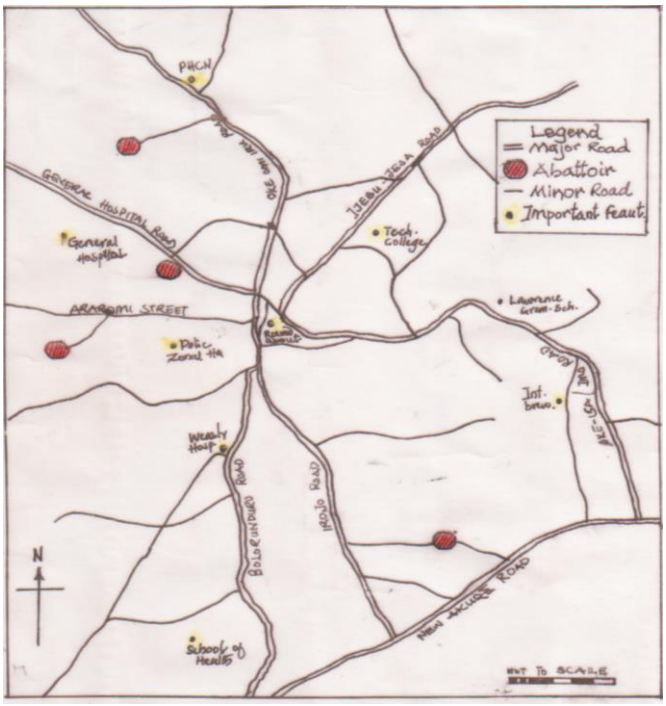

Fig. 3: Abattoirs Locations in Ilesha Town
Source: Ministry of Lands and Physical Planning, Osogbo, Osun State, May, 2015

Raymond (1997) submits that waste can affect water, land and air qualities if proper practices and management are not followed. Waste from animals that are washed into the streams, if not protected, reduced oxygen in water thereby endangering aquatic life and cause a serious problem of biodiversity. Observing that improper animal waste disposal can lead to animal diseases being transmitted to human through contact with animal faeces.

In many developing nation like Ghana abattoirs wastes are disposed into the streams or rivers and are not treated and the waters are also used from the same sources for washing slaughtered meat (Adelegan, 2002). The situation is not different in Nigeria where most liquid and gaseous wastes are released into the immediate environs of the abattoir. In some instances, the solid wastes are deposited with other urban wastes some distance from the abattoir. The pathogens from cattle waste could also be transmitted to human via water based recreation. The well in meat processing areas sometimes polluted.

Medical experts associated some disease with abattoir, for example wool sorter diseases, diarrhea, typhoid fever, asthma, pneumonia, chest diseases and respiratory diseases among others (Odeyemi, 2009). These diseases can spread from the abattoir to the neighbourhood via vectors or animals. However growing population with increase in demand for meat has resulted in increased abattoir related pollution and has attracted intervention in many developed countries like Canada France, Italy, Spain and Germany.

Impacts of Abattoir Location on Land Use Pattern

Location of abattoir is always near urban centers and very high amounts of wastes were produced in relatively small areas (Odeyemi, 1991). In most abattoirs in Nigeria the waste from the abattoir operations is a source of embarrassment as conventional methods for the disposal of animal wastes and manure, as well as slaughterhouse and other animal industrial wastes are inadequate in Nigeria. At zoo town in Port Harcourt, slaughter houses waste are channeled directly into a portion of one of the tributaries of the River Niger. Animal slaughtered in Omi-Eran abattoir alone can account for 65% of the total animal in Ijesa land. The wastes from the slaughtering ground in Omi-Eran General hospital area, Araromi and Irojo abattoir are washed into the streams that supply the environment / Community with water. The communities are blessed with a land that normally supplies them with good water when dug which is known as well water. During the dry season the well normally dry up and lead to highly irregular supply of water which makes these communities to always make use of the water from the streams.

High risk of pathogens is a strong indication of high pollution and hence, it is not safe to dispose the waste into the environment. The high count is due to the excreta from the animal intestines some of which is washed to the streams. The odour that emanate from the waste at Omi-Eran General hospital area, Araromi and Irojo abattoir are highly harmful. The solid waste that is dumped around the abattoirs is not far from the settlement / building. During the raining season the solid waste is washed and spread into the houses, causing maggots and flues infestations which lead to the subsequent outbreak of diarrhea. A new report from Food and Agricultural Organization (FAO) says livestock production is one of the major causes of the world's most pressing environmental problems, including global warming, land degradation, air and water pollution and loss of biodiversity. Using a methodology that considers the entire commodity chain, it was estimated that livestocks are responsible for 18 percent of greenhouse gas emissions, a bigger share than that of transport (FAO, 2003).

