Typological Analysis of Housing Development in Lagos Peri-urban Settlements

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Abstract

The research examined the typological analysis of housing development in the peri-urban settlements of Lagos State, Nigeria. Case study methodology was adopted using random sampling to select housing developments, under different housing initiatives, in purposively selected peri-urban settlements in Ibeju-Lekki Local Government Areas of Lagos State. Primary data were sourced from survey questionnaires, direct observations and in-depth interviews administered to household heads in the case study area. Data analysis was done using descriptive statistics to generate frequencies, percentages, cross tabulations of the variables. Findings show different housing typologies under three categories; owner-occupied, part-rental and full-rental housing. Housing typologies in the study area were influenced by different housing initiatives, and the socio-economic attributes of the residents which revealed a heterogeneous mix of the population in terms of culture, literacy level and household size. It is recommended that the residents' socio-demography should be put into consideration in building typology designs to enhance effective user performance in peri-urban housing development under different housing development schemes in Lagos State.

Keywords: *Peri-urban; housing typology; architecture; socio-demography; housing initiatives.*

Introduction

Housing typologies in the emerging peri-urban settlements in Lagos, Nigeria is a product of many factors often not perfectly meeting the required needs of the end users. The complexity of the different actors in the peri-urban is giving rise to a new urbanism which if not controlled may lead to poor housing performance in the region. Presently, Lagos peri-urban plays significant role of housing a great percentage of urban population. Different housing initiatives are emerging with diverse housing architecture, mostly unsustainable designs. Government participation in housing is perceived to be ill-conceived because post occupancy evaluations have proven most housing typologies adopted failing to meet the users' needs (Ibem *et al*., 2013).

The motive behind each development scheme would inform the typology of housing to be adopted. The predominant housing development in the peri-urban is executed under self-help housing which leaves design within the control of the households. Rising demand for housing and increased preference for single family houses is the major driver of self-help housing development in peri-urban settlements in developing countries (Gough and Yankson, 2000). Individual household take responsibility for the construction of their housing units and associated with most self-help housing development is non-customized and standardised architectural designs which impact on the typology (Bangdome-Dery *et al*., 2014). Non-Marxist/Liberal Housing Theory recognises that the major function of housing in a community is affected by the residents. Family financial status is key in the housing typology to be adopted. This is the premises for self-help housing development in most peri-urban (Tunstall *et al*., 2013).

The private developer-led housing development is unique because it is formally regulated and is predominantly occupied by middle class and higher income migrants from the city centres (Simon, 2008). According to Marxist or radical theory, housing is seen as a use of value and exchange and a product whose consumption can only be realized by those with a housing need and those who can afford it. However, it encourages and fosters the exploitation by bodies like private developer often engaging in mostly unaffordable and unsuitable housing typologies for the low and middle income group. This theory is the basis for profit driven housing development by private developers in the peri-urban of

Lagos.

The state-led housing development comes in the form of state intervention through industrial and housing development, and also to drive the growth of the suburb. Positive theory advocacy is what drives government-led housing. It emphasizes the role of housing quality as being factored by suppliers. It defines housing as an item of consumption to be supplied by government authorities. Housing is seen as socio-economic and environmental dimensions. Family and individuals economic status is factored into the design of housing typologies. Family economic status determines the course of improvement of the housing units, which play a major role in the operation of the housing market for various levels of social groups (Waziri & Roosli, 2013).

Prior studies on housing typologies have been limited to urban Lagos and none have investigated the factors influencing housing typologies in the emerging Lagos peri-urban settlements. Understanding of the relationship between residents' socio-demography, housing initiative and housing relationship is needed in policy design of peri-urban housing development to achieve residents' satisfaction. Therefore this study aims at analysing the typologies of housing in Lagos peri-urban and specifically seek to investigate the factors to be put into consideration in achieving sustainable housing design and development.

Literature Review

According to Isa & Jusan (2012), housing is a building structure that human lives for meeting shelter and social needs. Housing theories relate to Marxism, Radicalism and Liberalism. It is based on ideology and identity (Nassar, 2013). It is the social and spatial process in which building types are considered to be the convergence of social relation and spatial practices. There are three views to housing theories according to Soliman (2004). They are the Marxist theory or radical theory, Non-Marxist or Liberal theory and Positive theory. Under Marxist or radical theory, housing is seen in a capitalist social formation interest. It sees land as a precondition for housing production.

Non-Marxist/Liberal Housing Theory sees housing as one of the basic components that go into the movement of development due to the elements, materials and services. This theory believes that housing is among the basic components that go into the movement of development, due to the elements, material, and services which actively relate to different activities; whether in industry,

manufacturing, or services, as with various building materials, like iron, cement and timber; or infrastructure services, road networks and transportation (Tunstall *et al*., 2013). Financial capacity is key. However, Positive Theory relates housing as socio-economic and environmental dimensions. Furthermore, family and individuals economic status is basic factors for determining housing priorities. Consequently, family economic status determines the course of improvement of the housing units and ultimately which play a major role in the mechanisms of the housing market for various levels of social groups (Waziri & Roosli, 2013).

Housing typologies refer to the distillation and classification of existing building types and urban forms in term of social function and spatial efficiency (Keyes, 2010). Housing typology defines members of the same household. It has evolved with technological innovations like the rise in the use of automobile and emergence of industrial building components. It changes according to the needs of the developers (Law *et al*; 2008). Housing typology is based on need, scale, style and location. The patterns of housing investment, housing form, community services, settlement density and morphology are relevant to the growth and pattern of peri-urban development. Housing classification is determined by society, affordability and legality in form of government-led, private development-led and self-help housing. Housing in the peri-urban exists under three types of initiative and governance; self-built housing development, private developer - led housing and state-led housing development (Shen & Wu, 2013).

Housing typologies in the peri-urban in terms of socio-spatial attributes are classified into commodity housing, single family house and middle rise buildings. Each type of housing is dominated by different types of neighborhood. The commodity housing has co-renting as its unique attributes and serves the poor migrants. It is called rooming apartment and it is characterised by one apartment sub-divided into many bedrooms. Furthernotable classificationof peri-urban housing typologies are single family bungalow, semidetached bungalow, rooming house, storied apartment building and duplex (Olotuah, 2006). Considering household size, the floor space per person for living and working is the primary determinants of housing typology (Ravetz, et al., 2013). Investigation by Binns, Maconachie, & Tanko (2003) on housing

typologies in peri-urban of northern Nigerian cities are rooming house, detached house, compound houses and blocks of flats. Rooming house is common to serve low income earners. It is adopted because of ease of design, low cost on construction and high return from rental.

Socio economic status has great influence on the housing typology. It is notably affected by income status of the residents. Socio-cultural diversity and the socio-economic characteristics of the residents greatly influence the physical characteristics of housing development in the peri-urban. Housing development in the peri-urban calls for consideration of the socio-economic attributes of the different income groups of the migrants but this is not the case in most peri-urban housing developments (Shen & Wu, 2013). Differentiating factors between the peri-urban resident groups could be through either socio economic factors, personal motivation for housing, housing choices preference and the resulting spatial differentiation. Non migrant groups are mostly home owners regardless of socio economic status. Rural migrants constitutes the root of rental housing in the peri-urban. This class of people eventually settles in low cost private rental houses in the peri-urban (Wu and Zhang, 2012).

The Study Area and Scope of Study

Ibeju-Lekki Local Government Area is the selected case study area for this study. Ibeju-Lekki as shown in Figure 1 is one of the four Local governments outside Lagos metropolitan region. Within the past ten years, housing development has been on the increase to accommodate the overspill from central Lagos. The socio-demography comprise of multi-cultural and reasonably literate population. It has a land area of about 646 kilometers square which equals one quarter of the total land mass of Lagos state.Ibeju-Lekki had a population of 117,481 out of Lagos State's total of 9,113,605 according to the National population Commission (2006) census. The sample frame constitutes the existing housing units in peri-urban settlements in Ibeju-Lekki.

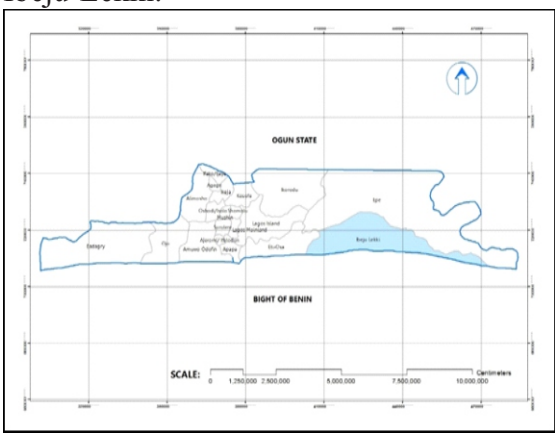

Figure 1: Map of Lagos State showing Ibeju-Lekki.
Source: Field Survey (2016).

Methodology

The case study approach was applied by conducting a field survey of housing developments executed under different initiatives in the study area. Both qualitative and quantitative data were used. Quantitative data were extracted from the questionnaire instrument administered to household heads of randomly selected housing units in purposively selected 16 settlements in Ibeju-Lekki. Among the 370 questionnaires administered, total of 366 good and completed questionnaires were retrieved from the study area. Badly completed questionnaires were regarded as missing system in the analysis.

The questionnaires were administered mostly during the weekend to ensure a high response rate. Descriptive analysis was conducted on the data to generate percentages and frequencies of respondents' socio-demography, housing initiatives, housing typologies. Test of correlation was conducted to determine the factors influencing housing typologies in the study area. Data analysis for this study was carried out using the Statistical Package for Social Sciences (SPSS) version 22 for windows for statistical analysis of the quantitative data.

Findings and Discussion

Characteristics of Housing Typologies in the Study Area

Housing typologies in this study is discussed based on architectural typologies, occupancy, initiatives, units of household per building and the number of rooms per household. Analysis of the field survey presented in Table 1 shows the basic housing typologies identified in the study area. The three commonest housing types in the peri-urban are the single family bungalow unit which constitutes about 76.2%. The single storey family unit (11.5%) and two family detached storey building (4.9%). Other less prominent housing types are two family semidetached bungalow (2.2%), semidetached duplex (1.6%), multiple units traditional housing (1.1%), multiple unit bungalow row housing(1.1%), storey block of flats, single unit traditional housing(0.3%) and tenement storey building (0.3%).

Table 1: Housing typologies in the study area.

Housing Typology	N=366	%
Single family bungalow unit	279	76.2
Single family storey unit	42	11.5
Two families semidetached bungalow	8	2.2
Two families semidetached storey building	18	4.9
Semi-detached duplex	6	1.6
Block of flats storey building	2	0.5
Single unit traditional housing	1	0.3
Multiple units traditional housing	4	1.1
Multiple unit row bungalow housing	4	1.1
Tenement unit bungalow	0	0
Tenement storey building	1	0.3
Missing	1	0.3

Source: Field survey (2017).

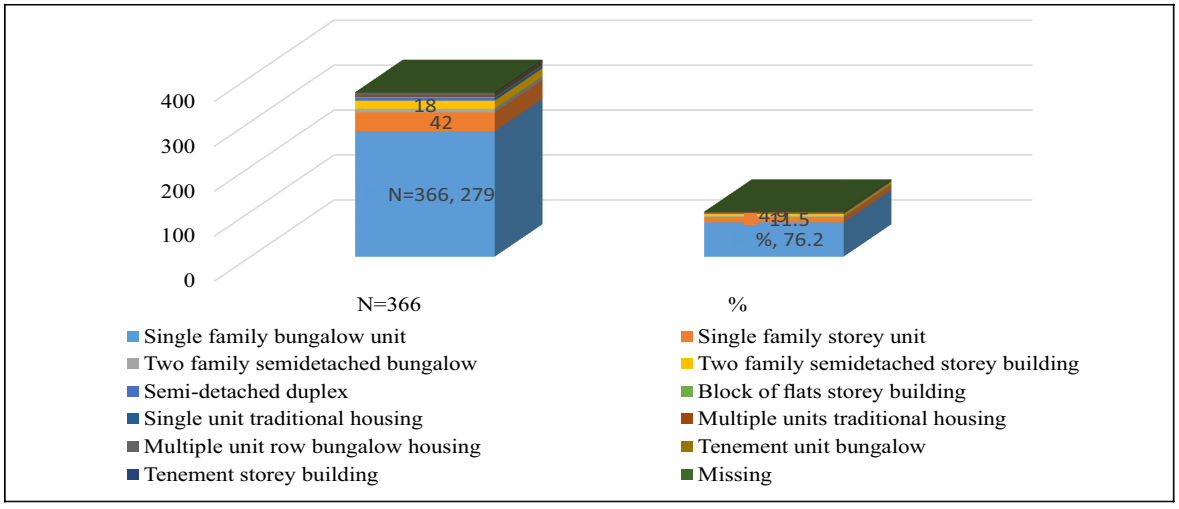

Figure 2: Housing typologies in the study area

The Generic Classes and Types of Peri-Urban Housing Developments in the Study Area

Three classes of housing development were identified in the study area. They are full family occupation, part family/part rented occupation and rental housing. Each class has different types of housing attached and also specific socio-spatial characteristics.

Full Family Occupation

Single family bungalow unit (Figure 3), is the most prevalent in both Ibeju-Lekki peri-urban settlements. It is predominantly

owner occupied and not part rented. Analysis of the questionnaire shows the prevalence of this housing typology among the low income group, the Yoruba ethnic group, age group of 45-56 years and household size of 3-5 persons. Some housing units are also single storey family housing (Figure 4 and 5) and a wholly owner occupier especially among the polygamous families in the peri-urban. The single unit traditional housing is the regular housing unit among the natives built to be lived in by all extended families and usually with poor quality building materials.

Part Family Occupation/Part Rented

The two families' semidetached bungalow housing (Figure 10) in the peri-urban is partly owner occupied and partly rented out. Part of the building is usually occupied by the owner while the other wing of the bungalow is rented out for investment purpose and also often for security purpose in areas of the peri-urban that are far from the active areas. Two families' semidetached storey housing unit (Figure 6 and 7), is like the two families semidetached but different in that it is storey. The owners usually occupy one unit of the whole housing while the other wing is rented out.

The semidetached duplex housing unit (Figure 8 and 9) is a two winged duplex buildings in which one is owner occupied and the other rented out. It is common in developer-led housing and also among the middle income earners. Multiple units' traditional housing is built by association of extended family members, often having part rented out while another will be occupied by the natives. It is rather an inheritance housing in the peri-urban of Ibeju-Lekki.

Rental Housing

Block of flats storey housing (Figure 14) is a multi-family housing built mostly and purposely for profit and mostly not occupied by the owners. Tenement bungalow unit, commodity housing (Figure 11) is a single unit rental housing, sharing common sanitary facilities and built purposely for low income and the poor. Tenement storey building (Figure 12 and 13) is a bigger form of tenement housing, it has a ground and first floor but each floor has rows of sanitary facilities communally shared.

Finally, multiple unit row housing (bungalow) consists of many households units on the same parcel of large lands built for rental purpose and not for the owner occupier.

Architectural Design Typologies in the Study Area

Class A. Full Family Occupation

Figure 3 (Type 1): Typical floor plan of a single family bungalow housing in the study area.

Source: Field work (2017).

Figure 4 (Type 2): Typical Ground floor plan of a single storey family housing unit in the study area.

Source: Field work (2017).

Figure 5 (Type 2): Typical First floor plan of a single storey family housing unit in the study area.

Source: Field work (2017).

Class B. Part family occupation/part rented.

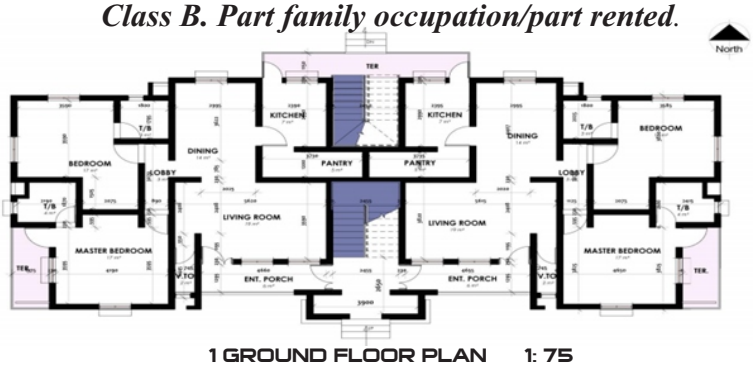

Figure 6 (Type 3): Typical ground floor plan of a two families' semidetached storey housing unit in the study area.

Source: Field work (2017).

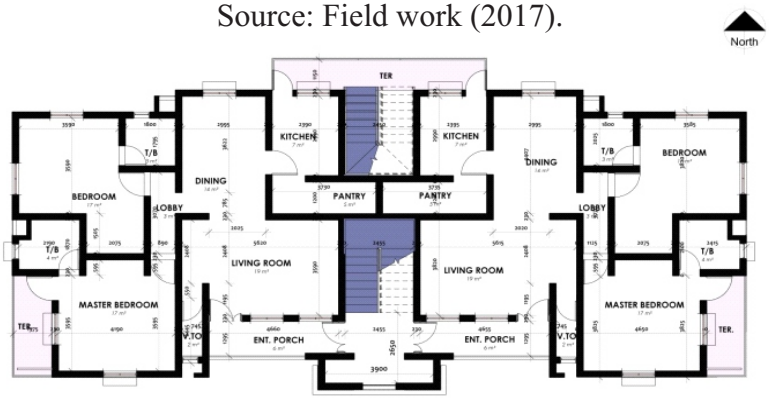

Figure 7 (Type 3): Typical first floor plan of two families' semidetached storey housing unit in the study area.

Source: Field work (2017)

Figure 8 (Type 4): Typical ground floor semidetached duplex housing unit in the study area.

Source: Field work (2017)..

Figure 9 (Type 4): Typical first floor semidetached duplex housing unit in the study area.
Source: Field work (2017).

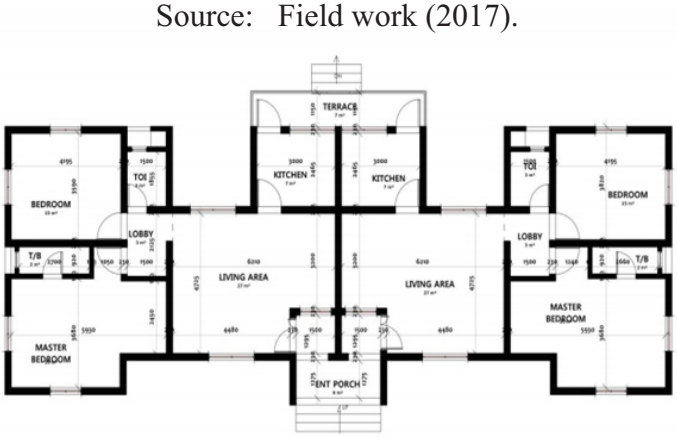

Figure 10 (Type 5): Typical ground floor plan of two families' semidetached bungalow housing unit in the study area.
Source: Field work (2017).

5.3.3 Type C. Rental housing development

Figure 11 (Type 6): Typical ground floor plan of a tenement bungalow housing unit in the study area**.**
Source: Field work (2017).

1 GROUND FLOOR PLAN 1: 75

Figure 12 (Type 7): Typical ground floor plan of a single storey tenement housing in the study area. Source:
Field work (2017).

1 FIRST FLOOR PLAN 1: 75

Figure 13 (Type 7): Typical first floor plan of a single storey tenement housing in the study area.
Source: Field work (2017).

Figure 14 (Type 8): A typical floor plan of a Block of flats storey housing unit in the study area.
Source: Field work (2017).

Socio-Spatial Analysis of Housing Typologies in the Study Area

There are three types of occupancy in the study area, full family occupation, part rented house occupation and full rental occupation (Table 2). The full family occupation is more prevalent in Ibeju-Lekki peri-urban settlements having 56% while part rented housing units are 44%. Housing initiatives were mainly of three types in peri-urban settlements of Ibeju-Lekki. Self-help housing is the commonest constituting about 84.4% of the housing development. Private developers' initiatives are about 14.5% of the housing development in the peri-urban while government housing initiative was 1.1%.

The commonest household units per building in Ibeju-Lekki are 7-8 units having 28.1% of the total households. Other types are 3-4 units (22.1%), 8-above units (20.7%), 5-6 units (18%) and less than 2 units (10.9%). The prominence of multiple units of household per building could be attributed to the preference for storey building and investment-driven growth in Ibeju-Lekki peri-urban settlements. Shown further is the analysis of room per household. The commonest is 6-9 rooms' household having 25.7%. Others are 0-2 rooms (11.2%), 3-5rooms (24.9%), 10-12 rooms (19.9%) and more than 13 rooms (15%).

Table 2*: Analysis of Characteristics of housing units in the study area*

Variable		N=366	%
Occupancy	Full family occupation	205	56
	Part family occupation/part rented	161	44
Housing Initiative	Self-help housing	309	84.4
	Private developer/Cooperative	53	14.5
	Government housing	4	1.1
Household units per building	0-2 units	40	10.9
	3-4 units	81	22.1
	5-6 units	66	18
	7-8 units	103	28.1
	8-Above	76	20.7
Rooms per household	0-2	41	11.2
	3-5 room	91	24.9
	6-9 room	94	25.7
	10-12 room	73	19.9
	13 and above	55	15
	Others	12	3.3

Source: Field survey (2017).

Residents' Socio-Demographic Characteristics

Through the field survey presented in Table 3, there are five recognised household sizes in the study area. Household size of 1-2 persons constitutes 13.1% of the households, more than 13 persons (3.3%) and 10-12 persons (2.2%). Household sizes of 3-5 persons are the commonest, having 55.2% of the respondents' population. People with secondary school education are 30.1% and constitute the highest. Highest level of literacy is the first degree, diploma and secondary school certificate having 32.7%, 20.8% and 34.3% respectively. 44.6% of household heads earn above N150, 000 monthly. This is the predominant income group which is the high income group. The low income group earning between N25, 000.00 to N50, 000.00 is 36.3% while the middle income earning N50, 000.00- N150, 000.00 constitute 19.1%. The Yoruba ethnic group constitutes the largest portion of the population in the study area, it is 71.9% while the Hausa tribe is the least represented.

Table 3: Socio-economic characteristics of the household heads.

Variable		N=366	%
Household size	1-2 persons	48	13.1
	3-5persons	202	55.2
	6-9persons	96	26.2
	10-12persons	8	2.2
	More than 13 persons	12	3.3
Literacy level of the household head	Postgraduate	56	15.3
	BSc/Higher diploma	105	28.7
	Diploma	62	16.9
	Secondary	110	30.1
	Primary	25	6.8
	None	8	2.2
Monthly Income of household head(Naira)	Low income N25,000.00-N50,000.00	133	36.3
	Middle income N50,00.00-N150,000.00	70	19.1
	High income N150,001.00-Above	163	44.6
Respondents' Ethnic group	Yoruba	263	71.9
	Hausa	6	1.6
	Ibo	70	19.1
	Others	27	7.4
	Total	366	100

Source: Field survey (2017).

Factors Influencing Housing Typologies in the Study Area

Impact of Housing Initiative on Housing Typology

The correlation analysis presented in Table 4 shows there is a significant relationship between housing initiatives and housing typology in the study area (0.200** P<0.01 in Ibeju-Lekki). This signifies that there is a relationship between housing initiatives and typologies in the study area.

Impact of residents' socio-demography on housing typology

The test of correlation between housing typologies and respondents' socio-demographic attributes economic (Table 5) shows that income is the only attribute having significant relationship with housing typologies in the study area (-0.205** P<0.000). Therefore, housing typologies is influenced by respondents' socio-demography in the study area.

Table 4: Test of correlation between housing typologies and housing initiatives.

Variables	Pearson Correlation	P-Value	Inference
Housing typologies and housing initiatives.	0.200**	0.000	There is a significant correlation between the two variables.

** Correlation is significant at the 0.01 level (2-tailed).
List wise N=366.

Table 5: Correlation between housing typologies and respondents' socio- demography

Test Variables	Sub Variables	Pearson Correlation	P Value	Inference
Housing typologies and respondents' socio-economic attributes	Income	-0.205**	0.000	Significant negative linear relationship
	Literacy group	0.043	0.410	No significant correlation
	Ethnic group	0.061	0.242	No significant correlation

** Correlation is significant at the 0.01 level (2-tailed).
List wise N=366.

Conclusion

There were ten different housing typologies identified in the study area each having distinguishing socio-spatial attributes. Generic classes of housing typologies observed in the study area were full family occupation, part family/rental and full rental housing. Housing occupancy in Ibeju-Lekki shows that full family occupation was 56% while part family and part rented occupancy were 44%. Each type is a function of the use of the building. The commonest housing type in Ibeju-Lekki were the single family bungalow housing and single family storey building constituting 76.2% and 11.5% respectively. The commonest type of households units per building was the 7-8 units, 0-2 grouping was the least. The commonest rooms per household in Ibeju-Lekki housing were 3-5 rooms. Furthermore, the factors influencing housing typologies in the study area, a test of correlation was conducted which shows that housing typology is affected by socio-demography of the residents. Major socio-economic attribute that affects housing typology in the study area is income with a p-value of 0.000 and Pearson correlation of -0.205, it shows a significant negative linear relationship with housing typology. The implication of this is that the less the income, the less the quality and standard of housing typology that can be assessed. A test of correlation also shows that housing

typology in the study area is affected by the housing initiatives under which the building construction is executed. It can be concluded that the different housing typology in the study area is a response to the existing housing policy and residents' socio-demography.

Recommendation

There should be an inclusion of the end users in the design stage, especially projects targeting low income group and middle income group, to help in achieving appropriate housing delivery strategy by housing providers in terms of the provision of an efficient and user responsive housing units. Post occupancy evaluation should regularly be carried out in any housing initiative, outside self-help, to determine their efficiency and suitability for the peri-urban settlements. This will enhance performance standard in other housing projects to be carried out.

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Influence of Electric Power Generator Variables on Indoor Air Quality in Residential Buildings

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Abstract

The study assessed the influence of electric power generator variables on the quality of air in t indoor environment of buildings. A quantitative survey method was adopted for the study. Kaduna metropolis was the study area grouped into twelve (12) clusters; and six (6) households were purposively selected from each of the cluster for the survey. A total of 72 households that operate electric power generators for power supply in buildings participated in the study. IMR1400 combustible gas analyzer was used to measure 432 samples of air pollutants' concentration in the 72 households (6 per household). SPSS version 15 was used to correlate the generator variables with the air pollutants measured. The results showed that the characteristics of generator age (at 0.05 significance level) at all the clusters were similar unlike the generator capacities which were different in few clusters. It was also observed that all the generator distances away from the building indoor were the same except for Sabon Tasha. For the indoor air pollutants concentration, carbon monoxide (CO) concentration for all the clusters were the same, while few of the clusters have similar concentration of Sulphur dioxide (SO_2) and half of the clusters have the same oxides of nitrogen (NOx) concentrations. The mean CO concentration recorded in the indoor was 6.18ppm less than the WHO limit (10ppm), while the mean SO_2 concentration was 0.17ppm higher than the WHO limit of 0.01ppm and the mean NOx concentration was 0.14ppm higher than the WHO limit (0.04 to 0.06ppm). The results also showed that the indoor CO concentration (at 0.05 significant level) has no relationship with generator age, capacity and distance. Also, SO_2 and NOx have no significance relationship with the age, capacity and distance. It was concluded that the generator age and capacity did not influence the indoor air pollutants concentrations but the generator distance from the building influenced the emission of CO in the building indoors. It was recommended that studies on the indoor gaseous pollutants concentration and the generator distance from the building should be intensified.

***Keywords**: Building indoor environment, air pollutants, households, IMR 1400, electric power generator*

Introduction

Increased awareness of the importance of the building indoor environment in recent times has caught the attention of many researchers (White & Marchant, 2009; Stanley, Mbamali, Zubairu, Bustani, Andrew, & Joshua, 2010). Indoor air quality and noise levels are some established parameters which affect the well-being of building occupants (who spend 80 – 90% of their time indoor) as well as, building components (Ideriah, Herbert & Ideriah, 2007; Stanley, Mbamali & Dania, 2011). Man's activities (fossil fuel combustion, cooking, construction activities; use of building materials, heating and cooling systems, pesticides, etc.) have continued to alter the quality of the building indoor environment (Kandpal, Maheshwari, & Kandpal, 1994 and United State Environmental Protection Agency [USEPA], 2009).

In Stanley *et al.* (2010), improper openings for ventilation in buildings and several other factors also facilitate the accumulation of pollutants indoor which pose health problems. Concentrations of pollutants such as carbon monoxide, nitrogen oxides, Sulphur dioxide, microorganisms, etc. above certain limits in the indoor air are found to affect the health of the building occupants (Ideriah *et al.*, 2007).

The combustion of fossil fuel in generators and their products have been observed to be responsible to some extent for air, water, soil and noise pollutions which are particularly acute in urban areas (Hall, 2006). Carbon dioxide (CO_2), nitrogen oxide (NO_x), Sulphur dioxide (SO_2), carbon monoxide (CO), particulate matter (PM), etc. and burnt engine oil are some of the by-products emitted during the combustion of electric power generators. Nitric oxide (NO), nitrous oxide (N_2O) and nitrogen dioxide (NO_2) generate nitrogen oxides (NOx) (César, Carvalho & Nascimento, 2015). Others are heat, vibration and noise (Offiong, 2003; IPCC [Intergovernmental Panel on Climate Change], 1996).

The burning of fossil fuel as observed in Rao (2007) annually releases 7.0 billion tonnes of carbon (in the form of CO_2) into the atmosphere worldwide. Carbon dioxide (CO_2) is a greenhouse gas whose presence in the atmosphere has a warming effect on the earth's climate. Nitrogen oxide (NOx) deplete the ozone layer, an exposure upwards of 150 – 200ppm results in bronchiolitis, a dangerousdisease which occurs within 3 – 5 weeks after exposure (Dimari, Abdulrahman, Akan, & Ogugbuaja, 2007). SO_2 is believed to be responsible for impaired visibility, damage

of vegetation and materials, harm to human health and production of acid rain (Rao, 2007).

Nigeria is faced with lots of environmental, social and economic challenges as observed in Akande and Owoyemi (2008), and Stanley *et al.* (2010). Most households (60%) live on less than a dollar a day (CAPPS, 2007), not enough to cater for a minimum standard of living. These have affected the quality of life style and health of most Nigerians. Most households in Nigerian cities operate small capacity fossil fuel electric power generators for electricity supply (Energy Commission of Nigeria [ECN], 2009). This was due to the fact that the Power Holding Company of Nigeria (PHCN) solely responsible for generation and supply of electricity to the public have not fared well in the discharge of its mandate (Stanley *et al.,* 2010).

Study by Stanley *et al.* (2010) showed that small household generators in Nigeria operate an average of six (6) hours daily, while average distance of generator away from building was 5.6m. These alongside poor ventilation (Okafor, Hassan, and Hassan, 2008) have influenced the quality of indoor air and noise level in the households. The study therefore assessed the impact of fossil fuel electric power generator on the building indoor environment of some selected households in Kaduna metropolis.

Methodology

The study area was Kaduna metropolis located on a flat altitude of about 600m above sea level along the Kaduna River in the North Central region of Nigeria with tropical wet and dry climate (Beddow, 2010). The city is made up of high, medium and low-income settlements with a population of 1,570,331 (FRN 2009). It is made up of four (4) local government areas; Chikun, Igabi, Kaduna North and Kaduna South. Regarded as the "power house and nerve centre" of government and the northern political class in Nigeria, Kaduna is one of the industrialized cities in the country with notable industrial layouts (Kakuri, Barnawa and Zaria road/Mando) (Obioha, 2009). It is also the centre of knowledge with lots of public, private and military institutions sited strategically within the metropolis. It hosts diverse cultural and ethnic groups in Nigeria which makes the metropolis a typical setting of Nigerian cities.

This study assesses the impacts of fossil fuel electric power generator in indoor environment of residential buildings in

Kaduna metropolis. The types of the building studied were residential made of sandcrete blocks. Air pollutant concentrations in the building indoor were measured in seventy two (72) households operating fossil fuel electric power generator grouped into twelve (12) clusters (Kawo, Mando, Bakin Ruwa, Gwanin Gora, Kurmin Mashi, Tudun Wada, Barnawa, Gabasawa, Narayi, Sabon Tasha, Malali and Kabala Doki). Cluster sampling technique was adopted in the study due to acceptance of the respondents to give access to their indoors and generators. A random of 6 households who operate electric power generators were selected from each cluster which sum up to 72 households. In each household the measurement of air pollutant concentration were carried out as described below.

The indoor air pollutants measured were CO, SO_2 and NOx. A state of the art combustible gas analyzer (IMR 1400) shown in Fig. 1 was used to assess the indoor air pollutant concentrations in the indoor of the generator operators. The sampling probe of the analyzer was held at a height of 1m in the living room of the generator operators for two (2) minutes after 180 seconds calibration of the analyzer. The average volume of the respondents' living room studied was 40.32m^3. The concentration of pollutants present were recorded in part per million (ppm) as displayed on the analyzer. Six (6) households were assessed in each cluster and six (6) measurements were also carried out for each of the household surveyed. Three (3) measurements were before operating the generator, while the remaining three (3) during operation. A total of four hundred and thirty two (432) measurements were conducted.

Figure 1: The IMR 1400 Combustion Gas Analyzer

The initial values measured by the IMR 1400 Combustion Gas Analyzer before the operation of the generator were subtracted from the final values. These were done to exclude the background concentration of the pollutants. The mean of the results obtained were compared with standards (limits)

provided by Federal Environmental Protection Agency (FEPA) and World Health Organization (WHO).

Sample t-test and correlate analyses were carried out with the aid of SPSS version 15 to test the significance level of the generators profile and pollution levels at 95% confidence interval to ascertain similarities in operation of the generators in the metropolis.

Results and Discussion

Significance Levels of Generator Operation

The significance levels of generator operation in the study area were assessed to ascertained the characteristics of the variables measured (whether the same or different). The results are presented in Tables 1 to 3.

Table 1: Significance Levels of Generator Operation

S/N	Cluster	N	Generator Profile and Pollutant Concentrations at 95% CI					
			Age	Capacity	Distance from Indoor	CO	SO_2	NOx
1.	Kawo	6	0.01	0.11	0.00	0.22	0.00	0.36
2.	Mando	6	0.01	0.07	0.00	0.21	0.36	0.29
3.	Kurmin Mashi	6	0.00	0.00	0.04	0.36	0.24	0.36
4.	Malali	6	0.01	0.01	0.00	0.17	0.00	0.00
5.	Bakin Ruwa	6	0.00	0.07	0.01	0.17	0.08	0.36
6.	Tudun Wada	6	0.00	0.01	0.00	0.36	0.36	0.19
7.	Gabasawa	6	0.00	0.01	0.00	0.21	0.00	0.00
8.	Kabala Doki	6	0.01	0.00	0.00	0.18	0.00	0.00
9.	Narayi	6	0.01	0.01	0.00	0.36	0.00	0.00
10.	Barnawa	6	0.02	0.01	0.00	0.21	0.36	0.36
11.	Sabon Tasha	6	0.02	0.00	0.08	0.12	0.00	0.00
12.	Gwanin Gora	6	0.01	0.10	0.01	0.18	0.00	0.00

Table 2: Generators' Profile

S/N	Variables	Mean	SD	N
1	Generator Age (years)	3.74	2.48	72
2	Capacity (KVA)	2.34	2.40	72
3	Generator Distance from Indoor (m)	3.86	2.64	72

SD: Standard Deviation, N: Number

Table 3: Generator Smoke Control Measures Adopted

S/N	Variables	Frequency (No)	Percentage (%)
1	Close all openings	39	36.4
2	Stop use of generator	4	3.7
3	Locate generator as far as possible from occupancy	70	65.4
4	No action taken	8	7.5
5	Sandcrete block as construction material	72	100

It can be observed that the characteristics of variable for generator age (at 0.05 significance level) at all the clusters are similar with average age of 3.74 years. However in few clusters (Kawo, Mando, Bakin Ruwa and Gwanin Gora), the characteristics of the variable for the generator capacities are different (average of 2.34KVA) with p-values of 0.11, 0.07, 0.07 and 0.10 respectively.

It was also observed that virtually all the generator distances (kept at distances of < 5m, 5m to 10m, 10m to 15m and >15m with average distance of 3.86m) away from the indoor are the same except for Sabon Tasha with $p = 0.08$. For the indoor air pollutants, the characteristics of CO concentration for all the clusters are the same with $p > 0.05$. However, the variables for SO_2 concentration measured are not all the same. The clusters with the variances included Mando, Kurmin Mashi, Bakin Ruwa and Barnawa with p-values of 0.36, 0.24, 0.08, 0.36, 0.36 and 0.36 respectively.

Also, half of the clusters have the concentration of NOx $p > 0.05$. These clusters included Kawo, Mando, Kurmin Mashi, Bakin Ruwa, Tudun Wada and Barnawa with p-values of 0.36, 0.29, 0.36, 0.08, 0.36 and 0.36 respectively. It is therefore evident that the characteristics of the variables from generator operation in the

study area (all clusters) can be said to be the same. These enable the study to sum up the clusters as an entity for Kaduna metropolis.

Gaseous Pollutants Concentrations

Sample T-Test and Correlation were used to compare means and test the relationships between gaseous pollutants emitted by generators with related variables as shown in Tables 4 and 5.

Table 4: Mean Indoor Gaseous Pollutants from Generators

S/N	Pollutant	N	Concentrations (ppm)				
			Mean	SD	95% CI		WHO & FEPA Limit
					Lower	Upper	
1	CO Indoor Concentration	72	6.18	14.84	2.70	9.67	10
2	SO_2 Indoor Concentration	72	0.17	0.81	-0.03	0.36	0.01
3	NOx Indoor Concentration	72	0.14	0.50	0.02	0.26	0.04 to 0.06

From Table 4, the indoor CO concentration (with mean 6.18ppm and 95% CI upper limit of 9.67ppm) is less than the WHO limit (10ppm). The average SO_2 indoor concentration was found to be 0.17ppm which is higher than the WHO limit of 0.01ppm. Also, the NOx indoor concentration (with mean 0.14ppm and 95% CI upper limit of 0.26ppm) is higher than the WHO limit (0.04 to 0.06ppm) but was lower (0.02) at the lower limit. It is evident that the indoor CO pollutant concentration in the households was within the WHO and FEPA limits. However, SO_2 and NOx fall below the WHO and FEPA limits.

Table 5: Correlation of Indoor Gaseous Pollutants with Generator Age, Capac ity and Distance

S/N	Pollutant	Correlation Values at 0.05 Significant Level		
		Generator Age (year)	Capacity (KVA)	Generator Distance from Indoor (m)
1	CO Indoor Concentration	0.91	0.49	0.05
2	SO_2 Indoor Concentration	0.76	0.82	0.39
3	NOx Indoor Concentration	0.44	0.83	0.16
	N	72	72	72

From Table 5, the indoor CO concentration (at 0.05 significant level) has no significant relationship with the generator age and capacity. It is however, observed that CO have significant relationship with the distance of the generator kept away from the indoor environment ($p<0.05$). This implies that the generator distance (average 3.86m) away from the building contributes to the concentration of CO pollution in the indoor environment. Also, SO_2 and NOx have no significant relationship with the age, capacity and distance ($p>0.05$). It is evident that the indoor pollutants in the building indoor environment are independent of the generator parameters. The relationship between the air pollutants and the generator parameters (age, capacity and distance) showed no statistical significance, except for CO concentration and distance of generator from the indoor environment.

The concentration of the pollutants from the above tables were obvious especially SO_2 and NOx. Mean value of CO were within the normal range. However, SO_2 and NOx were observed to be above the recommended limits of WHO and FEPA which can cause health problems to the building occupants. The health effects of exposure to NOx within limits of 150 – 200ppm results in bronchiolitis, a dangerous disease which occurs within 3 – 5 weeks after exposure (Dimari et al., 2007). NOx is also known to deplete the ozone layer. In César *et al.* (2015), exposure to nitrogen oxides (NOx) emitted by burning fossil fuels has been associated with respiratory diseases. SO_2 is believed to be responsible for impaired visibility, damage of vegetation and materials, harm to human health and production of acid rain (Rao, 2007). The threat could be aggravated by absence of good cross ventilation which is characterized by most Nigerian households (Okafor *et al.,* 2008). Poor ventilation retains the pollutants indoor for long periods and the duration in which the generator is operated is also a contributory factor. The presence of the pollutants in the indoor are also attributed to dispersion and wind effect as observed by Abdulkareem and Kovo (2006) and Ndoke and Jimoh (2005).

Conclusion

Electric power generators in Kaduna metropolis have similar characteristics in age, capacity and distance away from the building indoor environment. The indoor SO_2 and NOx mean concentrations were higher than the FEPA limits (0.01ppm and 0.04 to 0.06ppm respectively). The study established that most of the pollutants in the building indoor have no significant

relationship with the generator age and capacity. It was also established that the generator distance from the building indoor influences the CO emission in the building indoors. It is recommended that studies on the adequate distance for generator away from the indoor environment should be carried out to establish the generator safe distance.

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Impact of Physical Infrastructure Facilities on the Living Condition of Residents in Festac Town, Lagos

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Abstract

The study utilises the survey design to hypothesise the impact of Estate Physical Infrastructure Facilities (EPIF) on the living conditions of residents of Festac town of Lagos. It identifies infrastructure issues that require urgent care. Using questionnaires on a sample population of 210 Festac residents and the stratified sampling technique to collect data, 81.4% response rate was attained. The primary variables of the study are the functional condition and the adequacy of the EPIF. From Pearson's chi-square and Crammer's V Symmetric measures, inferences were drawn about the deplorable functional condition and the inadequacies of the studied EPIF. Weak effects size between EPIF and living conditions were also verified. The poor status of water supply lines and pipework, street lighting, access roads and footpaths; the inadequacy of water supply, and drainage facilities are the infrastructure issues that exhibit least impacts on living conditions. The Estate is not able to meet the needs and aspirations of the residents significantly on the scale of EPIF. Cross boundary validity is not proven. Based on the empirical information, there is a need to upgrade the physical infrastructure facilities comprehensively.

Keywords: *Living Conditions, Festac Town, Estate Infrastructure, Impact, Physical Facilities, Public Housing*

Introduction

Lagos Metropolitan Area witnessed an unprecedented high rate of infrastructure and facilities' provision when trade and commerce flourished with the introduction of export cash products in the late 1940s.

The economic system of the country was modernised with the construction of road and railway networks, Apapa sea and Ikeja airports, which enhanced the accessibility of Lagos from other regions of the country. Lagos remained the major town for taking in and discharging both imported and exported goods. During this period, there was a concentration of infrastructure and social amenities in Lagos. However, the most worrisome situation was the selective planning system presented by the pre-1960 administrations. Instead of a comprehensive planning of Lagos Metropolitan Area, it was only the government places of residence and works, such as Government Residential Areas (GRA) at Apapa, Ikoyi, Ilupeju and Ikeja that were properly designed.