However, the report says that livestock sectors potential contribution to solving environmental problems is equally large, and major improvements could be achieved at reasonable cost. Based on the most recent data available, livestocks long shadow takes into account the livestock sectors direct impacts plus the environmental effects of related land use

changes and production of food crops animals consume. It finds that expending population and incomes worldwide, along with changing food preference are stimulating a rapid increase in demand for meat, milk and eggs while globalization is boosting trade in both inputs and outputs.

Abattoir Waste and Management

According to National waste Act, 1989 (Act 36b of 1989) which defines waste as any solid material or materials that is suspended, dissolved or transported in water (including sediment) and which spilled or deposited on land or into a water resources in such volume, consumption or manner as to cause, or to be reasonably likely to cause the water source to be polluted. Also Environment conservation Act (Act 73 of 1989) defines "Waste" as any matter, whether gaseous liquid or solid or any combination thereof which is from time to time designated by the minister as any undesirable product, emission, residue of any process or activities.

Abattoirs wastes worldwide are facing the tasks of treating and disposing of wastewater and residues. Abattoir waste water quality and quantity depend on water usage; the type of animal slaughtered and the amount of rendering or processing that is done on site. About 21% of an animal is wasted after processing (depend on animal type) and 80-90% of solid abattoir waste is recycled or reused mainly into feed industry (European Union, 2001). Much of the mass of abattoir waste ends up as a waste water stream from rendering plants. Fertilizer and gelatin industries are using hoof parts and bone meal. Land-application of blood is now less common. Large amounts of Nitrogen (N), Phosphorus (P) and Potassium (k) in waste blood make it a good source of plant nutrients. However, it can cause public nuisance due to odour and environmental concerns. Stomach contents have high levels of N, P and K and in well balanced proportions with N: P: K ratio of about 5:1:1. Wash waters contain lower levels of N, P and K. Thus, excess application of these wastes can cause potential waste pollution problems and may be harmful to plants (European Union, 2001).

Environmental Pollution and Its Control

Pollution is the introduction of contaminants into the environment to cause instability, disorder, harm or discomfort to the ecosystem i.e. physical system or living organisms. It can take the form of chemical substance of energy such as noise, heat or light. According to Wikipedia (2011) which indicated to general concern globally in the controlled emission of the greenhouse goes especially carbon dioxide, this therefore shows that ignorance about the effect of pollution worldwide is capable of destabilizing the human environment. Pollution makes flora and fauna sick, it even kills them. It contributes to climate change. Human beings are the cause and also have to be held resources possible for solution especially the youth because they are the future.

The management and control of all environmental waste into the water, land, air and entire ecosystem. The waste from Heating, Agriculture, Mining, Manufacturing, Transportation and other human activities whether they accumulate. The pollution can be curtailed through town planning measure. A principal method in this case is land use zoning method. In this method an area devoted for industrial will be developed accordingly through supervision by the development control unit. It can also be controlled through institution arrangement. This involves creating necessary body such as Federal Environment Protection Agency (FEPA) and State Environment Protection Agency (SEPA) which will be responsible for protection control policy formulation within the area of their jurisdiction. Also through Legislative measure, this is by controlling pollution through enactment of various laws that can prevent pollution as a result of human activities or natural changes. This may be in form of fines and jail terms. Other form of control is smoke and Waste reduction. This involves manufacturing firm to acquire more efficient and waste generating plants. It will also acquire considerable

amount of waste recycle and conversion to some other economic goods. Pollution control measures also involve efficient treatment. Industrial efficient will have to be treated before the waste is discharge into rivers and streams. The treatment should ensure that only cool water enter rivers and streams to control internal pollution. A collection pond where the treated water or water used in cooling machine should be provided. The water will then be discharged into the river or stream once normal temperature is achieved

MATERIALS AND METHOD

This research studies both large and small population by selecting and studying samples from population to discover the relative incidence, distribution and interrelationship between variables. It is especially appropriate for making descriptive studies of large population such as this study, thus is an appraisal research. The sample frame of this study is the total number of respondents from each household of the selected residential building in each of the areas and the butchers in those locations. Stratified sampling technique was employed which involves the division of the study area into residential and operational segments. Random sampling of the segments was done to obtain the number of respondents required from each segments with questionnaires targeted at the household heads of each houses and butchers. A dependable sample of 30% of the residential building selected in each location was taken to represent the target population. This amounted to 161 respondents for the survey research. Survey conducted for the butchers was total survey.