The predicament of indigenous urban residents was left open. Long-term uncoordinated urban-based developments of these governments were inherited by the post-independent governments. Lagos, during this period, especially between 1962 and 1968 witnessed an unprecedented high rural-urban migration of people from the rural and less privileged regions (Onibokun, Atwal & George, 1973). Similarly, the oil boom era of 1970s favoured urban concentration of industrial and social facilities in the South West Area. Lagos, then became one of the twenty emerging industrial centres, and that also made post-civil war rehabilitation programmes possible. Depravation, rapid urbanisation, poverty, and poor governance that pervaded the Nigerian space impacted on environmental quality, quantitative and qualitative residential housing. The United Nations (2002) informed that the quality and coverage of infrastructure services have a major impact on existing standards and economic growth. It is reckoned that two billion of the world's poor people lack access to decent sanitation, two billion lack access to electricity, one billion lack access to fresh water.

The demand to amend the status of existing infrastructure facilities in many housing estates, particularly those established over thirty-five years ago by the Federal Housing Authority, is now of paramount importance in most developing nations. The report tries to produce an original and make a vital contribution to municipal housing studies. If

metropolitan public housing infrastructure issues are not empirically documented and addressed, unabated social problems and misdemeanours could spread from one urban geographical area to another. This work investigates the impact of Estate Physical Infrastructure Facilities (EPIF) on living conditions in Phase One, Festac Town Housing Estate using the functional condition and adequacy of the EPIF as the latent variables and explanatory parameters. The objectives are:

(1) To assess the functional condition of the EPIF
(2) To evaluate the adequacy of the EPIF in the Estate
(3) To appraise the impact of EPIF on living conditions in the Estate, and identify specific EPIF that require comprehensive upgrades.

The survey should provide empirical data about the importance of EPIF to aggregate conditions of livelihood, and attract the attention of the Federal, State, and Local Government policy makers to improve the EPIF and the housing quality in the Estate. The fundamental queries to be answered by this study derive from the objectives. They relate to the functional condition, adequacy of the EPIF, and overall statistical association between EPIF and condition of living, and the EPIF that requires attention.

Review of Literature

Housing, in a more general and social term, is the process of providing dwelling units for people to live in. Fadahunsi (1985) argued that for housing to be effective, it has to be seen in its communal setting: That is, housing must be considered beyond ordinary building, but it must be a building in which the occupier would like to live with happiness. Many components bear upon the desire to live in a house: These include the community, the physical setting, the installations that make the ingress into and outflow from the community easy or difficult, affordability, the accessibility of essential facilities for use in the home, such as water, and electricity (Onibokun, 1985).

Likewise, the availability of these facilities, as noted by Hardy and Setterthwaite (1986) defines the quality of the housing area and the survival of its dwellers. Misra (1986) and Ajibola, Awodiran & Salu-Salako (2013) regarded these facilities as basic infrastructure needed for quality urban life. As a stipulation for a household to be more attractive and conducive for the occupier, the entire physical environment must be viewed. The reason is that a planned environment would provide easy communication and transportation,

schools, parks, and playgrounds, shopping centres, open spaces, water and electricity. Similarly, a livable housing area must be adequately drained, while waste disposal systems must be functioning effectively, to ensure the cleanliness of the surrounding environment (Fadahunsi, 1985).

In characterising housing delivery, one should see the need to eliminate overcrowding, which is the worst pollutant of the environment and a major cause of slums. Clinard (1973) characterises slum areas as overcrowding, congested housing, area with deficient physical amenities. Thus, absence of social amenities coupled with an inadequate housing unit provision to fit the demand of the resident population may be reckoned as the root of slum and urban blight (Barrett and Beardmore 2000; Cronin and Guthrie, 2011).

Housing needs go beyond quantitative housing units. One needs to look at the quality of existing housing facilities and the prospects of increasing the housing stock. Hence, the effort to meet with housing units required must not jeopardize the relevance of housing quality (Fagbohun, 2008) It is suggested that neighbourhood conditions, structure, internal adequacies of dwelling units, the number of people in the household and their peculiar requirements and traditions, combine to constitute different needs of individual families and householders (McNeil and Dollery, 1999). In this wise, housing is shelter, and for the shelter to meet the criteria of habitability and livability, it should conform to a set minimum standard (Onibokun, 1985). Ibiyemi and Adenuga (2013) explained physical estate, infrastructure facilities as a set in the aggregate of all facilities that grant a housing estate to run effectively. Such facilities are water supply, drainage, waste disposal, roads, sewerage, street lighting, and telecoms, while estate social infrastructure constitutes the other. Agbola (1994) indicated that it is only through development control which contains land use zoning and planning standard that the ultimate objective of physical planning could be attained. The aim is to achieve a healthy, conducive, satisfying and aesthetically pleasing environment in which to pursue different kinds of human activities.

Hammer, Booth, and Love (2000) stated that the provision of safe and adequate infrastructure is also key to enhancing property values. Harvey (1993) was of the view that a residential user may be prepared to pay a high value for a property depending

on his consideration for basic installations such as accessibility, water and electricity, while McNeil and Dollery (1999) informed that infrastructure services have contracted along a new urgency in part because they possess a direct bearing on economic development. McNeil and Dollery revealed further that studies had demonstrated that adequate infrastructure reduces the cost of production, which in turn affect profitability, levels of output and employment; particularly in small-scale businesses. They were of the opinion that when infrastructure works, productivity and labour increase; when it does not operate, economic renewal can be shelved or even arrested.

Living conditions as a construct, is expressed as the qualitative measure of a residential Estate as a place of abode that considers the needs and aspirations of residents in terms of utility and satisfaction derivable from functional condition and adequacy of the estate physical and social infrastructure facilities (Ibiyemi and Adenuga, 2013). Living in a livable housing area also correlates with affordability, adequate social infrastructures, secure, dependable and economical transportation choices (NARC 2012; Centre for Affordable Housing; CAH, 2012). Jakande (2003) noted that in Nigerian urban areas, there is an acute scarcity of livable residential houses. The reason is that most Nigerians in Urban areas live in rented houses. Private owners, built a larger percentage of these houses incrementally over many years, and since most of these owners hold for economic purposes, the rents they charge are often high, and are usually payable two years or more in advance, whereas, the tone of these houses is poor and of substandard classes. A good deal could not be managed by the government to contain the situation, as its contributions are a minuscule fraction of the entirety of the existing housing stock. Therefore, urban poor has no option than to pay high rents for substandard housing and its complimentary services.

The study of Olajuyigbe, Rotowa & Adewunmi (2012) reported that Festac Town was a typical community that is presently not being serviced by mains water utilities due to the inability of the Water-Supply Agency (WSA) to supplying water to the area. Households, as a result seek other alternative sources, including water vending. Previous work on EPIF and living conditions of estate residents is known to literature, but theories regarding statistical measures of impacts for priorotisation are less considered. Past studies dwell on adequacies and availability of infrastructures. However, decision makers

also need to have insights into the specific requirements to guide them in ordering infrastructure repair-replacement choices. This study proceeds further to contribute the empirical baseline information upon which to rationalise their decisions.

The Study Area

The Estate, *FESTAC Town,* also known as the Black Arts Festival Town, situates along the Badagry Expressway. The long-term objective is to offer additional housing stock for the people of Metropolitan Lagos after Black Arts Festival of 1977. The Estate will occupy, in its closing phase, an area of 1,770 hectares and will let in seven residential communities of 15-20,000 people each. Therefore, the entire development will be able to hold a total population of 24,000 dwelling units or approximately 120,000 people. The Phase 1 development commenced in 1974 and was completed by mid-1976. The construction of buildings and various services was awarded to about 40 contractors in 70 sites of the project while 14 main contractors got the works on infrastructure. Lagos is the commercial capital of Nigeria and a microcosm of Nigeria. The population is over twenty million, and due to its apparent planlessness, the pressure on social and physical facilities finds its fullest manifestation. Festac Town Housing Estate is the largest public residential housing estate in Nigeria, both in physical size and resident population (Ibiyemi & Adenuga, 2013). The choice is justified for study as a case. Figure 1 below shows the arterial and connector roads in the Estate. The tiny-urls connect the links to the Location Map (http://tinyurl.com/pe4au8a) and the Report Images (http://tinyurl.com/j7bg4ln) .

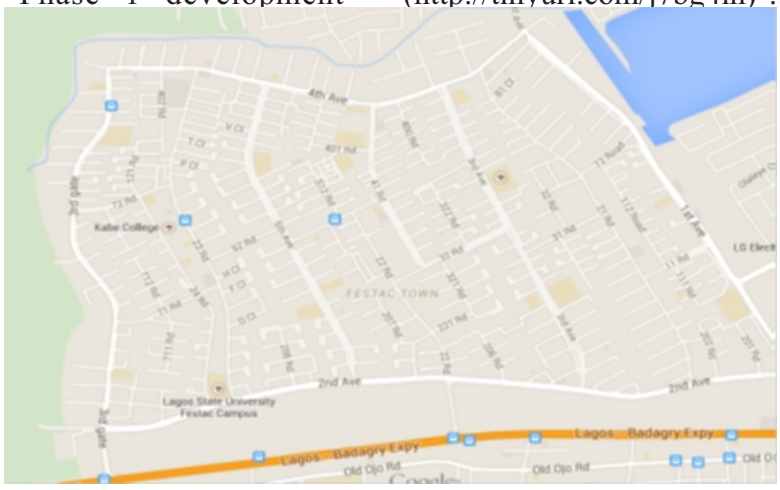

Figure 1. Map showing arterial and connector roads in the Estate: Source: Olajuyigbe, Rotonwa & Adewunmi (2012)

Phase 1 covers a total area of about 460 hectares, comprising of three residential communities I – III. It has a combined planned capacity of about 11,000 dwelling units for 55,000 people. The road layout is made up of local roads (cul-de-sacs and minor roads; connector roads - 5th Avenue, 23 Road, 22 Road, 21 Road, and 20 Road, while the arterial roads are the 1st, 2nd, 4th and 7th Avenues. The distribution of dwelling units by income groups is shown in Table 1 infra.

Table 1. Distribution of Dwelling Units by Income Group

COMMUNITY	LOW INCOME	MEDIUM INCOME	HIGH INCOME	TOTAL
I	2482	638	1100	4220
II	3008	332	723	4053
III	1835	206	461	2502
TOTAL	**7325**	**1166**	**2284**	**10775**
%	**68%**	**11%**	**21%**	**100%**

Source: FHA Brochure, 1976

Over 1,000 additional units were also provided in the reclaimed area of Community III (also in Phase 1) and thus, the total number of dwelling units in this phase is 12,000 with an expected population of 60,000. Under the present phase, the total number of dwelling units was divided into 68% for low income, 11% for middle income and 21% for high income. Plot sizes for individual units range from 200 to 1,200 square metres.

Table 2. House Types and Classification

TYPE	CLASS	ACCOMMODATION	
10	AH4	2-storey, 4-bedroom detached house– Two sitting/dining, one guest room, study, and a 3 room outhouse	HIGH INCOME
9	BH3	2-storey, 3-bedroom detached house, two sitting/dining, and a 2 room outhouse	
8	H4H3	2-storey semi-detached 3-bedroom house, one sitting/dining, and a 2 room outhouse	
7	H3M3	2-storey Terrace 3 bedroom houses, one sitting/dining.	MEDIUM INCOME
6	M3	4-storey block of 8 flats, each with 3- bedrooms, one sitting and dining	
5	M3L2A	4-storey block of 16 flats, each with 3 bedrooms, and one sitting/dining.	
4	F1M2B & F1M2A	2-bedroom bungalow with one sitting/ dining + garage	
3	F1L2	2-bedroom bungalow with one sitting/ dining.	
2	L2A	4-storey block of 16 flats (2-bedrooms, and a sitting room)	LOW INCOME
1	L/A	4-storey block of 32 flats (one bedroom, and a sitting room)	

Source: Fortune Ebie, 1980

Methodology

In this section, the various steps followed in data collection and analysis are explained. The instrument used for data collection are questionnaire survey, direct observation and personal interview. The questionnaire was mailed to 210 sampled Festac Town residents. The sample size of 210 was selected randomly from the working population of housing units contained in the Local Government Office at Amuwo Odofin. Stratified sampling technique was also used. Although, there are ten categories of house types in Festac Town Phase 1, stratification was done in three categories in accordance with the major qualifying income levels at the time of the original allocation in 1976: Detached/Duplex houses (above N4500; types 8–10) Terrace houses/Flats/Bungalows, (N2400 – N4000; types 3 -7) Flatlets (under N2400; types 1 & 2) and Private; with a sample population of 45, 96, 60 and 9 respectively.

The Questionnaire was designed to elicit information on functional condition and adequacy of the EPIF. A total of 171 responses were received; made up of 33 for the Detached/Duplex houses, 90 for Terrace houses/Flats/Bungalows, and 39 for Flatlets and 9 for Private residential. The response rate of the survey is 81.4%. Although the response rate is high, we made any effort to investigate any selection bias. Sample selection bias is always a possible problem where there are a substantial number of non-responses. Not accounting for it can lead to bias parameter estimates and misleading conclusions if it exists (Vossler and Kerkvliet, 2003).

Descriptive statistics based on distribution of responses for the two main independent variables: functional condition and adequacy of EPIF, each having sub-variables as in Appendix A. Pearsons chi-square and Crammer's V statistics were employed as test of association and effect size. Reliability analysis was carried out for internal consistencies, and all the items correlated adequately in the constructs. The minimum corrected item-Total-correlation is 0.730, and cronbach alpha coefficient reported 0.89. Generally, Cronbach alpha coefficient ≥ 0.7 is the average correlation matrix for internal consistencies (Devellis, 2003;Kline, 2005; Pallant, 2011).

Results and Analysis

The descriptive statistics of the responses in respect of functional condition and adequacy of EPIF are presented in Table 3 and 4, Sections 1and 2 below:

Table 3. Indexed Percentage Distribution of Functional Condition of EPIF

Section One:

	N	VB	B	F	G	VG
Condition of access roads, minor roads, and footpaths	171	0.221	0.386	0.086	0.071	0.021
Condition of street lighting	171	0.414	0.257	0.100	0.029	0.014
Condition of drainage system	171	0.157	0.214	0.357	0.071	0.014
Condition of electricity supply lines, and cable network	171	0.129	0.257	0.414	0.014	-
Condition of water supply lines and pipework	171	0.514	0.171	0.071	0.014	0.043

N-no. of respondents; *VB*-Very Bad; B -Bad; *F*-Fair; *G*-Good; *VG*-Very Good

Section one inquired about the condition of EPIF in fulfilment of research question 1. As shown in Table 3 above, an aggregate of.17.8% rated the condition of access roads, minor roads, and foot paths as either fair, good or very good. Street lighting, drainage systems, electricity and water supply lines were rated 14.3%, 44.2%, 42.8%, and 12.8% respectively. The indication is that the estate physical infrastructure facilities are in deplorable conditions.

Table 4. Indexed Percentage Distribution of Adequacy of EPIF

Section two	***N***	**SA**	**NA**	**FA**	**A**
Mains electricity supply	171	0.010	0.686	0.214	-
Mains water supply	171	0.114	0.743	0.057	-
Roads and Streets	65	-	0.686	0.457	0.243
Street lighting	171	0.557	0.557	0.100	-
Drainage facilities	171	-	0.657	0.257	0.100

NA-Not Adequate; SA-Somewhat Adequate *FA*- Fairly Adequate; A-Adequate

In section, two the respondents were asked questions to elicit the adequacy of the estate physical infrastructure in response to research question 2. 68.6% indicated that mains electricity supply is not adequate within the Estate, while 21.4% rated it fair. Respondents rated water supply, street lightening, and drainage facilities as not adequate (74.3%, 55.7%, 65.7% respectively). The response indicates that water, roads, street lighting and drainages are not adequately provided. The services could not be deemed to be efficient.

The descriptive statistics of the responses in respect of functional condition and adequacy of EPIF were recoded for ease of application of SPSS22. The transformed responses are presented in Table 5. Responses relating to independent variables were recoded into two categories (Yes, 1; No, 0) (see Table 5). **Yes**: *Condition* (Very Good/Good)-Good; *Adequacy* (Adequate/Fairly Adequate); **No**: *Condition* (Fair/Bad/Very Bad)-Bad; *Adequacy* (Not Adequate/Somewhat Adequate).

Table 5. Percentage Summary of Observed Frequencies of Responses (Recoded)

Independent Variables	*Observed Frequencies (OF) EPIF*		
	Yes (1)-good	*No (0)-bad*	*N*
1. Functional Condition			
*Condition of access roads, minor roads and foot paths (CARMFP).	68	103	171
*Condition of street lighting (CSL)	56	115	171
*Condition of drainage system (CDS)	108	63	171
*Condition of electricity supply lines, and cable networks (CESCN)	105	66	171
*Condition of water supply lines and pipework(CWSLP)	54	117	171
2. Adequacy	**Adequate**	**Not Adequate**	
Electricity supply (ADES)	52	119	171
Water supply (ADWS)	21	150	171
Roads and streets (ADRES)	115	50	165
Street lightening (ADSL)	31	137	168
Drainage facilities (ADDF)	52	99	151

The bar chart in Appendix A (Fig.4) further illustrates the relationship between EPIF and livability in the Estate. From the chart, ADRES, CDS, and CESCN have high counts for "livable" while CSL, ADSL, ADES, CWSLP, CSL, CARMFP and ADDF have high counts for "not livable".

The indication is that respondents' "livable" preference is based on their satisfaction with ADRES, CDS, and CESCN, while dissatisfaction with CSL, ADSL, ADES, CWSLP, CSL, CARMFP and ADDF influenced the respondents' "not livable" preference.

Chi-square Test of Independence was utilised to appraise the impact of the EPIF on living conditions in the Estate by testing the overall statistical association to provide answer to research question 3. The frequencies in Table 5 are also encompassed in Table 6 and can be explained in the light of the SPSS output in Table 6.

Table 4 gives the frequency counts, expected frequency and the difference between the two for each of the twenty cells. Expected count frequency in each of the cells produced by the factorial combination of living condition and EPIF is >5. This means that the analysis has not violated a core assumption underlying the chi-square test.

Preference for the independent variables examined varied as a function of living condition. Following considering the magnitude of standardized residuals (STDRes): The residual is the error between

what the model predicts (expected frequency) and data actually observed. $Residual_{ij} = observed_{ij} - model_{ij}$, in which i and j represent the two latent variables. The chi-square statistic is the sum of the STDRes, so the relationship is direct (Field, 2009). To determine what contributes to the overall association, chi-square measures individual STDRes in each cell, and each STDRes is a z score. Field (2009) affirms the rule that: *If the value lies outside of ±1.96, then it is significant at .05.*

For this study, STDRes with greater than ±1.96 value in any cell tells us that significantly more residents than expected considered the sub-variable to live on the Estate, and less number of residents than expected did not consider the sub-variable. Therefore the sub-variable has a positive influence on the overall association, or outcome.

Conversely, (STDRes with less than ±1.96 value indicates that, the sub-variable did not significantly contribute to the association. Hence, ADES (STDres -1.9), CWSLP (STDres 1.6), ADDF (STDres -1.0), CSL (STDres -1.4), CARMFP (STDres .1) did not significantly contribute to the association.

The overall indication is that living condition is influenced by the independent variables at varying magnitudes relative to their standardized residuals.

Table 6. Crosstab result of Living condition in the Estate, functional condition and adequacy of EPIF

Living condition in the Estate * Functional condition & adequacy of EPIF Cross tabulation

			Functional condition & adequacy of EPIF										
			CARMFP	CSL	CDS	CESCN	CWSLP	ADES	ADWS	ADRES	ADSL	ADDF	Total
Living condition in the Estate	Respondents CAT A - not livable	Count	103	115	63	66	117	119	150	50	137	99	1019
		Expected Count	103.7	103.7	103.7	103.7	103.7	103.7	103.7	100.0	101.8	91.5	1019.0
		% within Living condition in the Estate	10.1%	11.3%	6.2%	6.5%	11.5%	11.7%	14.7%	4.9%	13.4%	9.7%	100.0%
		% within Functional condition & adequacy of EPIF	60.2%	67.3%	36.8%	38.6%	68.4%	69.6%	87.7%	30.3%	81.5%	65.6%	60.6%
		% of Total	6.1%	6.8%	3.7%	3.9%	7.0%	7.1%	8.9%	3.0%	8.1%	5.9%	60.6%
		Std. Residual	-.1	1.1	-4.0	-3.7	1.3	1.5	4.6	-5.0	3.5	.8	
	Respondents CAT B - livable	Count	68	56	108	105	54	52	21	115	31	52	662
		Expected Count	67.3	67.3	67.3	67.3	67.3	67.3	67.3	65.0	66.2	59.5	662.0
		% within Living condition in the Estate	10.3%	8.5%	16.3%	15.9%	8.2%	7.9%	3.2%	17.4%	4.7%	7.9%	100.0%
		% within Functional condition & adequacy of EPIF	39.8%	32.7%	63.2%	61.4%	31.6%	30.4%	12.3%	69.7%	18.5%	34.4%	39.4%
		% of Total	4.0%	3.3%	6.4%	6.2%	3.2%	3.1%	1.2%	6.8%	1.8%	3.1%	39.4%
		Std. Residual	.1	-1.4	5.0	4.6	-1.6	-1.9	-5.6	6.2	-4.3	-1.0	
Total		Count	171	171	171	171	171	171	171	165	168	151	1681
		Expected Count	171.0	171.0	171.0	171.0	171.0	171.0	171.0	165.0	168.0	151.0	1681.0
		% within Living condition in the Estate	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	9.8%	10.0%	9.0%	100.0%
		% within Functional condition & adequacy of EPIF	100.0%	100.0 %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	9.8%	10.0%	9.0%	100.0%

Table 6. Crosstab result of Living condition in the Estate, functional condition and adequacy of EPIF

Living condition in the Estate * Functional condition & adequacy of EPIF Cross tabulation

			Functional condition & adequacy of EPIF										
			CARMFP	CSL	CDS	CESCN	CWSLP	ADES	ADWS	ADRES	ADSL	ADDF	Total
Living condition in the Estate	Respondents CAT A - not livable	Count	103	115	63	66	117	119	150	50	137	99	1019
		Expected Count	103.7	103.7	103.7	103.7	103.7	103.7	103.7	100.0	101.8	91.5	1019.0
		% within Living condition in the Estate	10.1%	11.3%	6.2%	6.5%	11.5%	11.7%	14.7%	4.9%	13.4%	9.7%	100.0%
		% within Functional condition & adequacy of EPIF	60.2%	67.3%	36.8%	38.6%	68.4%	69.6%	87.7%	30.3%	81.5%	65.6%	60.6%
		% of Total	6.1%	6.8%	3.7%	3.9%	7.0%	7.1%	8.9%	3.0%	8.1%	5.9%	60.6%
		Std. Residual	-.1	1.1	-4.0	-3.7	1.3	1.5	4.6	-5.0	3.5	.8	
	Respondents CAT B - livable	Count	68	56	108	105	54	52	21	115	31	52	662
		Expected Count	67.3	67.3	67.3	67.3	67.3	67.3	67.3	65.0	66.2	59.5	662.0
		% within Living condition in the Estate	10.3%	8.5%	16.3%	15.9%	8.2%	7.9%	3.2%	17.4%	4.7%	7.9%	100.0%
		% within Functional condition & adequacy of EPIF	39.8%	32.7%	63.2%	61.4%	31.6%	30.4%	12.3%	69.7%	18.5%	34.4%	39.4%
		% of Total	4.0%	3.3%	6.4%	6.2%	3.2%	3.1%	1.2%	6.8%	1.8%	3.1%	39.4%
		Std. Residual	.1	-1.4	5.0	4.6	-1.6	-1.9	-5.6	6.2	-4.3	-1.0	
Total		Count	171	171	171	171	171	171	171	165	168	151	1681
		Expected Count	171.0	171.0	171.0	171.0	171.0	171.0	171.0	165.0	168.0	151.0	1681.0
		% within Living condition in the Estate	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	9.8%	10.0%	9.0%	100.0%
		% within Functional condition & adequacy of EPIF	100.0%	100.0 %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	9.8%	10.0%	9.0%	100.0%

Table 7. Pearson's Chi-square results

Chi-Square Tests			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	237.024[a]	9	.000
Likelihood Ratio	246.372	9	.000
Linear-by-Linear Association	15.356	1	.000
N of Valid Cases	1681		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 59.47.

As indicated in Table 7, it could be concluded that there was a statistical association between the living condition in the Estate and EPIF, for the different sub-variables. With Pearson's chi-square = 237.024, p=.001 (<.05), the null hypothesis that there was no overall association between function condition of EPIF, adequacy of EPIF, and living condition could not be accepted. The inference is that the statistical proportion of "livable" is significantly different from the proportion of "not livable", for which the association could be inferred. Therefore, EPIF impacts on the living condition of the estate residents.

Table 8. Symmetric measures of Cramer's V

Symmetric Measures			
		Value	**Approx. Sig.**
Nominal by Nominal	Phi	.376	.000
	Cramer's V	.376	.000
N of Valid Cases		1681	

Table 8 provides measures of the strength of relationships or the effect size (ranges between 0 and 1). The closer to 0, the weaker the association. Cramer's V at .376 indicates a weak effect size. With the situation in the table where Cramer's V is far from 0, it could be concluded that a weak situation occurs. **Conclusion and Policy Considerations**

The work has determined the functional condition, adequacy of EPIF, livability in the Estate, their statistical association (p<. 05; Crammer's V=. 346; z=±1. 96), as indicative of impact of EPIF on living conditions. Since the relationship is a weak one, the infrastructure requires an urgent comprehensive upgrade generally. ADES, CWSLP, CSL, ADDF, and CARMFP are the

infrastructure issues that have to be upgraded urgently by the authorities. All the research questions have been answered, and objectives fulfilled. It validates the theories of McNeil and Dollery (1999) and UN (2002) that the contribution to the quality and coverage of infrastructure services has a major impact on the living standards and economic growth of the people directly.

The Estate is bedeviled by the spiral population explosion and resultant overcrowding, with an occupancy ratio of three persons per room (WHO standard – two persons per room) and an average population density of 1950 persons per hectare (Ibiyemi & Adenuga, 2013). The resident population needs to be controlled to reduce overcrowding and the spread of communicable diseases. The buildings appear to be in satisfactory external physical conditions, well ventilated and painted externally. Site observation confirmed that the buildings are structurally sound. However, the Estate is not significantly able to meet the needs and aspirations of its residents on the scale of Estate Physical Infrastructure Facilities. The reason is that only about 50% of the EPIF considered in this study exhibited positive impacts on living conditions.

Festac Town needs to be upgraded with an integrated conservation strategy for a FESTAC TOWN IMPROVEMENT PROJECT (FESTIP). The initiative is to give infrastructure facelift, control of population and community development as linked interventions.

The Improvement Project should be attached to the Office of the Amuwo Local Government Area Chairman, and the operators of the Project are to enlist the support of the Federal Housing Authority (FHA) and the Festac Police. FESTIP could comprise of representatives of the Local Government, Federal Housing Authority, FTRA, an Estate Surveyor and Valuer and a Town Planner. Financial and legal empowerment are desirable, through relevant bylaws to carry out the following tasks:

(1) Demolition of all structures, the development of which are inconsistent with the provisions of section 1 of FHA Revised Approval to Building Plans Regulation of 1985 which states in part as follows: “Any unapproved development shall be liable to demolition after a notice has been duly displayed……” Immediate suspension and subsequent reappraisal of building permits for new development, notably for

shops and places of worship to control and reduce resident population and corresponding pressure on available social services.

(2) Development control is one of the measures applied by physical planning agencies, especially, local planning authority, but in the case of Festac Town, FHA should ensure that developers do not deviate from building plans approved for them throughout the implementation of construction on the plot earmarked for them. The target is to enhance environmental quality, improved housing condition, the privacy of residents and the free flow of air, among others. Despite the importance of development control standards in physical, zoning, and balancing, a series of elements, such as enforcement, hinder its effectiveness.

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Appendix A

Functional Condition

CARMFP	Condition of Access Roads, Minor Roads, and Footpaths
CSL	Condition of Street Lighting
CDS	Condition of Drainage System
CESCN	Condition of Electricity Supply Lines and Cable Network
CWSLP	Condition of Water Supply and Pipework

Adequacy

ADES	Adequacy of Electricity Supply
ADWS	Adequacy of Water Supply
ADRS	Adequacy of Roads and Streets
ADSL	Adequacy of Street lighting
ADDF	Adequacy of Drainage Facilities

Valuers' perception of the effect of client influence on valuation practice

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Abstract

The literature indicates that valuers yield to client influence to bias valuations. Studies also show that client influence has several effects on valuation practice. This study investigated valuers' perception of the effect of client influence on valuation practice with the objective of determining whether the perception differs for valuers of different characteristics. The investigation focused on secured lending valuations in Nigeria. The research design was cross-sectional survey. The sample comprised 270 valuation firms selected through the stratified random sampling design. Data collection utilised questionnaire structured on 5–point Likert format. Data analysis employed mean statistics and Kruskal-Wallis test. The results revealed that valuers perceive that client influence undermines integrity of the valuers; the valuation firm and the valuation profession; as well as questions valuers' expertise and, constrains the development of the valuation profession. This perception is the same irrespective of the characteristics of the valuer. It can be inferred that valuer characteristics are not important in explaining valuers' perception of the effect of client influence on valuation practice. The policy implication of the research is the necessity for the regulatory agencies to review valuation practice standards to institute measures to check the intervention of clients in valuations. The limitation of the research is that it investigated only valuers. It suggests that research be conducted on the subject from clients' perspective.

Keywords: *Client influence; valuation; bias valuation; valuer characteristics; valuation practice*

Introduction

Collateral posted by borrowers in secured lending provides protection to the lender against borrowers' default to repay the loan. As the loan amount is usually a function of the value of the collateral, the valuation of collateral is important to the parties. Before accepting assets as collateral, Nigerian banks engage registered valuation firms to value the assets (Aderemi, 2015; Nwuba, Egwuatu, & Salawu, 2015c). Although valuers possess some level of independence to exercise their judgement on valuation, the dynamics in business environment makes such judgement vulnerable to bias (Klamer, Bakker, & Gruis, 2017). This bias sometimes manifest through the influence of clients.

Studies in Nigeria (Amidu & Aluko, 2007a, 2007b; Ogunba & Iroham, 2011; Nwuba, 2015a, 2015b), South Africa (Wilkens, 2014) and Tanzania (Mwasumbi, 2014) have revealed the existence of client influence on valuers to bias valuation. Evidences also exist in Malaysia (Achu, 2011; Achu, Chin, Burhanb, & Nordin, 2015), Taiwan and Singapore (Chen & Yu, 2009), the UK (Crosby, Lizieri, & McAllister, 2010; Crosby, Hughes, & Murdoch, 2004) and New Zealand (Levy & Schuck, 1999, 2005). In some of the early studies on client influence, surveys in the US found widespread incidence of influence on residential (Worzala, Lenk, & Kinnard, 1998) and commercial (Kinnard, Lenk, & Worzala, 1997) appraisers. Smolen and Hambleton (1997) found that 80% of US appraisers had clients who pressured them to modify their valuations with over 33% having clients who insisted on the modifications. These studies found that clients use means such as information and threats to influence valuers.

Clients have motives such as minimising the effect of valuation on client company's income statement and net asset value (Achu, 2011) and ensuring that valuations represent the client's preferred outcome (Levy & Shuck, 2005) to influence valuers. Similarly, valuers have the means (inherent uncertainty in valuation), the motives (economic dependence) and opportunities to bias valuations in response to or in anticipation of client pressure (Crosby, Devaney, Lizieri, & McAllister, 2015). Valuers actually bias valuations in response to client influence (Achu et al., 2015; Wilkens, 2014).

The Appraisal Institute of Canada (2010) stated that client influence challenges the integrity of the valuer. Similarly, Kinnard et al., (1997) asserted that client pressure and

its effect on valuer independence have broader implications for the credibility of reported values of listed companies and ultimately confidence in related capital market.

Valuers' perception of the effect of client influence on their practice may influence their response to it. Nwuba, Egwuatu, and Salawu (2012) found that Nigerian valuers perceive that client influence has negative effect on valuation practice. The findings showed that valuers agreed that client influence reduces the integrity of the valuers and the valuation profession, limits the development of the profession and brings the valuer's expertise to question.

However, client influence depends on several factors. These factors include the characteristics of the valuer and valuation firm such as the age and experience of the valuer, the size of the firm, the integrity of the valuer and the integrity of the valuation firm; the characteristics of the valuation environment such as the regulatory framework; the characteristics of the valuation such as the purpose of valuation, and the characteristics of the client such as the type and size of client. (Achu et al., 2015; Levy & Shuck, 1999). Understanding how valuers' perception runs across these characteristics is important to dealing with the problem of client influence.

Accordingly, this study investigated valuers' perception of the effect of client influence on valuation practice with the objective of determining if the perception is different based on valuer characteristics. Thus, the question investigated was whether the perception of valuers on the effect of client influence on valuation practice differs for valuers of different characteristics. Valuer characteristics were measured by valuer's age, experience, academic qualification and the size and years of establishment of the valuer's firm. The investigation focused on secured lending valuations in Nigeria's banking sector. The term valuer is used here to mean estate surveyors and valuers, the nomenclature used in Nigeria.

Literature review

This section presents a review of related literature on client influence on valuation. The review covers factors that influence valuers' judgement, clients' motives to influence valuers, valuers' motives to succumb to client influence, the effect of client influence on valuation practice and the interplay of client influence with valuer characteristics. These issues are important in shaping the valuer's perception of the

impact of client influence. Knowing them is important to understanding how valuers perceive the impact of client influence on their professional practice and therefore necessary in evaluating the perception of valuers on the subject.

Client influence refers to clients' intervention in valuation to influence valuer's judgment to bias valuation. Crosby et al. (2010) described it as manipulation of the appraisal production process by the client with the aim of systematically biasing appraisal outcomes. In the literature, client influence is used as synoymous with client pressure. Also, the literature often uses client feedback synonymously with client influence. Client feedback often amounts to influence (Gallimore & Wolverton, 2000; Wolverton & Gallimore, 1999). In this paper, the term client infleucne is used as synonymous with client pressure and client feedback.

Clients may intervene in valuation process ostensibly to make inputs that will aid the valuer arrive at a credible valuation. This is necessary because often clients possess information relevant to valuer's work. However, sometimes clients misuse their information power and turn intervention to aid the valuer to interference to bias valuation. Findings demonstrate that information such as pending mortgage amount (Hansz, 2004; Nwuba et al., 2015b) and pending sales price (Gallimore & Wolverton, 1997) produce bias on valuers. Transaction feedback tends to influence valuers' judgment in unrelated future valuations(Hansz & Diaz, 2001).

Furthermore, Kinnard et al., (1997) found that client size represented by percentage of appraisal revenue affects US commercial appraiser's decision to alter their valuation in response to client request. They found a significant, direct relationship between client size and the appraisers' likelihood of modifying their valuations. In contrast, similar studies on Nigeria's residential valuers (Amidu & Aluko, 2007a) and the US residential appraisers (Worzala, et al, 1998) did not find client size significant in valuers' decision to alter their valuation in response to client request. Amidu and Aluko implied from their findings that Nigerian valuers do not compromise their independence and duty of objectivity in response to client influence, irrespective of the size of the client. Interestingly however, through other means, they found substantial amount of client influence and evidences of valuers' succumbing to influence. The researchers concluded that client influence

was having negative impact on valuation outcome.

Clients have motives to influence valuers. For instance, in New Zealand, findings revealed that the concerns for valuations to have market credibility and be realistic and accurate motivate clients to influence valuers (Levy & Shuck, 2005). This may appear rational but often, especially in less developed markets, there is ulterior motive to shift the valuer from objective valuation. The practice in the UK in which valuations go for negotiation and possible moderation before formal submission improves the quality of valuation through enriched information, but it is susceptible to abuse resulting in biased and less valid valuation (Baum et al, 2000).

Likewise, valuers have motives such as corruption and indiscipline in the society and fear of losing their clients to succumb to client influence (Nwuba et al., 2015a). Appraiser incompetence and desire to place profit above practice standards are also motives for biased valuations (Smolen & Hambleton, 1997). Similarly, Levy and Shuck (1999) stated that the highly competitive nature of the valuation market might make the valuer to succumb to pressure so as to obtain more briefs.

Client influence affects valuation practice in some ways. It results in valuation bias. Valuation bias affects valuation accuracy and might imply mortgage financing risks (Klamer et al., 2017). Client influence is one of the causes of valuation inaccuracies in Nigeria (Ajibola, 2010; Babawale & Omirin, 2012; Ogunba & Iroham, 2010). Wolverton and Gallimore (1999) found that client feedback is highly significant in altering US appraisers' role perception. In contrast, similarly modelled researches in the UK (Gallimore & Wolverton, 2000) and Nigeria (Amidu, Aluko, & Hansz, 2008) did not find the role perception of valuers to be associated with client pressure. Differences in the valuation environment may be responsible for the contrasting findings.

In addition, Amidu and Aluko (2007b) found that Nigerian valuers perceive that they are more likely to resist client influence if they are employed by big and well-established firms. On the other hand, the valuers agreed that a firm which earns a large proportion of its income from a single client would likely succumb to pressure from that client. The researchers argued that the bid by valuers to retain their clients in a competitive market could increase the valuers' tendency to yield to pressure. Likewise, in Taiwan and Singapore, Chen

and Yu (2009) found that valuers perceive that larger and more-established firms and firms not under pressure for work are in better position to resist client influence. Also, in New Zealand, Levy and Schuck (1999) found that younger valuers tend to be more methodical in their approach to valuation and might therefore require more evidence before they could modify their valuations. Thus, valuer characteristics can affect different aspects of client influence.

Clients have motives to influence valuers and they sometimes actually influence valuers to bias valuation. Valuers also have motives and opportunities to succumb to client influence to produce biased valuations. Valuers perceive that client influence affects valuation practice in several ways including decreasing the integrity of the valuer and the integrity of the valuation profession and questioning the expertise of the valuer. Client influence itself is affected by various valuer characteristics such as experience and age of the valuer and the size and level of establishment of the valuation firm where the valuer works. Understanding how valuers' perception of the impact of client influence on their professional practice runs across these characteristics is important in dealing with the problem of client influence.

The next section explains the methodology this research adopted to investigate the question.

Research methodology

The research was a cross-sectional survey. Questionnaire designed for the research was utilised for data collection. The construct that measured valuers' perception had ten variables structured on 5-point Likert format. 'Strongly disagree' was rated 1, while 'strongly agree' was rated 5. Between them were 'disagree' 'agree' and 'neutral' rated 2, 4 and 3 respectively. The respondents were asked to rate their perception on the scale. In the results, the range 3.5 to 4.49 is interpreted as 'agreed' while 1.5 to 2.49 is 'disagreed'. Below 1.5 is interpreted as 'strongly disagree' while 4.5 and above is 'strongly agreed'. Neutral lies between 2.5 and 3.49.

Cronbach's Alpha was used to test the reliability of the questionnaire with respect to the construct item on a random sample of 20 valuation firms. The result showed Cronbach's Alpha value of 0.870 which signifies that the instrument was reliable. The questionnaire was validated on the same sample with the Kendall's coefficient of concordance (W).

The population comprised 850 valuation firms listed on the website of the Nigerian Institution of Estate Surveyors and Valuers. Sample size was 270 determined with Cochran's sample size correction formula for populations less than 50,000. The study applied the stratified random sampling design with optimum allocation. The stratification was based on the former three geographical regions with two cities representing each region – Enugu and Port-Harcourt for the East, Lagos and Ibadan for the West, and Kaduna and Abuja for the North (Table 1).

Table 1: Sample Size Distribution

City surveyed	State	No of Valuation firms in the state	Sample Size	Percent
Enugu	Enugu	40	17	6.3
Port-Harcourt	Rivers	63	26	9.6
Lagos	Lagos	364	153	56.7
Ibadan	Oyo	22	9	3.3
Kaduna	Kaduna	35	15	5.6
Abuja	FCT	120	50	18.5
Total		644	270	100.0

Data analysis utilised mean statistics and Kruskal-Wallis test performed on IBM SPSS version 23. Kruskal-Wallis test was used to investigate the differences in the perception of valuers based on their characteristics. The methods adopted in the research follow exisitng studies on client influence on valuation. Most existing studies employed questionnaire survey design (Amidu & Aluko, 2007b; Amidu et al., 2008; Chen & Yu, 2009; Galllimore & Wolverton 2000; Smolen & Hambleton, 1997).

Results

Respondents' Demographics

Table 2: Summary Statistics of Respondents' Demographic Characteristics

Valuer's Characteristics	Response Categories	Frequency	Percent	Cumulative percent
Firm's staff strength	1 – 5	124	45.9	45.9
	6 – 10	99	36.7	82.6
	Above 10	47	17.4	100.0
Firm's years of establishment	1 – 5	6	2.2	2.2
	6 -10	50	18.5	20.7
	11 – 15	59	21.9	42.6
	16 – 20	76	28.1	70.7
	Above 20	79	29.3	100.0
Valuer's Age	Under 30	8	3.0	3.0
	30 – 40	121	44.8	47.8
	41 – 50	80	29.6	77.4
	Above 50	61	22.6	100.0
Valuer's Academic qualification	Higher National Diploma	72	26.7	26.7
	Bachelors degree	110	40.7	67.4
	Masters degree	82	30.4	97.8
	PhD	6	2.2	100.0
Valuer's Experience (in years)	1 – 5	20	7.4	7.4
	6 – 10	71	26.3	33.7
	11 – 15	62	23.0	56.7
	16 – 20	67	24.8	81.5
	Above 20	50	18.5	100.0
Professional grade	Fellow	61	22.6	22.6
	Associate	209	77.4	100.0

Source: Field Survey, 2017

Table 2 contains the demographic characteristics of the respondents. About 46% of the firms have five or less staff while about 17.4% have above ten. About 42.6% of the firms have been established for 15 years or less while 57.4% have existed for over 15 years. On the other hand, about 56.7% of the staff have 15 years or less post-qualification experience whereas about 43.3% have over 15 years. Overall, the demographics demonstrate that the sample included firms of various sizes and levels of establishment. It also included valuers of the two professional grades of the Nigerian

Institution of Estate Surveyors and valuers with varying years of experience and academic qualifications across a wide range of age brackets. Thus, the sample is considered suitable and the dataset reliable for the study. Moreover, respondents willingly participated in the survey. Consequently, the researchers have confidence in the validity of the results.