Table 3.1: Sampling Frame for the Household Survey and Abattoirs

S/N	Locality	Sample Radii Meter	Sample Frame	Sample Size of 30%	No of Abattoirs
1	Omi-Eran	300m	160 buildings	48 Respondents	84
2	General Hospital Area	250m	120 buildings	36 Respondents	32
3	Araromi	200m	140 buildings	42 Respondents	25
4	Irojo	300m	115 buildings	35 Respondents	18
	Total		**535 buildings**	**161 Respondents**	**159**

Source: Field Survey and Authors Computation, 2015

FINDINGS

During the research work, it was revealed that location of abattoir in residential environment have an adverse effects on the health of the residents and the ecosystem in the community. This means that abattoir have a negative impact on the land, air and water qualities which affect the aquatic habitat within abattoir environment.

The research analysis also revealed that Omi-Eran abattoir is a multipurpose and general abattoir where various animals were slaughtered on a large scale. The size of the abattoir facilities on ground and high level of patronage is a factor to this. The findings show that operators at Omi-Eran slaughters 66.04% of the cattle (cows) slaughtered in Ilesa while General Hospital Area slaughters 9.42%, Araromi slaughters 13.22% and Irojo slaughters 11.32% of the total cattle slaughtered in Ilesa. This shows that attention should be given to Omi-Eran abattoir wastes, pollutions, overstress of facilities e.t.c, because it generates more revenue for government than the other abattoirs based on the average number of animals slaughtered daily in each abattoir (Table 2).

Environmental condition of the study areas based on the research finding, 60% of the respondents (residents near the Abattoir) at Omi-Eran were of the opinion that the environmental condition of the Abattoir was fair. 21% agreed that the environmental condition of the Abattoir is good, while 19% agreed that the environmental condition was poor (Table 3). At General Hospital area, 42% of the respondent believed that the Abattoir was poor. While in that of Araromi, 48% of the respondent is of the opinion that the

environment condition was poor while at Irojo 47% of the respondents agreed that the environmental condition is also poor.

Table 2: Types and Average Numbers of Animals Slaughtered Daily in each Abattoir

S/N	Types Of Animal	Omi-Eran		General Hospital Area		Araromi		Irojo		Total	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	Fowls	145	54.90	40	15.10	39	14.90	40	15.10	264	100
2	Sheep	10	100.0	-	-	-	-	-	-	10	100
3	Pigs	15	65.22	2	8.70	3	13.04	3	13.04	23	100
4	Goats	80	72.10	8	7.20	10	9.00	13	11.70	111	100
5	Cattle(cow)	35	66.04	5	9.42	7	13.22	6	11.32	53	100
	Total	285		55		59		62		461	

Source: Field Survey, 2015

Table 3: Environmental Condition of the Abattoirs

S/N	Environmental Condition	Omi-Eran		General		Araromi		Irojo	
		FREQ	%	FREQ	%	FREQ	%	FREQ	%
1	GOOD	10	21	9	25	9	21	7	21
2	FAIR	29	60	12	33	13	31	11	23
3	POOR	9	19	15	42	20	48	17	47
	TOTAL	**48**	**100**	**36**	**100**	**42**	**100**	**35**	**100**

A. Air pollution as a result of open air burning at the abattoirs in the study area.
B. Foul odour as a result of animal waste i.e. bones and blood.
C. Improper disposal of waste from the abattoir to the nearby stream.
***Source**: Field Survey, 2015*

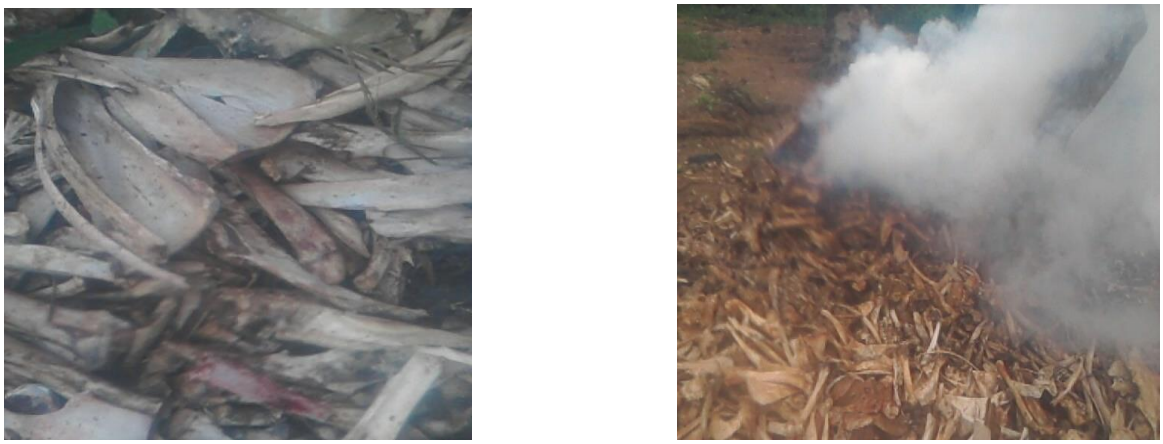

Plate 1: Pollution arising from burning of bones improper disposal
Source: Field Survey, 2015