Descriptive Statistics of Effect of Client Influence on Valuation Practice

Table 3: Descriptive Statistics of the effect of client influence on valuation practice

Impacts	N	Mean	SE	Remark
It undermines the integrity of the valuer	270	4.48	0.12	Agreed
It undermines the integrity of the valuation firm	270	4.46	0.12	Agreed
It undermines the integrity of the valuation profession	270	4.41	0.13	Agreed
It limits the development of valuation practice	270	4.21	0.14	Agreed
It decreases the importance valuation users attach to valuation outcomes	270	4.06	0.15	Agreed
It enhances the credibility of valuation	270	2.10	0.14	Disagreed
It brings the valuers' expertise to question	270	4.35	0.10	Agreed
It encourages quackery in the profession	270	4.11	0.14	Agreed
It increases the accuracy of valuation	270	2.08	0.13	Disagreed
It makes valuation outcomes more realistic	270	2.26	0.15	Disagreed

From table 3, using the descriptive statistics and decision criteria for the 5-point Likert scale, the valuers averagely agreed that client influence undermines the integrity of the valuer, the integrity of the valuation firm and the integrity of the valuation profession. Similarly, the valuers agreed that client influence limits the development of valuation practice. On the other hand, the valuers disagreed that client influence enhances the credibility and accuracy of valuation or makes valuation outcome more realistic. The results demonstrate that the valuers perceive that client influence has detrimental effect on valuation practice.

In response to a question on the size of adjustment the valuers had or were likely to make to their valuations to accommodate client influence, about 35% said 10% or less, about 56% said over 10% while about 9% said they had not and were not likely to make any adjustment.

4.3 Test of Hypotheses on Valuers' Perception of the Effect of Client Influence

Kruskal-Wallis test is hereby used to test the null hypothesis on the difference in perception of the effect of client influence on valuation practice by valuers of different characteristics. Valuer characteristics are measured by the valuer's age, experience, academic qualification, and the size and level of establishment of the valuer's firm. Academic qualification is the highest academic qualification of the valuer. It could be PhD, Masters degree, Bachelors degree, or HND. Experience refers to the valuers' years of work after qualification. On the other hand, firm size is measured by the number of valuers employed by the firm while the level of establishment is the years since the firm's establishment.

Hypothesis 1

H_O 1: Valuers' perception of the effect of client influence on valuation practice is not different for valuers of different age groups.

H_1 1: Valuers' perception of the effect of client influence on valuation practice is different for valuers of different age groups.

Table 4: Statistics of valuers' perception based on age

Statistics	Values
Chi-Square	0.209
Df	3
Asymp. Sig.	0.901

The result in Table 4 did not provide sufficient evidence against the null hypothesis ($p=0.901>0.05$), and so the null hypothesis cannot be rejected. Thus, valuers of different age groups have the same perception on the effect of client influence on valuation.

Hypothesis 2

H_O 2: Valuers' perception of the effect of client influence on valuation practice is not different for valuers of different academic qualifications.

H_1 2: Valuers' perception of the effect of client influence on valuation practice is different for valuers of different academic qualifications

Table 5: Statistics of valuers' perception based on qualification

Statistics	Values
Chi-Square	0.389
Df	3
Asymp. Sig.	0.943

Again, the result did not provide strong evidence against the null hypothesis ($p=0.943>0.05$). Hence, valuers' perception of the effect of client influence on valuation practice is not different for valuers of different academic qualifications.

Hypothesis 3

H_O 3: Valuers' perception of the effect of client influence on valuation practice is not different for valuers of different levels of experience.

H_1 3: Valuers' perception of the effect of client influence on valuation practice is different for valuers of different levels of experience.

Table 6: Statistics of valuers' perception based on experience

Statistics	Values
Chi-Square	8.620
Df	4
Asymp. Sig.	0.071

From Table 6, the null hypothesis cannot be rejected as the result did not provide strong evidence against it (*p=0.071>0.05*). Thus, experience does not make any difference in valuers' perception of the effect of client influence on valuation practice.

Hypothesis 4

H_O 4: Valuers' perception of the effect of client influence on valuation practice is not different for valuers from firms of different sizes

H_1 4: Valuers' perception of the effect of client influence on valuation practice is different for valuers from firms of different sizes.

Table 7: Statistics of the valuers' perception based on firm size

Statistics	Values
Chi-Square	5.741
Df	2
Asymp. Sig.	0.057

The results in Table 7 indicate that the size of valuer's firm does not make any difference in the valuer's perception of the effect of client influence on valuation practice (*p=0.057>0.05*).

'pothesis 5

5: Valuers' perception of the effect of ɛnt influence on valuation practice is not different for valuers from firms of different levels of establishment.

H_1 5: Valuers' perception of the effect of client influence on valuation practice is different for valuers from firms of different levels of establishment.

Table 8: Statistics of valuers' perception based on firm's level of establishment

Statistics	Values
Chi-Square	2.569
Df	3
Asymp. Sig.	0.463

The results in Table 8 demonstrate that valuers' perception of the effect of client influence on valuation practice does not differ for valuers from firms of different levels of establishment (*p=0.463>0.05*).

None of the test results provided strong evidence against the null hypotheses, an indication that valuers of different characteristics perceive the effect of client influence the same way. In other words, valuers, regardless of their characteristics perceive that client influence has detrimental effect on valuation practice.

Discussion

The results of the research revealed that valuers perceive that client influence affects valuation practice in various ways including undermining the integrity of the valuer, the integrity of valuation firm and the integrity of the valuation profession, constraining the development of valuation practice and decreasing the importance valuation users attach to valuation outcomes. On the other hand, the valuers disagreed that client influence enhances the credibility and accuracy of valuation or makes valuation outcomes more realistic. The perception is the same irrespective of the characteristics of the valuer involved. The findings on the effect of client influence on valuation practice support Amidu and Aluko (2007a). However, they contrast with Levy and Schuck (2005). In addition, the findings on the perception of the effect of client influence on valuation practice across valuer characteristics do not support previous findings that link client influence with valuer and valuation firm characteristics (Achu et al., 2015; Levy & Shuck, 1999).

The contrasts with previous studies suggest that the nature of client influence on valuation is different between Nigeria and New Zealand. It may also be due to the fact that the current research and Amidu and Aluko were on valuers whereas Levy and Shuck was on clients. The implications are that the valuation practice environment is important in client influence and the research context is important in its investigation. The results therefore support the need for research on the subject in different contexts.

The results suggest that valuer characteristics are not important in explaining valuers' perception of the effect of client influence on valuation practice. They also suggest that valuers regardless of their characteristics have similar disposition to client pressure. It is interesting that valuers across board view the effect of client influence on valuation practice negatively. It suggests valuers' awareness of the damage to their profession by client influence. It also suggests that valuers will be willing to work for the eradication of the malaise. Ironically, however, they yield to client influence to

bias valuation. The question then is why valuers succumb to client influence to bias valuation when they agree that client influence has a detrimental effect on their practice.

The results suggest the existence of some underlying factors that motivate valuers to succumb to client influence to bias valuation which have greater influence on the valuers or are more important to them than the consideration for the effect of client influence on their practice. The implication is the need for investigation into this area.

The research has implications for policy. Measures to check the intervention of clients in valuation process is necessary. The Nigerian Institution of Estate Surveyors and Valuers and the Estate Surveyors and Valuers Registration Board of Nigeria need to review the valuation practice standards to set boundaries on the involvement of clients in valuations and rules for valuers' handling of client influence. They should address valuer independence and seek for legislation to safeguard it.

The research also has implications for practice. The findings are significant for secured lending in Nigeria's banking sector. There is the tendency for client interference on valuations to jeopardise secured lending decisions and consequently put banks' loan portfolio potentially at risk. There are also implications for valuers' education. Valuers need to be properly educated on professional ethics and in particular, on the long-term implications of accommodating client influence to bias valuation.

Conclusion

The literature provides evidence that clients influence valuers to bias valuation and that valuers yield to client influence to produce biased valuations. It also reveals that client influence affects valuation practice. This study investigated valuers' perception of the effect of client influence on valuation practice with respect to valuer characteristics. The results revealed that the perception of the valuers is the same regardless of the characteristics of the valuer involved. It can be inferred from the results that client influence has detrimental effect on valuation practice. It can also be inferred that valuer characteristics are not important in explaining valuers' perception of the effect of client influence on valuation practice.

The research can serve as a basis to argue for measures to safeguard valuers' independence and to significantly reduce client influence on valuation. The limitation of the research is that it is from the perspective of only valuers. A study of the

perception of clients might produce contrasting results. It is suggested that future researches investigate clients' perception of their influence on valuation practice.

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Achieving Sustainable Procurement Practices in the Nigerian Construction Industry: Examining Potential Barriers and Strategies

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Abstract

Procurement is a main procedure in realising construction project management. This study reviewed the existing procurement practices in the Nigerian construction industry with the aim of identifying barriers to sustainable procurement and develop strategies that will enhance procurement practices and ensure the construction industry perform sustainably. A sequential mixed methods research design was adopted in this study. The qualitative method was first employed to understand the current status of the procurement practices by using semi-structured interview and document analysis as tools. The study revealed that the most severe barrier to sustainability is lack of government commitment, and that the best strategy is to ensure that competent people are saddled with the responsibility for integrating and implementing sustainability issues. The study concluded that the current procurement practices in the Nigerian construction industry is yet to embrace the triple bottom line of sustainability initiatives as it places more emphasis on the economic aspect of procurement. Therefore, Nigerian Governments should join the global campaign through the review of current procurement Act to embrace sustainability. This will assist in addressing the barriers of sustainable development through procurement practices by leveraging their impact as major customers of good and services in the industry.

Keywords: *Barriers; Construction industry; Nigeria; Procurement and Sustainabilitybefore operating the generator, while the remaining three (3) during operation. A total of four hundred and thirty two (432) measurements were conducted.*

Introduction

In the 1980s, the Nigerian construction industry contributed 7% to the Gross Domestic Products (GDP) (National Bureau of Statistics [NBS], 2008). This significant contribution confirms Walsh and Sawhney (2002) assertion that construction activity is a significant contributor to GDP in most industrialized countries; and to global economic growth in general. Contribution of the construction sector in developed countries like the United States of America (USA) and Australia was recorded to be around 10.7% (Walsh and Sawhney, 2002) and 6.3% (Crose, Green, Mills & Toner, 1999) in 1996, respectively. It is evident, therefore, that the industry plays significant role in national development of a nation.

However, by 2002, construction contribution to GDP in Nigeria was reduced to 1% of the GDP (Organisation for Economic Co-operation and Development AFO/OECD, 2004). About 50% of the material resources for construction are taken from nature, 40% of energy consumption and 50% of total waste generated (Othman, 2010); resulting in ozone layer depletion, global warming, landfills, deforestation avalanches, quakes, pollution, and waste. As a result of these global effects, sustainable public procurement is increasingly being recognized as an instrument of government policy and a lever for wider economic, social and environmental changes (OECD, 2007). However, according to Carter and Rogers (2008), sustainable procurement surpasses the traditional triple bottom line of economic, social and environment changes. In fact, Berry and McCarthy (2011) viewed sustainable procurement as a process by which organisations attain their needs for goods, services, works and utilities in a way that enable them realise value for money on a whole life basis with the purpose of generating real long term benefits, not only to the organisations, but also to the society and the economy, while minimising damage to the environment. It encompasses ethical procurement and e-procurement (Angeles & Ravi, 2007; Wild & Li, 2011) which are fast-growing areas of interest in both corporate and government organizations across the globe.

In Nigeria, there has been existing open abuses to criteria in the award and execution of public works. These are apparent in repeated delays, cost overruns and frequent building collapse (Aibinu & Odeyinka, 2006; Ogunsemi & Jagboro, 2006; Fagbenle & Oluwunmi, 2010). The surge in uncompleted and abandoned projects littering the environment in Nigeria not only

contradict sustainable development but also calls to mind, the procurement methods employed to deliver such projects. It is obvious that the public procurement systems lack sustainability ingredients, both in concept and strategies. This underscores the need to integrate sustainability issues into construction procurement and establish the importance of paying particular attention to the stage of developing a procurement strategy in order to attain sustainable development and, transit to achieving economic growth and developmental strides in this millennium.

In 2002, World Summit on Sustainable Development called for governments globally to promote public procurement policies that will enhance sustainable development by encouraging the diffusion of goods and services that will be environmentally sound (United Nations [UN], 2002). In fact, one of the many recommendations was that governments should find a way of integrating sustainability issues into their public procurement decision making process. After this call, many developed countries such as Australia, Japan and the United Kingdom have taken the front seats in advancing the need for sustainable practices in public procurement (Abd-Wahid, Sazalli & Ramli, 2014). Despite the fact that sustainable procurement can improve procurement practices and promote sustainability performance of the construction industry in general (Ruparathna & Hewage, 2015a), coupled with the global policies, reports and researches addressing the subject matter, the Nigeria construction industry still lacks social, economic and environmental sustainability criteria. According to European International Contractors (EIC) (2004), to achieve sustainable development, 'sustainable procurement' is imperative in both concept and practice.

Consequently, governments the world over have recognized the necessity for a sustainable built environment since the construction industry has been known to use large amount of materials, energy, and generating huge volumes of waste (Ibrahim, Krawczyk & Schipporiet, 2004). Obviously, the way forward is to embrace sustainability in the construction industry. However, this is not the case in developing countries like Nigeria where the clamour for sustainability has just begun. To this end, this study will make contributions to the growing body of literature in sustainable practices.

The review will provide an insight into the current procurement practices in the Nigerian construction industry and examine

whether efforts have been made regarding the global callings on the integration of sustainable practices into country's procurement system. It will also examine the potential barriers to effective implementation of sustainable procurement in the Nigerian construction industry. In addition, this study explores the opportunity to present strategies that will help explain how sustainable practice policies and interventions necessary to further develop sustainable practices could be enhanced.

Literature review

Nigerian procurement practices

Uyarra and Flanagan (2010) defined public procurement as "the acquisition of goods and services by government or public sector organizations". Procurement is part of wider activities of government (Thai, 2001) and is designed to bring about transparency and innovations in transmuting the manner in which services are organised, rendered and delivered to improve the life of buyers and enhance user's experience. International Institute of Sustainable Development (IISD) (2008) reported that on the average, between 45 to 65% of a country's budget and 13% to 17% of their GDPs are procurement related, this alluded to the fact that public sectors are the largest consumers in an economy.

In Nigeria, between 1999 and 2000, there was a Country Procurement Assessment Report (CPAR) which indicated that prior to 1999, Nigeria lost $10 billion on a yearly basis to corruption via award of contracts (CPAR, 2000). As a result of this, Nigerian government identified the need to have a comprehensive public procurement policies and practices as essential recipes for good governance. Therefore, good practices are deemed to be capable of reducing costs and generating appropriate results; while poor practices often lead to waste and delays and are majorly the source of allegations for corrupt practices and government inefficiency.

It is on this premise that the "Due Process Policy" was introduced into the nation's procurement system in 2002 (Fayomi, 2013). The document was passed into an Act by the parliaments which is now called "Public Procurement Act" 2007 to become a full legislation designed to eliminate the shortcomings and government inefficiencies and weaknesses that characterised public procurement of the past. Before 2007, Nigeria was among the few Sub-Saharan African countries without documented legislation on Public Procurement.

The Nigerian government identified the need for public procurement system that

will urgently eliminate or reduce the global perception index and inefficiencies that have potentials to impact on good governance, and to build trust through the procurement system. Some of the defects noticed that necessitated the legislation according to the Budget Monitoring and Price Intelligence Unit (BMPIU) manual (2005) include:

I. Lack of competition and transparency in project procurement leading to high cost of project.
ii. Budget proposal submitted by the Ministries, Departments and Agencies (MDAs) not being related to justifiable needs.
iii. Improper project packaging and definition, compounding ineffectiveness.
iv. Projects not prioritized, recorded and synchronized among the MDAs such that many MDAs are pursuing the same or similar needs simultaneously with resultant lack of economic efficiency and effectiveness while creating overlap and waste.
v. Preference for new projects thereby encouraging regular midstream abandonment of projects in progress thus fuelling the cultural disdain for maintenance, rehabilitation and refurbishment of existing facilities and infrastructure.

However, the Bureau of Public Procurement is saddled with the responsibility to ensure full conformity of all stakeholders with the laid down guidelines and procedures for the procurement of works, goods and services with the five basic concerns that govern procurement policies:

I. To ensure that goods and services needed are procured with due attention to economy and efficiency;
ii To ensure that public fund is used to buy only those goods and services needed for national development;
iii To give all qualified bidders an equal opportunity to compete for contracts;
iv. To encourage development of local contractors and manufacturers; and
v. To ensure that the procurement process is transparent

However, a review of the current Nigerian Public Procurement Act 2007 shows no emphasis on sustainability. Whereas, an efficient public procurement system should ensure value for money in government expenditure, which is essential to a country facing enormous development challenges. In spite of the significance of public procurement to the economic growth of the nation, many of the previous studies conducted in Nigeria (e.g. Ogunsanmi, Iyagba & Omirin, 2003; Ojo, Adeyemi & Fagbenle, 2006; and Dada, 2011) have been

on the investigation of how a single or a few specific procurement alternatives influence one or two project objectives. Little or no empirical research exists in Nigeria that specifically addresses the triple bottom line of sustainable procurement practices within public and private sector of the industry. This informed the critical look this research, at how sustainability initiatives could be integrated into the current Nigeria procurement practices to achieve value for money on a whole-life-basis of the project. This in terms of creating benefits not only to the public sector, but also to the society and the economy, while minimising damage to the environment (Department for Environment, Food and Rural Affairs [DEFRA], 2006).

Sustainable public procurement

According to Brammer and Walker (2011), sustainable procurement is the act of incorporating a concern for comprehensive social and environmental influences within government or public sector procurement process. However, sustainable development is dependent upon sustainable procurement that maintains balance between social, economic and environmental needs of the society. Although, many procurement officers mainly focus their procurement strategies on three elements: price, quality and time without consideration for the fourth dimension, sustainability. Whereas, in practice, the sustainability impacts of a potential supplier's approach are evaluated based on quality consideration, which is often sub-divided into social, economic and environmental (Omwoha, 2015). Sustainable procurement is not only about responsible purchasing or being 'green'. It is about good business practices that focus on delivering procurement of goods and services socially and economically with sound solutions to a business while minimising the environmental impact throughout a supply chain (DEFRA, 2006).

Construction activities have significant impact on the environment and in spite of the acknowledgement that issues of the environments are germane to optimal performance of the construction industry, activities of the industry have resulted into waste generation, exploitation of resources, continuous and unabated degradation of the environment (Du Plessis, 2002). In spite of the increasing number of research on how procurement process could improve the performance of the construction industry, there is paucity of study in Africa more specifically in the Nigerian context that addresses the challenges of integrating the triple bottom line of sustainable

procurement practices within the public sector. Previous researches and literature that examined sustainable practices are mostly from the perspectives of the developed countries. For example, UK (Hall & Purchase, 2006); Canada (Ruparathna & Hewage, 2015b); the USA (Coggburn, 2004) and internationally or across countries or regions (Brammer & Walker, 2011), and few others from the Asia such as Malaysia (McMurray, Islam, Siwar & Fien, 2014).

It is of note that the policies on sustainable procurement varied across the globe because of local underlying forces (Perera, Chowdhury & Goswami, 2007), hence, it is essential to develop sustainable procurement guidelines that will reflect the local dynamics (Ruparathna & Hewage, 2015a). This is supported by Rwelamila *et al.* (2000) who contended that failure to consider local forces in the development of systems within the developing countries construction industries is a potential recipe for setbacks. Presently, there are no clear guidelines, procedures or mechanisms in place in Nigeria to integrate the sustainable initiatives in the procurement process despite being a member of the United Nations movement for Sustainable Development. And, adequate knowledge of sustainability concept and how it could be integrated or linked to the procurement process is yet to be comprehended within the context of Nigeria as a developing nation. Therefore, sensitisation and information remain the major issue for the development of sustainable procurement practices.

Research methodology

In order to realise the aim of this study which is enhancing the sustainability performance of construction industry by integrating sustainable procurement practices into the Nigerian public procurement process, mixed methods methodology combining both qualitative and quantitative sequentially was employed that is domiciled in pragmatic paradigm. According to Bryman (2006), pragmatism is a method of justifying the collective use of both qualitative and quantitative approaches in a single research.

In line with this, Dainty (2008) and Oyewobi (2014) contended that plurality of research approach within the construction management research will assist in providing solutions to the challenges facing the construction industry as the approach is capable of drawing from the inherent advantages of the two methods in improving the quality of the results. This approach is consistent with the methodology used by

Ruparathna (2013) and McMurray *et al.* (2014) in examining sustainable procurement barriers and opportunities in the Canadian construction industry and Malaysian organisations respectively. Following Creswell and Plano-Clark's (2011) procedure, sequential exploratory strategy was employed for this study. This entailed documentary analysis of documents such as tender notice, tender documents, pre-qualification requirements, contract documents and 2007 procurement Act. This was followed by semi-structured interviews that were conducted to obtain as much information as possible on the perceptions of the industry, and to capture a sense of what industry practices are perceived to be from construction practitioners with respect to sustainable procurement. Data obtained from this phase was used to develop the questionnaire survey for the second phase in order to have a better understanding of the study. These formed the basis for the conclusion reached and the recommendations proffered.

Qualitative Phase

The qualitative approach according to Liu and Fellows (2003) provides researcher a deeper understanding of problems to recognise the basic causes, principles, and behaviours of respondents on issues being investigated. According to Walker (1997), qualitative approaches are explanatory in nature with the major aim of attempting to uncover solutions to 'how?' and 'why?' questions by trying to develop themes from the information so obtained (Creswell, 2003).

Prior to the semi-structured interviews, documents relating to procurement issues which included tender notice, tender documents, pre-qualification requirements, contract documents and 2007 procurement Act were obtained from anonymous sources and also from the Bureau of Public Procurement websites as well as Budget Monitoring and Price Intelligence Unit (BMPIU) manual (2005). These documents were reviewed to identify whether they took into consideration the triple bottom line of sustainability in the procurement process. All the documents did not place emphasis on sustainable procurement issues which informed the decision to probe further using interview to have a critical look at the current Nigeria construction procurement practices; and explore the level of awareness, identify the barriers and find ways sustainability can be integrated into present procurement initiatives.

Interviews

The sequential research design adopted in

the study allowed the qualitative phase to come before quantitative, in order to examine the level of awareness of the concept of sustainable procurement and to establish that the second phase of the research will be more comprehended by the target audience for the research. This phase was realised through in-depth semi-structured interviews which provided the required opportunity for the researchers to have an in-depth exploration of subject (Trochim and Donnelly, 2008). To ensure that the obtained data for the phase will provide the required reliability and validity, experts in the construction industry were interviewed (see Table 1) (Lim, Oo and Ling, 2010).

A purposive sampling technique was used to select the procurement experts; ten semi-structured interviews were conducted with procurement experts and practitioners within the construction industry in the Federal Capital Territory, Abuja. This sampling technique is a non-probability sampling procedure which is usually used in research that has to do with selecting respondents based on their knowledge, appropriateness and typicality of the sample selected (David & Sutton, 2004; Cohen *et al*, 2005). Emails were sent randomly to 20 potential interviewees from the list obtained to solicit for their attention for interviews. Initially, only five respondents agreed to be interviewed and they included one person from the academia and 4 from the construction industry (two project managers, one quantity surveyor and one builder).

After several calls, a total of 10 interviewees were obtained (see Table 1) and a letter seeking their consent as well as the interview guide were made available to them ahead of the interviews. The interview guide consisted of 10 open ended questions that permitted the interviewer to probe further. Permission of the interviewees were sought to tape record the interview sessions; all of the respondents agreed to this and each interview lasted for about 25 to 30 minutes.

The interviews were transcribed, sorted, coded and analysed using the deductive analysis method following these three steps and according to the research question and literature review. The deductive method of analysis comprises constant comparison between the interview results in order to determine common themes in the interviewees' responses. The themes that emanated from the analysis were implementation of sustainability issues; barriers to the adoption of sustainable practices; sustainable criteria; method of evaluation of bidding; strategies for integrating triple bottom line laid the

foundation for the questionnaire survey in the quantitative phase.

However, the results of the questionnaire survey on the barriers and strategies for implementing sustainability in the Nigerian construction industry is presented here. A list of the persons interviewed, in addition to the interview guide, are as shown in Table 1.

Table 1: List of interviewees and their positions

Respondent's Designation	Number
Quantity Surveyors	2
Academics	1
Procurement managers	3
Procurement officers	2
Project managers	2

The quantitative phase

The quantitative approach was used to provide a general understanding of the research problem (Creswell and Plano-Clark, 2011). This approach was considered essential because it offered strong stream of evidence for empirical research in explaining phenomenon, and because it assisted the researcher in addressing the questions of '*how much'* or '*how many*?' as suggested by Walker (1997). Fellows and Liu (2008) suggested three main approaches that can be used in carrying out a quantitative study, these include desk research, experimentation and surveys.

Survey approach was adopted to obtain quantitative data using a cross-sectional means, and the item instrument was identified through extensive review of literature. The survey was carried out during the meeting of Procurement Officers in the Ministries, Departments and Agencies (MDA's) of the Federal Government of Nigeria at the Bureau of Public Enterprise (BPE), Abuja.

Though a purposive sampling method was adopted, it would have been difficult to have a large concentration of these professionals in one place and the high response rate obtained. One hundred and sixteen (116) well-structured questionnaires were self-administered to professionals that included Quantity Surveyors, Architects, Supply Chain Managers, Builders and Engineers. Out of these questionnaires, 100 (86.21% response rate) were returned as analysed below.

Results and Discussion

The items used in measuring the potential barriers were also first examined for its appropriateness for factor analysis. This was done to ensure that the basic assumptions of linear relationships and normality between

variables to be correlated and the pairs of variables at a moderate level were not violated. The PCA approach using varimax rotation was employed to extract possible components, all items with lower communalities were eliminated to improve variance to be explained in the factors. Kaiser's criterion using Eigenvalue greater than or equal to one was used in retaining the likely factors to be retained. The KMO was 0.733 which was above the required threshold of 0.5 as suggested by Field (2013) and Hair *et al*. (2010). Table 2 shows that four factors that have initial Eigen values greater than 1 were retained from the items employed to measure the barriers. From the Table 2, the first component explains approximately 27% while components 2, 3 and 4 explain 18.67%, 17.20% and 10.64% respectively. Together, all the components explain 73.39% of the total variation shown by the rotated results.

The first factor (Attitude and poor fiscal incentive**)** had seven items, the second (Financial constraints) had three items, the third factor (Poor leadership and awareness) had three while the last component (regulatory constraints) had two components loaded on it after it was rotated using varimax method. The rotation was executed many times to eliminate complex items and ensure that items were loaded onto only one factor (Field, 2013). This approach was used in a similar study carried out by McMurray *et al*. (2014) in establishing the opportunities and barriers of sustainable procurement practices by the Malaysian organisations. Based on the assessment of the intrinsic relationships among the variables considered and clustered under each factor as shown in Table 2, the study interpreted the results as follow:

Factor 1: The first factor extracted is renamed *attitude and poor fiscal incentive*. Six variables were clustered under this heading which includes: unwillingness to change, fewer developers undertake green building projects, lack of sufficient time to address sustainability issues, poor awareness and delay in decision making, economic conditions, lack of market segmentation, and risk associated with implementation of new practices. This finding underscores the results of Darko and Chan (2016) who identified among others attitude and lack of government incentives as barriers to sustainable procurement. Also, Al-Sanad (2015) identified unwillingness to change and presence of fewer developers undertaking green projects as major barriers to sustainability.

Factor 2: The variables loaded on this factor are classified as *financial constraints*. These variables include lack of funding, poor separation between capital budget and operational budget for sustainability issues. This barrier has been stressed by researchers such as Sourani (2008) and Walker and Brammer (2009) where it was argued that financial constraints is the most ranked barrier to sustainability issues in the UK construction industry. Also, Ametepey *et al*. (2015) posited that one of the major barriers to sustainable practices is financier barrier. However, Preuss (2007) stated that financial constraints are reported in many of the previous studies as the principal barrier to adopting sustainable procurement practices, while Roos (2012) considered inflexible budgetary mechanisms as a clog in the wheel of achieving sustainability.

Factor 3: This is named *poor leadership and awareness* and three variables were clustered under this factor. The result supports Roos (2012), who asserted that some strong barriers to sustainable procurement practices implementation were a lack of awareness and knowledge both at decision-makers and general public level. The assertion is not different from the conclusion drawn by McMurray *et al*. (2014) who examined sustainable procurement in Malaysian organizations and found that lack of awareness remained the most significant barrier to sustainable procurement implementation regardless of organizations or sectors. In line with these assertions is the findings by Sourani (2008) and Ametepey *et al*. (2015) who posited that lack of leadership is a barrier to sustainability.

Factor 4: The variables under this cluster are renamed as *regulatory constraints***.** Lack of government commitment and resistant to change are two major variables considered here. Sourani (2008) identified insufficiency and inconsistency of policies, regulations and commitment by leadership as chief barriers to sustainable practices among other factors. This assertion is re-echoed by Darko and Chan (2016) who posited that lack of authority and efficiency in enforcing green building laws and regulations constitute barriers to sustainable procurement practices.

Table 2: Factor loadings for the Rotated Components Barriers to sustainable procurement (N = 116)

Coding	Variable Description	Mean Value	Component loading 1	2	3	4	Communalities
	Attitude and poor fiscal incentive						
B6	Unwillingness to change	3.74	.910				.854
B5	Fewer developers undertake green building projects	3.69	.765				.650
B40	Lack of sufficient time to address sustainability issues	3.68	.732				.765
B23	Poor awareness and delay in decision making.	3.64	.723				.549
B1	Economic conditions	4.16	.620				.690
B21	Lack of market segmentation,	3.21	.607				.687
B2	Risk associated with implementation of new practices	3.59	.602				.616
	Financial constraints						
B37	Lack of funding and restrictions on expenditure	3.59		.865			.756
B25	Lack of sustainability measurement tools,	3.69		.825			.709
B38	Separation between capital budget and operational budget	3.41		.782			.733
	Poor leadership and awareness						
B20	Lack of leadership,	3.42			.869		.789
B32	Lack of awareness of clients,	3.75			.836		.763
B35	Lack of education and knowledge in sustainable design.	3.95			.689		.778
	Regulatory constraints						
B41	Resistance to change	3.51				.758	.830
B18	Lack of government commitment,	4.42				-.680	.840
	Total		4.032	2.801	2.580	1.596	
	% of Variance		26.882	18.672	17.201	10.639	
	Cumulative %		26.882	45.554	62.755	73.394	

KMO= 0.733, Bartlett's Test of Sphericity (Approx. Chi-Square) =1242.873 , df = 105, p=0.000

Note: 1.00-1.49 - not very severe, 1.50-2.49 - not severe, 2.50-3.49 moderately severe, 3.50-4.49 severe, 4.50-5.00 Very severe

The 35 items were identified in literature as ways of addressing sustainability in developing a sustainable procurement strategy. These items were subjected to Principal Components analysis (PCA) using IBM SPSS version 21. Before carrying out the PCA, the research test for the appropriateness of data for factor analysis. This was carried out to ensure that the underlying assumptions of normality, linear relationships between variables to be correlated and the pairs of variables at a moderate level were not violated. While inspecting the correlation matrix generated by the PCA, matrix revealed the existence of several coefficients above 0.3.

The Kaiser-Meyer-Olkin value was estimated to be 0.88, which was higher that the recommended threshold value of 0.5 (Hair *et al*., 2010; Field, 2013) and Bartlett's Test of Sphericity was statistically significant, which offered support to the factorability of the correlation matrix. This indicates that the variables were highly correlated to give a reasonable basis for factor analysis as shown in this analysis. The PCA indicated the presence of four components with eigenvalues greater than 1, which explains 26.19%, 20.50%, 13.76% and 10.07% of the variance respectively. The study examined the communalities before the rotation to establish the association between the variable and all other variables (Yong and Pearce, 2013). However, some variables with low communalities were removed to improve the scale since factor analysis is aimed at explaining the variance through the common factors (Child, 2006; Pallant, 2010).

The four components were rotated using orthogonal (varimax) rotation, based on the eigenvalues criterion of over 1 and the scree plot. Four components were retained After rotation, the four-component extracted explained a total of 70.58% of the variance, with Component 1, 2, 3 and 4 explaining 23.97%, 18.19%, 14.33%, 14.02% respectively. Table 3 shows the variables and component loadings for the rotated components, with loadings less than .50 removed to enhance clarity, hence factors retained are capable of explaining above 50% of the variance. Table 3 shows the variables considered for strategy for implementing sustainable procurement and how they are loaded under each factor, the following interpretation of the results are presented below:

Factor 1: This factor is named *improved compliance and efficiency*. The study

postulated that one of the best strategies to achieving sustainable procurement practices is through total compliance with rules and regulations governing sustainability. This strategy is emphasised by Du Plessis (2007), Sourani (2008) and Akadiri and Fadiya (2013), that to achieve sustainable construction through sustainable procurement practices, compliance with government regulative measures is the recipe.

Factor 2: The variables under this cluster is named *encourage best practices*. This practice is entrenched in the definition of sustainable strategy provided by HM Government and Strategic Forum for Construction (2008). The definition emphasised that all-embracing procurement must "*achieve improved whole life value through the promotion of best practice construction procurement and supply side ..... in both the public and private sectors and throughout the supply chain*" (HM Government and Strategic Forum for Construction, 2008; p.7). the study therefore argued that practices such as ethical sourcing, client leadership as well as other factors such as valuing people will lead to sustained sustainable procurement.

Factor 3: Under this factor, the study categorised the variables as strategy for *methods appraisal and personnel training.* The proposed strategy is in tandem with the conclusion drawn by Shafii *et al*. (2006) and Al-Sanad (2015), who highlighted education and training as drivers of sustainable procurement. As this will allow contractor to have the requisite knowledge in achieving sustainability targets and also be encouraged to identify innovative ways within the budget of the client in order to meet the objectives set in terms of cost, time and quality (Naoum and Egbu, 2016).

Table 3.: Factor loadings for the Rotated Components (N = 116)

Coding	Variable Description	Mean Value	Component loading 1	2	3	4	Communalities
	Improve compliance and efficiency						
WS14	Ensuring that sustainability requirements can be clearly assessed and measured	2.82	.901				.821
WS13	Adopting a balanced approach that ensures the explicit consideration of all sustainability dimensions	2.91	.843				.826
WS16	Emphasizing the importance of sustainability in tender evaluation and selection procedures	2.88	.843				.726
WS15	Ensuring transparency in procurement decision making	3.03	.841				.753
WS12	Integrating sustainability requirements into contract specifications and conditions (including specifying any project specific sustainability requirements)	3.65	.656				.540
	Encourage best practices						
WS28	Encouraging integrated supply chains	3.25		.847			.783
WS27	Encouraging long term contractual arrangements through strategic partnering (covering a series of projects)	3.50		.834			.781
WS35	Encouraging the supply side to improve communicational and knowledge sharing with all stakeholders throughout the project life cycle	2.84		.642			.620
WS33	Utilization/enhancement of existing assessment and measurements techniques and tools to considers sustainability	2.43		.626			.758
WS25	Evaluating alternative procurement methods/routes in terms of their potential to deliver sustainability objectives	3.55			.829		.716
WS23	Requiring the employment of a property trained workforce within the supply side	3.25			.828		.789
WS24	Ensuring that payment mechanisms take account of whether sustainability requirements are delivered.	3.34			.609		.563
	Methods appraisal and personnel training						
WS31	Encouraging the Incorporation of sustainability issues into risk management	3.45				.764	.669
WS32	Provision of incentives and rewards based on sustainability performance throughout the project life cycle	3.38				.725	.581
WS18	Ensuring the competency of the people responsible for implementing and assessing sustainability issues (in both the client organisational and the supply side	3.85				-.652	.651
	Total		3.596	2.729	2.150	2.104	
	% of Variance		23.974	18.192	14.334	14.027	
	Cumulative %		23.974	42.166	56.500	70.528	

KMO= 0.877, Bartlett's Test of Sphericity =959.219 , df = 105, p =0.000

Note: 1.00-1.49 - highly unimportant, 1.50-2.49 - unimportant, 2.50-3.49 moderately important, 3.50-4.49 important, 4.50-5.00 highly important

From the analysed results, the findings indicated that there are barriers that are stunting the growth and development of sustainable construction by the Nigerian public clients which could be addressed by developing construction projects' procurement strategies.

The finding is supported by Mensah and Ameyaw (2012); Cheri and Chiriseri (2014) who identified the following as some of the barriers to sustainable procurement: Higher initial associated costs; lack of government interest; lack of social drive/responsibility; lack of public education; and lack of adequate supervision during construction among others. The results have shown that the ways of addressing sustainable construction and also assessing the level of agreement to the importance of the following factors for the Nigerian Public client which addresses sustainable procurement practices (social, economic and environmental sustainability) in developing a procurement strategy are not followed in the Nigerian construction industry.

Among majority of the different categories of respondents, ensuring compliance with regulations and government policies (for instance, Procurement Act) ranked 1st regarding the ways of addressing sustainability in developing a procurement strategy. This is supported by Jensen (2011) who observed that even though existing processes show understanding and acceptance of the sustainable procurement concept and its related fundamentals, there has been less attention in investigating how the proper procedures should be optimized for organisational strategy and operations.

Although, it is unclear how the three elements (economic, social and environmental) should interact optimally especially for procurement decision making and implementation purposes but when carefully adopted, procurement process can be enhanced. This also agrees with Jones *et al*. (2006) and Walker and Hampson (2008) who revealed that for a performance measurement mechanism to measure the direct or indirect impact on sustainable procurement practices and show that organisational performance still lacks the fundamentals.

This to some extent explains why sustainable procurement has continued to lack total acceptance in construction practices here in Nigeria unlike in countries like EU and UK where there are favourable legal (and policy or legislation) frameworks.

Conclusion

This study provided a broad overview of the Nigerian procurement system to ascertain if sustainable practices are inherent in the current system and afterwards addressed two main objectives - barriers to sustainable practices and strategies that could be employed to integrate sustainability into the current procurement processes.

The findings indicate that lack of government commitment is a major barrier to the adoption of sustainable procurement while the best strategy for integrating sustainability into the system is through total compliance to sustainability. Generally, it is revealed that the current procurement practice in the Nigerian construction industry is yet to embrace the triple bottom line of sustainability initiatives as it places more emphasis on the economic aspect of procurement. Therefore, Nigerian Governments should join the global campaign through the review of current procurement Act to embrace sustainability.

This will assist in addressing the barriers of sustainable development through procurement practices by leveraging their impact as major customers of goods and services in the industry. And, in order to fully realise the benefit of sustainable procurement, future research is required to examine the influence of sustainable procurement on the construction project performance (in terms of cost, time-schedule and quality).

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Physical Development Pattern and Crime Incidences in Ilorin, Kwara State, Nigeria

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Abstract

The paper inquired if the nature and physical development characteristics of the neighbourhoods constitute crime exposure factors in Ilorin. The study identified common crimes experienced and their spatial distribution in the neighbourhoods of Ilorin. It further characterized the nature and physical development conditions of the neighbourhoods of the study area. In carrying out the study 960 households spread across 35 aggregated neighbourhoods of the study area were sampled for their crime victimization experiences using a designed crime victimization survey questionnaire administered through a systematic random sampling procedure, in a survey conducted in October, 2015. In addition, extensive but discreet physical observations and rating of the physical development characteristics of the neighbourhoods were conducted as part of the survey. In analyzing the data obtained, the study employed Jenks' natural breaks classification method to classify the neighbourhoods of the study area into four crime densities; and Pearson Product-Moment Correlation technique to establish the relationship between the quality of neighbourhood physical development and exposure to crime. The study confirmed the common crimes experienced by residents of the study area; established a spatial classification of criminality in the study area; as well established a (r) value of -0.633 between the nature of neighbourhood physical development and exposure to crime using correlation analysis. The study recommends the design and implementation of periodic urban renewal programmes to minimize exposure to crime in poorly developed neighbourhoods of the study area.

***Keywords**: crime pattern, neighbourhood, physical development pattern*

Introduction

One of the challenges currently confronting the African continent like many other parts of the developing world is the unprecedented pattern of urbanization (Hove, Ngwerume and Muchemwa, 2013). The continent witnessed a 3.3% annual growth rate in the population of urban residents between 1990 and 2000, a rate regarded as one of the highest in the world at that period (Pieterse, 2010; UN-Habitat, 2008). Urbanization in Nigeria is taking place amidst worsening living conditions, including widespread unemployment, poverty and inequality (Baker, 2010; Eguavoen, 2010; UNCHS, 2008; Cohen, 2006). One of the fall-outs of this pattern of urbanization and rising population growth rate in the country, therefore, is the rising pattern of criminality and insecurity which has continued to manifest in different dimensions, including acts of terrorism, kidnapping, violent armed robbery, assault, rape and child trafficking among several others (Sanni, Morenikeji, Jinadu & Dalil, 2017; Jinadu, Morenikeji, Sanusi, Dukiya & Owoyele, 2012).

The Nigerian Police Force statutorily saddled with the responsibility of maintenance of law and order in the country has been so overwhelmed by the challenge of criminality such that the agency has been described as largely ineffective and inefficient as a result of several institutional constraints bedeviling it, including inadequate manpower, lack of expertise, lack of adequate equipment and poor conditions of service (Alemika, 2013; Karimu, 2014; Olujimi, 2005). The fear of crime and feeling of insecurity have therefore, become pervasive in many parts of Nigeria and is thus seen as the major social problem currently confronting the country (Ayoola, Adeyemi &, Jabaru, 2015; Ahmed, 2012; Fajemirokun, Adewale, Idowu, Oyewusi & Maiyegun, 2006) and which is partly responsible for her being consistently ranked low in Global Peace Index (2014).

The increasing threat of crime and insecurity in the country is apparently linked to the rapid expansion and unregulated growth of many urban areas, including Ilorin, the study area. Many towns and cities in the country are either without a master plan or it is moribund and poorly implemented, thus promoting haphazard physical development, particularly in the core, old and poor neighbourhoods. Many residents of the cities are therefore, increasingly vulnerable or exposed to incidences of crime and insecurity due to their social and economic conditions or the physical characteristics of their neighbourhoods. It is against this

background that this study sought to confirm and determine the extent of the association between the physical development characteristics and conditions of neighbourhoods of Ilorin and their crime vulnerability.

Thus, the study assessed the physical development attributes of neighbourhoods of Ilorin, Nigeria, and determined if they are among factors that make the area vulnerable to crimes. It also identified the types of crime; examined their spatial distribution pattern; and, assessed the characteristics of neighbourhoods' physical development as correlates of crime vulnerability.