Table 4: Method of Waste Disposal by the Abattoir Operators

S/N	Method	Omi- Eran	General Hospital Area	Araromi	Irojo	Total	%
1	Open dump	0	6	2	1	9	6
2	Burning	12	6	2	4	24	13
3	In the stream	30	6	5	4	45	29
4	Waste Management Agency	42	14	16	9	81	52
	Total	**84**	**32**	**25**	**18**	**159**	**100**

Source: Field Survey, 2015

An environmental health issue that is also important in the study area is disposal of waste water used in the abattoir into the stream without any treatment (Table 4). This unhygienic disposal of waste water in the study area also act as important factor hastening the breeding of mosquitoes and release of viruses and bacteria into the neighbourhood

CONCLUSION AND RECOMMENDATIONS

The study revealed that effluents from the abattoirs constitute potential hazard to the land use planning and development. There is a need for proper management and monitoring so as to improve the economic value, health of the residents and safe environment. It is suggested that the abattoirs should be relocated from residential environment to a place far away due to the environmental and health effect. It is also suggested that if the abattoirs cannot be relocated, they should be provided with necessary facilities and amenities, so as to improve the quality of meat and promotion of safe, healthy, conducive and convenient environment which is the focus of any government.

From the findings on the operation of Abattoir, the following steps could be adopted to improve and mitigate the rate of environmental degradation caused by the abattoir. For the living standard of the residents living in the Abattoir environment to be improved, the idea of relocation should be taking into consideration. Those abattoirs in Ilesa should be relocated to other places that is safe for the health of the people. Government should provide a new masterplan design of the new site that will take into cognizance the hygienic nature of meat sellers. Facilities and proper management measure should be provided in the new site in order to create new ideologies to the design and management of our urban environment. The rationale behind the relocation is due the damaging nature of the abattoir to environmental sustainability of their host communities. Due to the financial nature of the country and particularly Osun State, government could embark on renovation and refurbishment of the existing abattoirs in order to enhance and improve their physical state. Facilities need to be provided as it seems that majority of the abattoir lack basic facilities for proper functioning.

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The Issue of Communication in the Construction Industry: A case of South Africa

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ABSTRACT

Communication within construction presented exceptional problems. This is particularly evident within the construction sector, where interactions have the tendency to be characterised by unacquainted classes of people coming together for brief periods before dispersing to work on other ventures. Owing to its specific characteristics, the construction industry creates a complex communication environment. This paper sought to improve communication in construction. In order to define the problem in more detail and to achieve the purpose of the study, an exhaustive literature review on communication in construction was conducted, a total of ten experts on the practice of communication in construction in Gauteng (South Africa) were interviewed, through semi-structured, in-depth interviews. Findings revealed that the majority of issues regarding communication in construction were reported to be between demand and supply-side stakeholders. The robust interaction in construction projects between stakeholders seems to make construction projects very exposed to communication problems. Furthermore, a waste of time was revealed as a result of poor communication, a discrepancy in stakeholders 'power and about poor consensus particularly in the public sector, and a lack of stakeholders' ability to sympathise with the other parties involved.

Keywords: Communication, Construction Industry (CI), South Africa

INTRODUCTION

In today's world, people have a better understanding of the necessity to practice good communication in the society in order to effectively deliver meaningful communication. Construction is a fragmented and dynamic sector with a project-based nature (Perumal, 2011). More often, problems in construction are regarded as communication problems (DETR, 1998). Because of its unique characteristics, the CI forms a complex communication environment. For that reason, a lot of stakeholders work in regularly varying sets of relationships which are contractually driven. The culture presents a reality of conflicts and lack of reciprocal respect and trust [Dainty *et al.* 2006]. This study aims at improving communication in construction. To define the problem in more detail and to achieve the research aim, an extensive literature review on communication in construction was carried out, and interviews were conducted with experts in the field of construction in Gauteng (South Africa). This gave a first impression of the situation in the practice and literature of construction. The findings, as well as the empirical details from the interviewees, are reported in section 4 of the treatise. A more focused problem definition, the research aim and set-up to cross-examine the problem are also presented. The next section (Section 2) reports the literature study. The paper ends with some conclusions.

Purpose of Study

The purpose of this study is to improve communication in the construction industry, which would significantly lead to fewer delays and lower expenses.