The Study Area

Ilorin is the capital of Kwara State, north-central Nigeria. The city is regarded as one of the most populous state capitals in north central Nigeria with an estimated 2014 population of about 1, 029, 658 made up of approximately 171, 609 households, based on the national household average size of six (Sanni, 2017). Ilorin is located between latitude 8^0 30" and 08^0 50" North of the Equator and between longitude 04^0 20" and $04^0$35" East of the Greenwich Meridian. The city occupies an area of approximately 150.59 square kilometers. It is about 500 kilometres to Abuja, the nation's administrative capital and about 300 kilometres to Lagos, the country's major commercial hub. Ilorin is generally regarded by many as the gateway between the northern and southern parts of the country and therefore, a melting pot (Olaleye, Abiodun & Asonibare, 2012). Although it was historically a Yoruba settlement, it is now largely inhabited by people of diverse cultures from within and outside the country, with majority being the Yoruba and Hausa-Fulani (Jimoh, 1994).

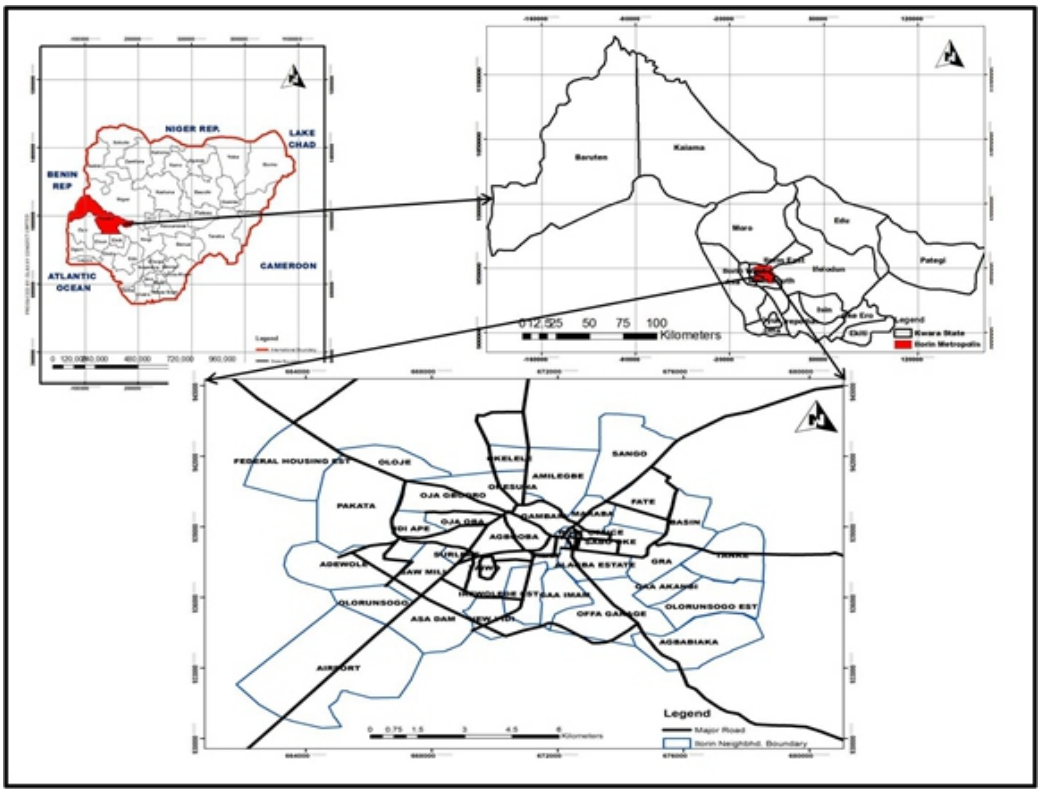

Figure 1: Map of Nigeria highlighting Kwara State and Ilorin
Source: Kwara State Ministry of Lands and Survey, Ilorin (2015).

Review of Related Literature

Concept and Nature of Crime

Crime is defined as a violation of societal rules as accepted and interpreted by operational criminal code. It is seen as an infraction of both the basic principles of law and norms of civilized and acceptable conduct ((Siegel, 1995; UN-Habitat, 2007; Eme, 2012). There are many kinds of crime and have been categorized into basically three types. These are crimes against persons or personal crimes, property crimes and crimes against public order.

This study is concerned with crimes committed within residential neighbourhoods and which are mostly property crimes and crimes against persons. The former includes petty theft or stealing and house-breaking or burglary, while the latter includes assault, armed robbery, auto-theft/snatching, rape, kidnapping and murder amongst others. The third type of crime in the literature, crime against public order, is mostly of moral infractions (UN-Habitat, 2007) but, not the concern of this

paper as it is usually difficult to relate it to specific physical conditions of the city. It includes corruption, fraud, forgery, embezzlement, public peace disturbance, conspiracy and perjury amongst others.

Urbanization and Crime

The relationship between urbanization and crime occurrence has been the focus of several studies (Kamalipour, Faisl & Memariam, 2014; Marzbali, Abdullah, Abd'Razak & Tilaki, 2012; Sampson & Laub, 1993).

Although many of these studies have been undertaken by researchers outside the built environment, particularly criminologists, sociologists and psychologists (Portugali, 2011), they have not fallen short of emphasizing the connection between urban spatial structure or morphology and the socio-economic and cultural conditions of urban residents. Residents of cities are more likely to be victims of crimes than those who reside in the country-side (Ceccato & Wilhelmsson, 2012; Kunkeler, 2011). In many instances, studies have shown that more than half of residents of cities acknowledged being victims of crime in their life time (Badiora & Fadoyin, 2014; Fajemirokun *et. al*, 2006, Alemika & Chukwuma, 2005).

Cities are places of intense economic and social interactions, some of which are associated with unpleasant experiences, including dwelling amidst criminality (Ceccato & Wilhelmsson, 2012).

Although it is almost impossible to create a totally crime-free environment, cities cannot lay claim to social sustainability without paying considerable attention to the security of residents. However, the problem of crime in the cities has long been recognized as a serious and growing challenge in many countries around the world, particularly in the developing countries (UN-Habitat, 2008).

In Nigeria, studies have shown that the insecurity problem, particularly those within the urban areas are increasingly becoming violent, frequent, heinous and sophisticated (Ekoja & Odole, 2008; Fajemirokun *et al*., 2006; Agbola, 2004). Armed robbery involving breaking of banks, murder or hired killings, kidnappings and communal strives and invasions amongst others.

It is therefore, important to seek newer approaches in addressing the issues of crime and insecurity in the city. One of such approaches that has the capability of

enhancing urban safety and security is city planning, especially the aspects of design, development and governance.

Spatial Dimension of Urban Crime

Although the fact that cities are the domain of crime and violence globally has been widely acknowledged (Moser, 2004; Kunkeler, 2011), it is important to stress that not all parts of the city are usually regarded as unsafe and insecure.

Thus, the variation in the level of crime and violence within the city has also been highlighted (Sanni *et al*., 2017; Jinadu *et. al*, 2012; Gaviria & Pages, 1999; Sampson & Laub, 1993). It has thus been emphasized that levels of violence and criminality in the city are often much related to variations in social conditions, income levels and quality of housing and living environment, etc. (Weisburd, 2015; Sherman, 1992).

As a result, instances abound of neighbourhoods of the city that are known and stigmatized for their relatively high level of violence and insecurity (Schneider, 2007; UN-Habitat, 2007). High rates of crime and violence are more frequently associated with distressed and disadvantaged areas or neighbourhood, especially those with high levels of poverty, unemployment and minority populations (Kershaw & Tseloni, 2005; Anselin, 2000; Ackerman, 1998).

Research Methodology

The study employed both primary and secondary data. The primary data used for the study include data relating to the description and characterization of the nature and quality of neighbourhoods' physical development conditions. This was generated based on extensive discreet physical observation of the sampled neighbourhoods. Three criteria were evolved for the assessment of the physical development conditions of the neighbourhoods, such as; the layout quality and status of development (orderly, not too orderly and haphazardly developed) and whether housing in the neighbourhoods were averagely developed in accordance with physical planning standards.

The physical development planning standards include observance of required setbacks between buildings and between buildings and centre of the road, building line alignment, density control and ratio of plot size developed. The third assessment criterion used was the density type (low, medium or high) of the neighbourhood.

Although the study obtained police records of common crimes committed in Ilorin between 2005 and 2014, it however relied mostly on survey data of crime occurrence and victimization pattern in the study as the police records did not indicate specific neighbourhoods where crimes were committed. A designed crime victimization survey questionnaire was administered on 960 household heads across the neighbourhoods selected through a two-stage clustered and systematic random sampling procedure, although only 912 were filled and returned. Data generated include the common neighbourhood crimes experienced by household members as well as the frequency of their occurrence within the various neighbourhoods.

For the purpose of analysis of the data on the nature of neighbourhood physical development, the three evolved assessment criteria were assigned values of between 1 and 10. While the most positive attributes were rated 10, the most negative were assigned a value of 1, and 5 for the average condition. The mean of scores from the three criteria generated for each neighbourhood was then correlated with the total sums of crime incidences recorded in the neighbourhoods as generated by the survey questionnaires, using the Pearson Product-moment correlation technique.

Findings and Discussion

Common Crimes in Ilorin

In identifying the common crimes experienced by residents of the neighbourhoods, the study examined both residents' perceptions as expressed in the survey conducted and the Police official crime records of the area between 2005 and 2014. When the two sets of data were subjected to a bi-variate correlation analysis, the result produced a correlation value (r) = 0.914135. This implies that the police crime records of the study area, despite acknowledged limitations of such official records of crime by many studies as highlighted in the next paragraph, correlate very highly with residents' perception of criminality in the study area.

As shown in Table 1, therefore, petty theft or stealing is the most common crime experienced within the various neighbourhoods of Ilorin with a mean value of 547. It is closely followed by house-breaking with a mean value of 421. The Table indicates that other crimes commonly experienced in the study area are assault, armed robbery, rape, kidnapping and murder.

Table 1: Common Crimes Experienced in Ilorin

Crimes	Police Data	Survey Data	Mean	SD
Petty Theft	432.4	662	547	162.3517
House Breaking	278.7	563	421	201.0305
Armed Robbery	25.6	268	147	171.4027
Rape	14.5	179	97	116.3191
Assault	297.5	423	360	88.7419
Kidnapping	5.9	56	31	35.42605
Murder	45.8	7	26	27.43574

Source: Extracts of Police Crime Records of Ilorin, 2015; Authors' Analysis, 2017

However, several limitations associated with official records of crime in developing countries have been highlighted by many studies (Soares, 2004; Alemika, 2013; Olatunbosun, 1998; Gyong, 2010) and include low reporting rate of crime and other social and cultural inhibitions such as culture of amicable settlements between parties to crimes.

Spatial Distribution of Crime Incidences in Ilorin

For ease of analysis and neighbourhood comparison, the total sum of crime incidences experienced by households in each neighbourhood of the study area (based on the survey conducted) were summed up and using Jenks' natural breaks classification method developed by George Jenks (1967), the crime sums were partitioned into four crime densities of low, moderate, high and very high.

Based on the classification method employed, 7 neighbourhoods that experienced a total of between 11 and 35 crime incidences in the last five years were classified as low crime neighbourhoods, while another 10 that experienced a total of between 47 and 68 crime incidences were classified as moderate crime areas. Sixteen neighbourhoods with total crime incidences of between 75 and 93 were classified as high crime areas, while 2 neighbourhoods were particularly classified as very high crime areas because they recorded total sums of crime incidences of 115 and 117 respectively (Table 2).

Table 2: Classification of Spatial Pattern of Criminality

Classification	Neighbourhood	Frequency	Percentage (%)
Low Crime	Adewole Estate	32	1.37
	Federal Housing Estate	15	0.64
	GRA	11	0.47
	Irewolede Estate	35	1.50
	Olorunshogo Estate	26	1.11
	Airport Area	15	0.64
	Alagba Estate	31	1.33
	7	**165**	**7.07**
Moderate Crime	Fate	62	2.66
	New Yidi Road	47	2.01
	Okelele	64	2.74
	Oloje	52	2.23
	Olorunshogo	68	2.91
	Sabo Oke	52	2.23
	Saw-Mill	58	2.49
	Surulere	60	2.57
	Balogun Gambari	67	2.87
	River Basin Estate	65	2.79
	10	**595**	**25.50**
High Crime	Asa Dam Road	89	3.81
	Amilegbe	93	3.99
	Post Office Area	89	3.81
	Unity Road	77	3.30
	Tanke	86	3.69
	Sango	84	3.60
	Pakata	78	3.34
	Okesuna	79	3.39
	Oja Oba	91	3.90
	Oja Gboro	87	3.73
	Offa Garage	80	3.43
	Agbabiaka	87	3.73
	Maraba	87	3.73
	Idi-Ape	80	3.43
	Gaa Imam	79	3.39
	Gaa Akanbi	75	3.21
	16	**1341**	**57.48**
Very High Crime	Agbo Oba	115	4.93
	Taiwo Road	117	5.02
	2	**232**	**9.95**
Total	**35**	**2333**	**100.0**

Source: Authors' Analysis , 2017

Nature and Quality of Neighbourhoods' Physical Development

As earlier highlighted under research methodology, the physical development qualities of the various neighbourhoods of the study area were physically observed and assessed using three criteria. Based on the assessment criteria of density, only one neighbourhood (GRA) was characterized as low density, while sixteen others were characterized as medium density neighbourhoods. The remaining eighteen neighbourhoods of the study area were classified as high density areas. This, in addition to other categorization, is illustrated in Table 3.

Based on nature of physical development, eight neighbourhoods were classified as well laid out and orderly developed, while another fourteen were categorized as not too orderly developed. The remaining thirteen neighbourhoods were classified as haphazardly developed. Based on average compliance with physical planning standards in housing development, nine of the neighbourhoods were classified as well planned, fifteen as not properly planned, while the remaining eleven were classified as not planned.

Table 3: Characterization of the Physical Development of Neighbourhood

S/N	Neighbourhood	Density	Nature of Devt.	Planning Status
1.	Adewole Estate	Medium	Orderly Developed	Planned
2	Fate	Medium	Orderly Developed	Planned
3	Federal Housing Est.	Medium	Orderly Developed	Planned
4	Gaa Akanbi	High	Not too orderly	Not properly planned
5	Gaa Imam	High	Not too orderly	Not properly planned
6	GRA	Low	Orderly Developed	Planned
7	Irewolede Estate	Medium	Orderly Developed	Planned
8	Idi-Ape	High	Haphazardly developed	Not planned
9	Maraba	High	Haphazardly developed	Not properly planned
10	New Idi	Medium	Not too orderly	Not properly planned
11	Agbabiaka	High	Not too orderly	Not properly planned
12	Offa Garage Road	High	Not too orderly	Not properly planned
13	Oja Gboro	High	Not too orderly	Not planned
14	Oja Oba	High	Haphazardly developed	Not planned
15	Okelele	High	Haphazardly developed	Not planned
16	Okesuna	Medium	Haphazardly developed	Not planned
17	Oloje	High	Haphazardly developed	Not planned
18	Olorunshogo	High	Haphazardly developed	Not planned
19	Olorunshogo Estate	Medium	Orderly Developed	Planned
20	Pakata	High	Haphazardly developed	Not planned
21	Sabo Oke	Medium	Haphazardly developed	Not properly planned
22	Agbo Oba	High	Haphazardly developed	Not planned
23	Sango	High	Not too orderly	Not properly planned
24	Saw Mill	High	Not too orderly	Not properly planned
25	Surulere	High	Not too orderly	Not properly planned
26	Taiwo Road	High	Haphazardly developed	Not properly planned
27	Tanke	Medium	Not too orderly	Not properly Planned
28	Unity Road	Medium	Not too orderly	Planned
29	Gambari	High	Haphazardly developed	Not planned
30	Post Office Area	Medium	Not too orderly	Not properly Planned
31	Airport Area	Medium	Not too orderly	Not properly Planned
32	Alagba Estate	Medium	Orderly Developed	Planned
33	Amilegbe	Medium	Haphazardly developed	Not planned
34	Asa Dam Road	Medium	Not too orderly	Not properly Planned
35	River Basin Estate	Medium	Orderly Developed	Planned

Source: Authors' Analysis, 2017

Relationship between Neighbourhood Physical Development Conditions and Exposure to Crime

As shown in Table 4 the cross-tabulation of crime incidences across neighbourhoods (as earlier generated in Table 2) indicates that incidences of crime decreases with improvement in the physical development pattern of the neighbourhoods. The cross-tabulation shows that high crime incidences were recorded in neighbourhoods with poor physical development features, while low incidences of crime were recorded in neighbourhoods with relatively better physical development features. This pattern was further subjected to a Chi-square test. The result which produced p-value of 0.04 confirms that there is a relationship between the nature of physical development and pattern of criminality in the study area (Table 5). These analyses therefore, means that the better developed physically a neighbourhood is, the less exposed it is to crime.

Table 4: Neighbourhoods' Cross-tabulation of Quality of Physical Development and Crime Incidences

Crime	Poor	Medium	Good	Total
Very High	2 (100)	0 (0)	0 (0)	0 (0)
High	10 (63)	6 (38)	0 (0)	16 (100)
Medium	6 (60)	4 (40)	0 (0)	10 (100)
Low	0 (0)	6 (86)	1 (14)	7 (100)
Total	18 (51)	16 (46)	1 (3)	35 (100)

Source: Authors' Analysis, 2017

Table 5: Chi-Square Test of Association between Nature of Physical Development and Pattern of Criminality

	Value	df	p
X^2	32.35	21	0.04
N	35		

Conclusion and Recommendations

The paper did not only identify the common crimes experienced by residents of Ilorin, Nigeria, it established their spatial distribution among the various neighbourhoods. As a result, four crime density classes were established in the study area. These are low-crime, moderate-crime, high and very high-crime neighbourhoods. This means that while some neighbourhoods of Ilorin can be regarded as relatively secure, others are more exposed to varying types of

criminality. This finding agrees with those of similar studies such as Adigun and Adedibu (2013), Jinadu *et al.* (2012), Bernasco and Elfers (2010) and Doran and Lees (2005), amongst others which have established spatial variation of urban crime. In addition, when the mean of the three physical development measurement indicators was correlated with the sum of crimes experienced across the neighbourhoods, the study revealed that there is a strong inverse relationship between the quality of neighbourhood physical development and exposure to crime. It is therefore, concluded that relatively planned and orderly developed neighbourhood are less vulnerable to criminality than those that are haphazardly developed. This means that the better planned and physically developed a neighbourhood is, the less exposed or vulnerable it is to criminality.

Therefore, to minimize neighborhoods' exposure or vulnerability to crime arising from the nature and condition of their physical development, the study offers some recommendations. Firstly, it is recommended that urban renewal programmes, particularly in the old, core, blighted and haphazardly developed neighbourhoods of the study area such as Idi Ape, Agbo Oba, Oja Oba and Oja Gboro among others, be undertaken. The urban renewal programmes are to be within the framework of the master plan for the study area. Secondly, appropriate physical development control measures should be developed for adherence of developers and residents to the spatial plans for the area.

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Assessment of the Impact of Development Control Measure on Residential Property Rental Values in Minna Metropolis

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Abstract

This study aimed at determining the impact of development control on the trend in rental of property in Minna. the data collation for this study are from resident of the neighbourhood, estate surveyor and valuer's, town planners and personal observation through questionnaire, the methodology used is the cluster random sampling technique which was adapted to divide the area into residential neighbourhoods and furthermore, a purposive sampling technique was used because of the residential property characteristic. The data were analysed using inference statistical tools like Gini-co-efficient, correlation and multi-regression analysis among others, the resultant outcome showed that there is a strong positive relationship between development control measures and residential property rental values and also development control measures are not adequately enforced in the planned and unplanned neighbourhoods, it was recommended that estate surveyor and valuer's should advise their clients on the need and importance of investing in neighbourhood that have harmonious land use in order to easily recoup the huge capital outlay invested on residential property development and government should adopt new trends like the guided land development (GLD) and sustainable city programme (SCP). This will provide advancement in the frontier of investment in residential property development through proper execution of development control measures.

Keywords: *Development Control, Residential Property, Rental Value*

Introduction

Background to the study

The phenomenal growth of Nigerian towns and cities have given rise to metropolitan areas where land is a key factor of production and fundamental component in social economic development of a Nation (Olayiwola, Adeleye & Oduwaye, 2006, Federal Ministry of Housing and Urban Development, 2006; Akogun, 2011). Demand for land for different purposes result to competition, this requires sufficient planning and control to guarantee functional, efficiency and harmonious development of these land uses and settlements (Orekan & Atinuke, 2014). To realize this essential activity, layout of different land uses are undertaken to regulate and control physical development. Residential property developers have made it habitual to neglect securing of town planning development permit before the commencement of development on their plots.

However, professional estate surveyors and valuers according to Kauko (2003) as cited in Emoh, Oni and Egolum (2013) enumerated accessibility factor, neighbourhood level factor, public services, taxes, density factors, specific negative externalities, identification, description, location and use of a property as the attributes commonly used in property valuation and in fixing price for these attribute, they are usually assessed to ascertain if they are in conformity with planning regulations because they are fundamentally taken into cognizance when carrying out valuation for any purpose because of their influence on the final value opinion. The rationale behind the land use planning is to make sure that metropolitan activities are organize and build up in physical space with concern for protection of public interest this comprises health, safety of lives and property, convenience, efficiency, conservation, environmental quality, social equality, social choice and amenity (Ajibola, Olaniyan and Simon, 2012).