LITERATURE REVIEW

Defining Communication

Many researchers have defined communication differently, however; the core meaning remains the same. Communication is the process in which information is encoded and imparted by a sender to a receiver via a channel/Medium (Perumal, 2001). The message is

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then decoded by the receiver and feedback given to the sender. According to Axley (1984), communication can be defined as a metaphorical 'pipeline' along which information is transferred from one person to another. It is the essential component of any system of human interaction as deprived of it, no significant or logical activity can take place (Thomason, 1988). Nevertheless, defining the term communication is difficult as it is such a multifaceted and vague concept. Communication can have a diversity of meanings, contexts, forms and impacts and so will mean diverse things to different people in various situations (Dainty et al., 2006). This is undoubtedly the case within the CI, where a plethora of dissimilar communication occurs concurrently. Communication requires that all parties must have an area of communication commonality (Perumal, 2011). According to the author, these communication commonalities include auditory means such as speaking, singing and at times tone voice as well as nonverbal and physical means such as body language, sign language, eye contact and even written communication. It is a process by which we assign and convey meaning in an attempt to create shared understanding. This process necessitates a wide repertoire of skills in intrapersonal and interpersonal processing, listening, observing, speaking, questioning, analysing and evaluating. Collaboration and cooperation occur through communication. They are three categories of communications in business (Perumal, 2011): written, verbal and non-verbal communication. Written communication comprises letters, emails, memos, reports and formal documents. Verbal communication comprises chat, presentation and voicemails. Non-verbal communication uses signals to communicate and study body language (Thompson, 2002).

Regardless of the complications inherent in defining what communication is, it is imperative that a working definition of the notion is developed to underpin the analysis of communications practice contained in this paper. To accomplish this, it is necessary to break down the concept in order to describe its composite components. These components can be summarised as follows (Dainty et al., 2006):

i. Communication generally includes the transfer of information, a general concept that comprises meanings namely process date, knowledge, skills as well as technology (Cheng *et al*., 2001). In construction, information is exceptionally varied given the important number of parties involved with construction activities.
ii. To communicate is to bridge a distance of some description, which can range from being short and simple, to long and complex (Skyttner, 1998). Once more, in construction, the disparate location of many of those involved with projects often require communication over longer distances than in, for instance, manufacturing environments.
iii. Successful communication (at an interpersonal level in any case) is a social skill involving the effective interaction between people (Hargie, 1986). In spite of development in off-site production techniques, construction remains a labour-intensive industry and therefore, social activity demanding communication between a wide variety of participants.
iv. Interpersonal communications between people generally require conveying facts, feelings, values and opinions (Kakabadase *et al*., 1988). Hence, interpersonal communications can be considered subjective and value laden. In many respects, construction is not an exact science and as such necessitates a degree of subjective understanding from those participating.
v. Communications do not only occur between individuals but can occur between groups or organisations (Baguley, 1994). Construction is inherently a team activity involving the concurrent involvement of many specialists so as to achieve efficaciously project objectives.

vi. Communication can be seen as a transactional process where something is exchanged between the parties involved (see Eisenberg and Goodall, 1993). Construction can be regarded as a series of transactions between the parties involved. Facilitating these transactions has been widely recognised as a key issue for the industry to address if it is to improve its performance in the future.

These various outlooks on communication all suggest that communication is basically about the transfer of information between people. Consequently, the point of communication in most cases is that one person (or team or organisation, etc.) desires another to receive information from another. Within an organisational context, this could be to convey an instruction to influence the actions of others, or may require an exchange of or request for information. To some extent, this interaction will be determined by the rules and norms of social behaviour, as it is people who translate the meanings and utilise the information (Gayeski, 1993).

Furthermore, this suggests that communication has to be a two-way process, as unless the transmitter of the information receives feedback that the message has been received, and then they will be unsure as to whether communication has taken place or if it has taken place successfully. Put simply, Therefore, communication involves the giving out of messages from one person and the receiving (and successful understanding) of messages by another in response (Torrington and Hall, 1998). The ways in which these messages can be conveyed are multifarious and may include speech, body language, writing, graphical or electronic media or any combination of these forms. As such, communication can be considered as a professional practice where proper rules and tools can be applied to improve the usefulness of the information communicated, as much as it can be a social process of interaction between people.

The Importance of Effective Communication

Nowadays, the importance of effective communication cannot be overemphasised. Almost every manuscript on how to manage people will cover important principles of how to communicate effectively with the personnel. At an individual and team level, people find it hard to operate in the industry if they do not develop a reciprocally agreed communication *modus operandi* to underpin their work activities (Dainty et al., 2006). Likewise, the management of organisational processes also calls for the establishment of a dynamic and effective communication channels that allow their numerous mechanisms to be conjoined appropriately. Armstrong (2001) briefly summarised the importance of communication to organisations as follows:

i. **Achieving coordinated results:** organisations operate using the collaborative actions of people, but independent actions lead to results discordant with organisational objectives. Coordinated outcomes, therefore, demand effective communications.
ii. **Managing change:** Almost all organisations are subject to constant change. This, sequentially, affects their personnel. Acceptance of and willingness to incorporate change is possible only if the reasons for this change are well communicated.
iii. **Motivating employees:** the extent to which an individual is driven to work efficiently for their organisation rest on the accountability they have and the scope for accomplishment afforded by their role. Feelings in this respect will depend upon the quality of communications from senior managers within their organisation.
iv. **Understanding the needs of the workforce:** In order to respond efficiently to the requirements of their personnel, it is important that they develop an effective channel of communication. This channel must enable feedback from the workforce on

organisational policy in a way that inspires an open and truthful exchange of ideas between employees and executives of the organisation.

Given the advantages of effective communication delineated above, the consequence of poor communications for an organisation is that employees will misjudge management decisions or respond to them in a way that was not deliberated. Equally, managers will misread the prerequisites of employees and will consequently suffer from lower performance and a higher turnover of staff.

Communication has become even more important as the business world has begun to move towards what is now defined by Dainty et al. (2006), as a 'knowledge-based economy'. A knowledge revolution has underpinned the shift towards a predominance of service sector organisations. Debatably, almost all large construction enterprises have now become service sector organisations, outsourcing the majority of their fruitful attitude and efficiently acting as managers of the process. Professional as well as managerial employees control their payroll, and it is these 'knowledge workers' whose intellectual capital becomes the ingredient that underpins organisational growth and development (Dainty, 2006). The challenge for such firms is how to generate knowledge sharing and enrich 'communities of practice' for improved performance. Communities of practice entail where groups of people who share a worry for the same questions, or set of problems come together and act together on a continuing basis (Wenger *et al*., 2002).

Additional prerequisite for effective communication in construction stems from the industry's tendency to experience change and transition. Dealing with change is more challenging in traditional industries like construction, which have revealed an unwillingness to embrace different ways of working, but is debatably more significant, taking into account the dissimilar pools of knowledge that must be incorporated in construction projects (Dainty et al., 2006). In the past, a 'silo' like mentality has triumphed which has been exposed to interfere with knowledge sharing within the industry (Dainty *et al*., 2004). Nevertheless, effective communication has the supremacy to break down such obstacles by bringing people together, thus promulgating improved cooperation and combined working within the sector. Therefore, effective communication can be regarded as the keystone of future industry improvement.

Communication in Construction

The literature on communication in construction has emerged in the early 1940s, mostly based on the situation in the United Kingdom [Emmitt and Gorse 2003]. Many problems regarding communication have been reported, with an emphasis on intra-supplier communication within the construction industry; demand-supply communication during the design phase; and communication between single demand and supply side parties, during the entire construction process. Here, the demand side comprises principals, users and investors and the supply side encompasses architects, contractors, subcontractors and advisors. The importance of improving communication in construction and the main factors influencing communication are discussed.

The efficiency of the construction process relies upon the quality of communication. According to Hoezen (2006), the following explain the reasons why improvements in communication are important:

i. An improvement in communication within the building team, in project teams and between the project manager and contractors could minimise failure (Thomas *et al.*, 1998; Franks, 1998; and Somogyi, 1999).

ii. More open communication at all levels could lead to innovations (Lenard and Eckersley, 1997) and better technical solutions (Atkin *et al.*, 2003).
iii. Improving communication in early stages of projects would positively influence the quality as viewed by all stakeholders involved (Emmit and Gorse, 2003; and Brown, 2001).
iv. Discussing the theme of communication during staff meeting would lead to better decision making, for example, less hastiness in moving to answers and better strategies of looking at the prerequisites first (Barrett, 1995; and Salisbury, 1998).

Various factors influence communication in construction; an overview can be derived from literature:

i. The first category of factors is connected to the organisation of the construction process (Hoezen, 2006). The Key aspects are the dissimilarity between formal and informal communication paths during the design stage (Mackinder and Marvin, 1982) as well as during the development stage (Pietroforte, 1992; and Higgin and Jessop, 1965); and the separation of design and production (Hill 1995).
ii. The second category involves the stakeholders themselves. Conflicting interests could result in hidden agenda, usually leading to limited communication (DETR, 1998; CIB, 1997; and Brown, 2001), and all stakeholders' frames of reference are considered of great influence on communication as well (Moore and Dainty, 2001; and O'Reilly, 1996).

Some studies have been concluded so that the CI could profit from improved communication. Even though the studies focus on numerous aspects of communication in construction, no literature overview has been discovered on the topic of demand-supply communication in construction.

Studies stressed on intra-supplier communication (e.g. head-and subcontractors) or intra-demander communication (e.g. principal and end user) or look at just one stage of the construction process. In the cases where communication between demand and supply side parties was studied, the focal point was on just a few stakeholders instead of considering many parties from each side.

METHODOLOGY

This study investigation began with a comprehensive literature review on the topic of communication in construction. In order to gain additional insight into communication issues, ten experts and professionals in the field of construction were interviewed. The selection criteria of the interviewees was based on their profession (constructor, consultant or professional principal); the type of projects they were currently working on or had worked on (Residential construction projects, building, institutional and commercial construction projects, industrial, specialised industrial construction, highway and heavy construction projects); and the sector they were working in or building for (private or public construction project).

The data were gathered through semi-structured, in-depth interviews. The format was that of a conversation with a structure and a purpose. Furthermore, to confirm the richness of the method employed, the participants in the study were first notified about the purpose of the study, what their participation involved, and how the results would be circulated. Subsequently, the interviewees were required to think of one or more particular projects that they were presently working on or had lately delivered. Open interview questions based on the purpose of the study allowed interviewees to talk about their experience. During the interviews, notes were made, which were transcribed directly after each interview. All types

of comments were grouped into three categories characteristics of the South African Industry; the importance of communication in construction; and the factors influencing communication. Due to the interview method selected, not all the interviewees' comments were analogous. For instance: some interviewees focused on the organisation of the construction industry as a whole, whereas others went into detail about contractual aspects. Regardless of these dissimilarities, there were lots of parallels and conflicting interpretations, drawing a clear picture of the communication environment as shaped by the construction industry. After the analysis, a synopsis of main topics was presented to the group of interviewees, sitting together. A discussion took place, during which nuances and adjustments were made. Interviewees clarified their observations to one another, providing further insight into the background of conflicting ideas. Based on this consultation, conclusions were reached.

DISCUSSION AND FINDINGS

Characteristics of the South African Construction Industry

The image of the South African CI, as perceived by the interviewees, is one of the industries made up of conservative, poor communication among stakeholders. Even more than in other sectors, human factors seem to ascertain most if construction projects develop in a good way or not: there needs to be some "chemistry" between the individuals involved to make the process go well (Hoezen, 2006). Because of the small margins, the hierarchy within the supply-side is rigid, and stakeholders behave in both strategic and calculating ways. This behaviour is a result of lack of mutual trust, reversely discouraging stakeholders to ameliorate their communication. The respondents stated that when something goes wrong, it results in pointing fingers on both sides, the claiming of extra efforts, attached to a declining level of trust. The interviewees further reported that trust is the main reason for principals' wishing to be involved in the whole process. Because of their tendency to control every detail, several consultants are implicated. In infrastructure projects top management just give the impression to get involved in the latter stages of the construction process only, while in public housing projects, for instance, their involvement is being asked more and more in earlier phases of the process. However, they still have little experience with it. Consequently, top management only thinks about the product to construct, rather than the problem it should tackle.

Discussions, as a result, tend to be about product specifications and project plans rather than about functional requirements, wishes and needs. Regardless of the fact that communication has been organised in much the same way for a long time, interviewees affirm that a dialogue is starting: constructors are reconsidering their professional relationships with clients, and government becomes conscious that procurement should be less detailed. In general, interviewees honour the industry for its devotion, hard work and expertise.

The Importance of Improving Communication: Interviewees' Perceptions

Overall, communication in construction was not identified as problematic by the interviewees; nevertheless, they acknowledged that communication processes are far from optimal. A waste of time was revealed as a result of poor communication. For instance, errors from early stages of the construction process have to be resolved later which, result in making adjustments in latter stages of the construction process and more often requires extra money. Interviewees believe that improved communication would undoubtedly lead to fewer delays and lower expenses. Furthermore, all stakeholders' contentment about the process as well as the standard of the product could escalate when they would communicate effectively.

Factors Influencing Communication: Interviewees' Perceptions

According to the interviewees, the main problem of communication in the South African CI lies in the lack of stakeholders' ability to sympathise with the other parties involved. This is

particularly the case between demand side and supply side parties. Knowing that designers and constructors do not experience how their choices affect the use and maintenance of the product, it is hard to communicate about these themes. This results in constructors who do not think along with the principal; principals who are not open-minded to the constructors' input; and designers who design objects that do not always match the wishes and needs of their principals. Moreover, the stakeholders' discernment of their functions in the process is not on all occasions viewed as professional. Respondents state that principals do not always think meticulously about their wishes and needs, and do not take responsibility so as to implement their will. Neither are constructors as responsible as respondents think is indispensable: they usually act in strategic and manipulative manners. The respondents approve that the preparatory measures of the project are necessary. Principals should get their requests clearer and consequently sufficient time should be spent on the brief. As regards the brief, some interviewees suggested that the brief should comprise mostly functional specifications; others stated that specifications should be unmistakable and detailed. Though, interviewees share a complete agreement that the principal's outlook of his or her own role is critical. For a clear communication, principals should consider themselves as chiefs and similarly act like this by being honest and straightforward regarding the prerequisites and making obvious the do's and don'ts.

Lastly, interviewees mentioned a discrepancy in stakeholders' power and about poor consensus, particularly in the public sector. Frankness about the budget available and reciprocal accountability could positively affect communication.

The Research Set-up and Problem of Communication in Construction

The interviews conducted in South Africa, support the findings in the literature. The factors influencing communication as declared by the interviewees have their place into either the organisation of the construction process or the interests of stakeholders involved. According to the results, interviewees seemed to concentrate on the communication between stakeholders on the demand side and stakeholders on the supply side. This is the area where the majority of issues were revealed, and therefore, demand-supply communication seems worth to be examined in more detail.

In the literature, communication in the CI is studied quite rigorously; nevertheless, the topic of demand-supply communication has not yet been surveyed exhaustively. Owing to this deficiency in literature and the relevance of the subject to the industry concerned, the objective of our study project is defined as acquiring insight into the organisation of demand-supply communication processes in construction and developing an approach to improve the efficacy of this organisation.

Communication was thus defined as a process in which the participants create and share information with each other so that to achieve reciprocal understanding (Rogers and Kincaid, 1981). In order to achieve the aim of the study, two research objectives were formulated:

i. To investigate how demand-supply communication is organised in construction; and
ii. To investigate the design processes of effective demand-supply communication for construction projects.

With reference to the above objectives, a research set-up was designed as follows:

Literature Study:

As already mentioned above the main goal of the study is to contribute to:

i. The field of communication by contributing to the knowledge on group communication, since stakeholders in construction, are part of different working groups);

ii. The field of management by defining how the organisation of demand-supply communication works in construction and;
iii. The field of construction by improving demand-supply communication.

The previous literature survey in the area of construction will be extended with an overview of relevant reviews on demand-supply communication in the sectors of designing and management. Some instruments are already accessible to an influence on demand-supply communication. Considering there is minor scientific base on the running of these instruments, additionally, an overview of demand-supply communication influencing instruments and procedures will be made (not necessarily in construction).

Theoretical Framework Development:
Dainty et al. (2006), proposed a model for group communication, combining several theories in the form of communicational (Shannon and Weaver, 1949), constructional (Walker, 2002); and organisational (Handy, 1999). The model contains both formal and informal communication routes, and members are regarded as individuals. Influencing factors in this model are members' roles (formal and informal); their degree of maturity and expertise; and all kinds of noise (language variances; changing frames of reference; physical noise (like plant and machinery), etc.).This model appears to be a good starting point for studying demand-supply communication. All factors influencing communication as identified from literature can fit within the model proposed by Dainty, Moore and Murray. Furthermore, the model could be developed and adapted to the aims of our study.

Empirical Research
In order to examine issues with demand-supply communication in the practice of construction, the structuring of demand-supply communication will be scrutinised in multiple construction projects, including tools used to enhance this communication.

Organisation of Demand-Supply Communication Processes
The empirical evidence will be analysed within the theoretical framework to acquire insight in the organisation of communication processes and factors that influence this. The consequences of methods and tools of this communication will be investigated.

Development of Approach
The insights gained will help to make recommendations for the use and development of methods and instruments to improve the efficiency of demand-supply communication in construction.

CONCLUSION

This research study started by defining a project to improve communication in construction. Based on the literature related to communication in construction and the interviews with experts in the South African CI, it was likely to address in more detail the issue of communication in construction. Literature concluded top management only thinks about the product to construct, rather than the problem it should tackle. The management of organisational processes also calls for the establishment of a dynamic and effective communication channels that allow their numerous mechanisms to be conjoined appropriately. A waste of time was revealed as a result of poor communication, a discrepancy in stakeholders 'power and about poor consensus particularly in the public sector, and a lack of stakeholders' ability to sympathise with the other parties involved. Further, it was reported that the majority of issues regarding communication were to be between demand and supply-side stakeholders. The robust interaction in construction projects between stakeholders (on demand and supply side) seems to make construction projects very exposed to communication problems. Interviewees also affirmed that dialogue is starting: constructors

are reconsidering their professional relationships with clients, and government becomes conscious that procurement should be less detailed. In general, interviewees honour the industry for its devotion, hard work and expertise. Interviewees believe that improved communication would undoubtedly lead to fewer delays and lower expenses. Furthermore, all stakeholders' contentment about the process as well as the standard of the product could escalate when they would communicate effectively. Because of the insufficiency of literature on demand-supply communication in construction, it can be stated that more research on the subject in question is needed.

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