The Land Use Act law of 1978, Urban and Regional Planning Law No. 88 of 1992, and also Housing and Urban Development Policy of 2012 are some of the laws put in place. It is the duties of government at all levels to provide planned and well serviced layouts and also monitor the growth of our town and cities to enhance value. Akogun (2011) postulated that the liveability of an environment has a significant influence on the property rental value receivable on the property that even when the rental value is

soaring high there is still high demand for the property, but alas, what we see today are escalating uncontrolled expansion, shanty town and slums in the major cities of Nigeria (Agbola, 2007; Fagbohun, 2007). Therefore the city of Minna is one the growing city the city is still plagued with predicament of ineffectual physical planning and inordinate housing development. and which has affected property investment. The study seeks to assess the extent to which development control has affected property investment in Minna. The study tends to answer the following two questions: What is the impact of development control measures on residential property rental value?; Does the difference in residential property rental values in planned and unplanned neighbourhoods in Minna metropolitan areas are statistically significant?

Conceptual Framework Of Urban Planning

Development of planning law started in 1863 when Town Improvement Ordinance was enacted to have power control over development and sanitation in Lagos city, 1904 Cantonment Proclamation which became the actual first planning legislation, it was an attempt to protect the Europeans from the health hazard so prevalent at that time, Uthma (1999) Township Ordinance of 1917, gave strategy for the controlled of development and finance of land and established municipal administrative responsibility (Oyesiku 2007 and Omole, 2012).

Town and Country Planning Ordinance of 1946 which was supported by the 1932 British Town and County Planning Act, it was enacted as a result of the planning problems of most cities in Nigeria. The Urban and Regional Planning Law no. 88 of 1992 was nationally promulgated to take into cognisant different culture, norms, climatic condition, topography and other factors that will meet local needs of the people (Agbola, 2007, Omole 2012). The Federal Environmental Protection Act (1988) and the harmful Waste Act, (1988) were enacted to monitor, reduce and possibly prevent environmental pollution to make the environment safe for habitation and thus lead to economic growth and development.

Alabi and Akinbode (2010) they viewed, Physical Planning as a way through which design, growth and management of the physical environment is in accordance with a predetermined guide and policy, its goal is to harmonize or co-ordinate all forms of development activities across different level

of a State or Nation. According to American Planning Association (2011), Ajibola *et al.,* (2012) that the purpose of land use planning is to advance the benefits of the people and their neighbourhoods by constructing convenient, unbiased, healthy, efficient, and good-looking environment to achieve sustainability for the overall interest of the society. In an attempt to realising the aim of Physical Planning Akinmoladun (1999) as cited in Adebayo (2005) identified five (5) ways by which public power can use in land use control which includes, prescribe the land use through zoning and building restriction; prevent the mis-use of land that might be injurious to the community that is to prevent slum formation; avoid the abuse of land; Prevent the disuse of land and directing the reuse of land for the most suitable purpose.

Kauko (2003) as cited in Emoh, Oni and Egolum (2013) enumerated accessibility factor, neighbourhood level factor, public services, taxes, density factors, specific negative externalities, identification, description, location and use of a property as the attributes commonly used in property valuation and in fixing price for these attribute, they are usually assessed to ascertain if they are in conformity with planning regulations because they are fundamentally taken into cognizance when carrying out valuation for any purpose because of their influence on the final value opinion. Okpala (2008) opined that physical planning is the procedure of planning the management of trend, structure and guide of the growth, development and regulation of urban areas with a view that all basic land uses meet the need and aspiration of the socio-economic groups in the society and ensure harmony in the land use(s).

According to Sanusi (2006) development control is the process of attaining the goal and objectives of a plan through logical implementation of the development plan. Fagbohun (2007) viewed it as the exercise of statutory powers to control development by authority responsible for town planning. It involves the control of spatial growth, development and redevelopment of town and cities. Fagbohun (2007) gave two basic strategies for development control; direct strategy which implies the act of implementing the policy of development control; it encompasses the preparation and execution of the plans in the urban as well as the rural areas. Indirect strategies which are enabling laws and legislations to direct spatial planning by planning authority to exercise its statutory powers on development control.

Ogundele, Odewumi and Aigbe (2011) two tools for development control include enforcement notice and stop work notice which are issued to the defaulter for contravening any planning laws regarding development without the approval of the planning authority and an unauthorized development. Jinadu (2007) view Standard as the means by which planning authorities control construction activities for the sole rationale of ensuring safety and health in the built environment. The definitive objective of housing standard is to guarantee specified quality construction of product and improve the health and safety of the resident of the house in the neighbourhood.

Value as a concept of good, from the economics point of view it signifying the desirability and pecuniary sacrifice to get the goods and services needed. Also, value is seen as an action which is a product of an appraisal, and it value connotes the rules, goals, norms, and standard that gives out the yardstick for the appraisal judgement (Holbrook, 1999). Value mean transfer or trade-off between sacrifice and benefit: More so it means an interface between a consumer and a product (Payne and Holt, 2001). The forces that influence residential rental values are social forces, governmental forces economic forces, physical and environmental forces.

Society operate essentially like a living thing that is dynamic in nature, property metamorphosis from pre-development stage to total obsolescence in which landed property's economic and other value diminishes as a result of social, economic, physical and administrative forces that influence the property structure and forms, Any natural or man-made disaster can cause social, economic and physical imbalance on the property causing damages and thus resulting to diminish in property value. Town planning techniques and principle allow for futuristic problem solving approach which recognises the connectivity between planning and potential increment in property value, (capital or rental value) (Dabara, et al. 2012).

The conceptualization of this study is founded on the variables that are used as development control measures(see Figure 1), These control measures when enforced have a positive impact on the land use (Harmonious land use) or negative impact on land use (Obnoxious land use), in either ways the enforcement of development control measures have an influence on residential land use choices by households because of the utilities derivable (Madu &

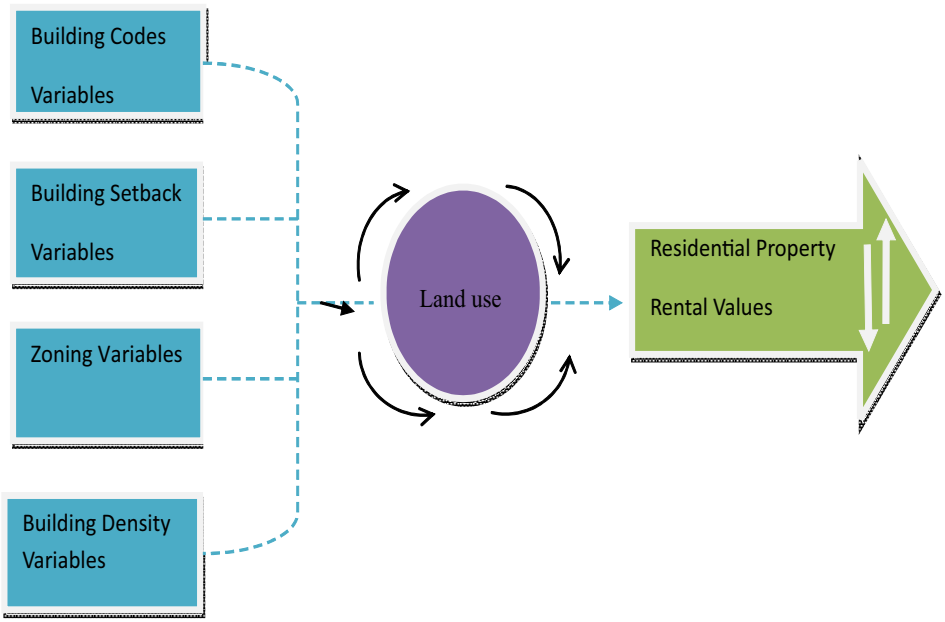

Figure 1. Conceptual Framework
Source: Aluko (2011b) and (2011c), Madu and Innocent (2013).

Study Area

Minna derived its name from ceremony perform annually by the Gbari people who are the first settlers and founders that is "Min" connotes my and "Na" connote "Fire" that is my Fire. Minna became state capital of Niger State on 1st of Aprill 1976, and translated to urban centre.

It is located on Latitude 9^0 37' North and Longitude 6^0 33'East, based on the Master Plan, (MP) the topography is mostly covered by gentle sloping plain to the central, southern and western section traverse railway lines and multiple road networks.

Minna has a mean annual rainfall of 1334 mm (52 inches) with the peak monthly rainfall in August and peak monthly temperature in March and lowest in August, Minna has a projected population 438, 827; rural-urban migration and proximity to Federal Capital Territory influence the population growth. Minna is blessed with some natural resources and small scale industries. However, there are a lot of financial institution like Banks, Insurances

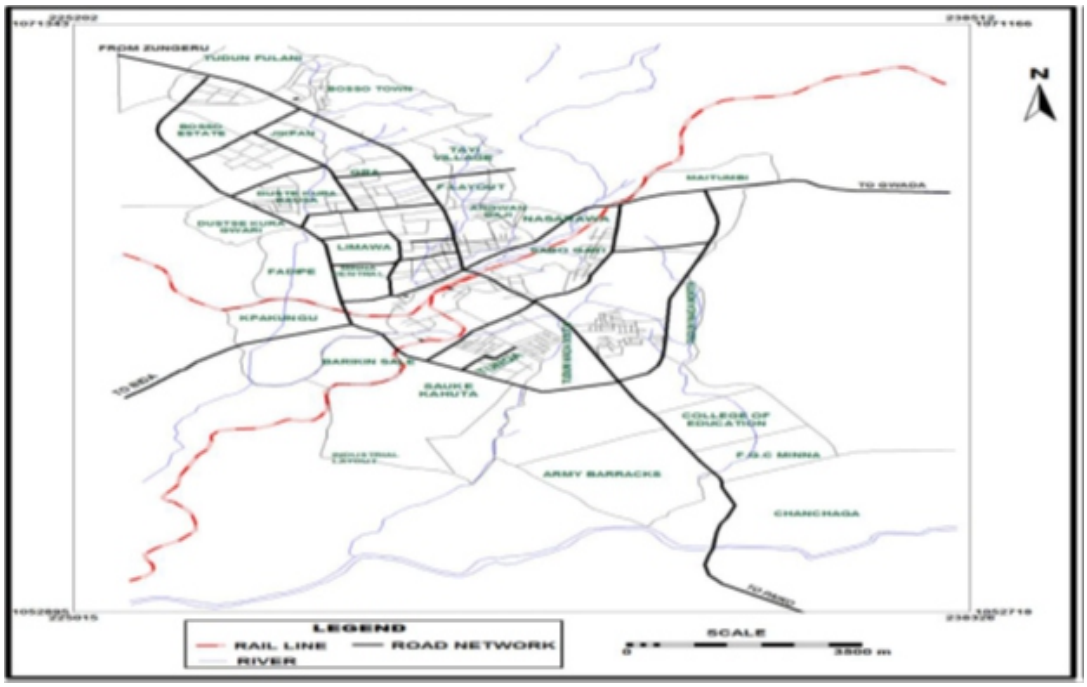

Figure 2 Minna Township Map.

Source: Extract from Minna Metric Sheet (2015) as produce by NIGIS.

Methodology

Essentially, the research method adopted for this study is the quantitative and inference research method because data required effectively cover the area under study the locale was grouped into planned and unplanned neighbourhoods. The population for the study consist of estate surveyor and valuer's (private and civil servants) to obtain data on rental values for a period of ten years, practicing town planner to obtain information on development control measures, occupants of two and three bedroom flat in selected neighbourhoods. The sampling frame is the total population of the resident in the Ten (10) selected neighbourhood of the metropolitan area, as a result of the nature of the property purposive sampling technique was used and above 400 houses were used as sample size with confidence level of 5%. Computation for the sample size = with confidence level of 5%. Computation for the sample size = with confidence level of 5%. Computation for the sample size = $1/K^2$ where k = level of significance.

Results

Data Presentation and Analysis

Table 1 shows the distribution of

Infrastructure unplanned Neighbourhood. To determine the adequacy of the distribution of infrastructure (access roads, education, health and electricity infrastructure) the use of Gini-coefficients derivations was adopted. The table above depicts the distribution and grouping of the availability of roads, education, health and electricity facilities in terms of percentage of households in unplanned neighbourhoods of Minna urban (Maitunbi, Shango, Anguwan Biri, Barkinsale and Kpakungu).. It was observed that the total response of the households is seen to be analogous to the availability infrastructural facilities in these 5 unplanned

Table 4.1: Quintile and Percentage of Distribution of Infrastructural Facilities in the Selected Unplanned Residential Neighbourhoods.

Quintile/ Percentage of Household	Access Road	Education	Health	Electricity
Lowest Quintile/20% of Households	41 (0.204)	41 (0.200)	41 (0.373)	41 (0.201)
Second Quintile/40% of Households	39 (0.194)	41 (0.200)	1 (0.009)	41 (0.201)
Third Quintile/ 60% of Households	41 (0.204)	41 (0.200)	36 (0.327)	40 (0.196)
Fourth Quintile/80% of Households	39 (0.194)	40 (0.195)	13 (0.118)	40 (0.196)
Fifth Quintile/100% of Households	41 (0.204)	42 (0.205)	19 (0.173)	42 (0.206)
Total No. Responses	**201**	**205**	**110**	**204**

Source: Authors field survey, (2015).

Table 2 shows the distribution of Infrastructure planned Neighbourhood. To determine the adequacy of the distribution of infrastructure (access roads, education, health and electricity infrastructure) the use of Gini-coefficients derivations was adopted. Above illustrate the distribution and grouping of the availability of education, electiricity, roads and health facilities in terms of fraction of households in planned neighbourhoods of Minna urban (Farm Centre/ Old NECO Area, M.I wushishi, Tunga Top Medical, Tunga Netico, Okada/ Dutsen Kura). the proportion of each quintile/household in the neighbourhood to their total response is however given in parenthesis. It should observe that the total response from the households to be parallel to the availability of infrastructural facilities in these 5 selected planned neighbourhoods.

INTRODUCTION

Table 2 Quintile and Percentage of Distribution of Infrastructural Facilities in Selected Planned Residential Neighbourhoods.

Quintile/ Percentage of Household	Access Road	Education	Health	Electricity
Lowest Quintile/20% of Households	35 (0.178)	38 (0.194)	19 (0.151)	39 (0.196)
Second Quintile/40% of Households	40 (0.203)	39 (0.199)	24 (0.190)	39 (0.196)
Third Quintile/ 60% of Households	40 (0.203)	37 (0.189)	18 (0.143)	40 (0.201)
Fourth Quintile/80% of Households	40 (0.203)	40 (0.204)	25 (0.198)	39 (0.196)
Fifth Quintile/100% of Households	42 (0.213)	42 (0.214)	40 (0.317)	42 (0.211)
Total No. Responses	**197**	**196**	**126**	**199**

Source: Authors field survey, (2015).

Table 3 shows that Okada area and Dutsen-Kura Hausa neighbourhood have the highest mean rent of 173636 in the planned area while the least mean rent are 102272 in M.I Wushishi/Kaffin Tella neighbourhood of Minna, interestingly in the unplanned area of Shango neighbourhood command the highest rent 109090, Barkin Sale and Kpakungu are commanding same mean rent 105000 while Anguwan Biri command the least mean rent 90000 in the area under study. A graphical representation of the trends is design and presented Figure 2 and 3.

Table 3 Descriptive Statistics for Property Rents (2 Bedroom) in Planned and Unplanned Neighbourhoods

Neighbourhoods	N	Mean	Std. Deviation
PLANNED			
Farm Centre/Old NECO	11	149545	36294
MI Wushishi/ KafinTela	11	102272	38037
Tunga Top Medical	11	145909	31290
Okada/Dutsen-Kura Hausa	11	173636	49045
Tunga/NITECO	11	126818	39323
UNPLANNED			
Shango	11	109090	33824
Anguwan Biri	11	90000	18973
BarkinSale	11	105000	30983
Kpakungu	11	105000	30983
Maitunbi	11	92727	23702
Total	110	120000	42160

Source: Authors field survey (2015).

Table 4 show the result of pairwise correlation between development control measures and rental value in planned neighborhood, building code, setbacks and density maintained strong significant relationship with rental value at 0.75, 0.7 and 0.65 respectively. This indicates that the more people are complying with building code, setback and density the more the increase in rental value of property. Building code and density are dispensable measures and jointly have strong relationship in increasing rental value (0.85).

Table 4 Pairwise Correlation of Development Control Measure in Planned Neighbourhoods with Residential Property Rents

	Building Code	Setback	Zoning	Density	Rent
Building Code	1				
Setback	0.83	1			
Zoning	0.44	0.45	1		
Density	0.85	0.78	0.43	1	
Rent	0.75	0.70	0.46	0.65	1

Table 4 show the result of pairwise correlation between development control measures and rental value in planned neighbourhood. Density maintained strong significant relationship with rental value at 0.63 respectively. This indicates that the more people are complying with building code, setback and density the more the increase in rental value of property. Building code and density are dispensable measures and jointly have strong relationship in increasing rental value (0.67)

Table 5 Pairwise Correlat ion of Development Control Measure in Unplanned Neighbourhoods with Residential Property Rents

	Building Code	Setback	Zoning	Density	Rent
Building Code	1				
Setback	0.62	1			
Zoning	0.34	0.27	1		
Density	0.67	0.65	0.37	1	
Rent	0.33	0.24	0.19	0.63	1

Source: Author's field survey (2015).

Table 6 shows the result of regression coefficients for the neighbourhoods that is planned and unplanned thus, 71.2% of the variation in rent is explained by the development control measures (town planning regulation regulations) in the neighbourhoods. In the overall, building-code is significant in the study, as it increases rental value in the neighbourhoods by 60.7%, Set back also predicted rental value by 41.6%.Location as a major determinant of rental value in any neighbourhoods predict rental value by 21.5%. Density variables in the unplanned neighbourhoods decrease rental value by 72.3%.Thus it shows that there is a strong relationship between rent payable in neighbourhoods that are planned and the rent payable in neighbourhoods that are unplanned, the greater the compliance to planning laws the higher the rent payable and verse versa.

Table 6. Regression of Development Control Variables

Predictors	Coefficients of Regression Model for all Neighbourhoods	Coefficients of Regression Model for Planned Neighbourhoods	Coefficients of Regression Model for Unplanned Neighbourhoods
Bldcode	0.60737*	0.6484*	0.3901
	(5.81)	(2.109)	(1.064)
Setback	0.4161*	0.8054*	0.1558
	(6.23)	(1.034)	(1.184)
Zoning	0.21508*	0.7046*	0.5354
	(3.44)	(1.551)	(1.23)
Density	0.7236*	0.0814	0.6559*
	(4.32)	(2.555)	(-1.43)
Constant	26.5618	17.4395	49.934
	(-10.39)	(3.065)	(2.135)
R Square	71.2%	60.1%	53.7%
F Statistic	10.23	7.43	4.36
Durbin Watson (DW)	1.87	2.12	2.02
No. of Observation	400	205	195

Figure 1 shows the trends in rental value of 2B/R across the selected planned areas . Okada/Dutse kura overlapped all other areas and farm centre also showed trend from behind to overlapped others and Tunga Niteco parallel trend and gentle upward to other two areas. This further indicates that Okada/dutse kura, farm centre and tunga niteco experienced better trend in rental value which suggested the development in the areas were regulated and controlled.

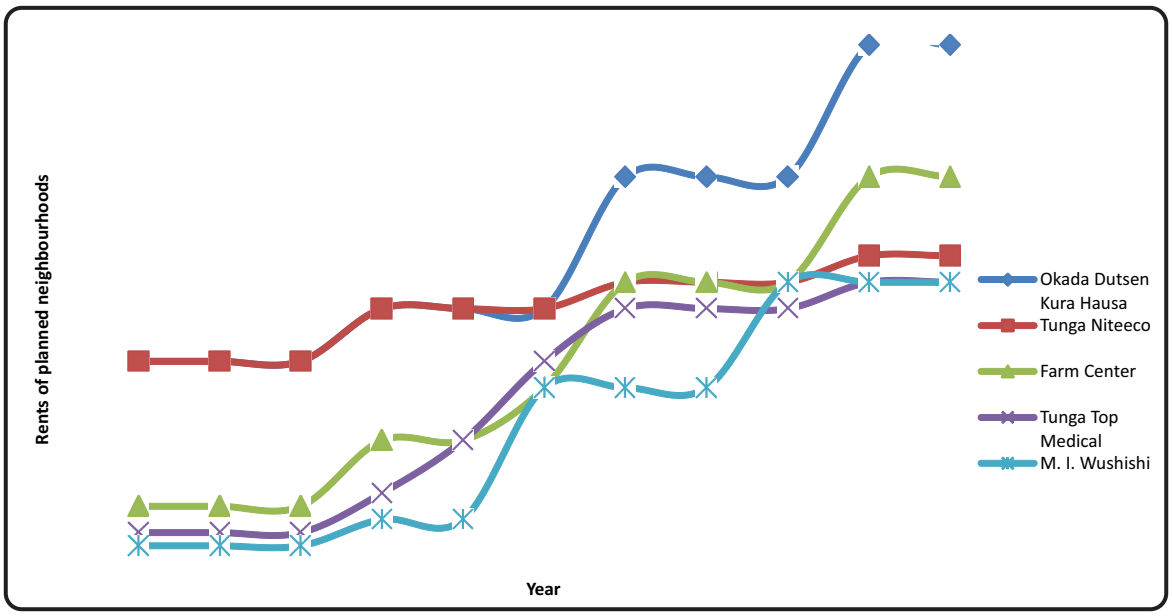

Figure 2Trends in Property Rents (2 & 3 Bedroom) for Planned Neighbourhoods, 2004-2015.

Figure 2 shows the trends in rental value across the selected planned areas . Shango overlapped all other areas and Barike sale and Kpakungu also showed trend from behind to overlapped both Angwan biri and Maitunbi areas. This further indicates that Shango Kpakungu and Barike-sale showed prospective and better trend in rental value than other unplanned areas.

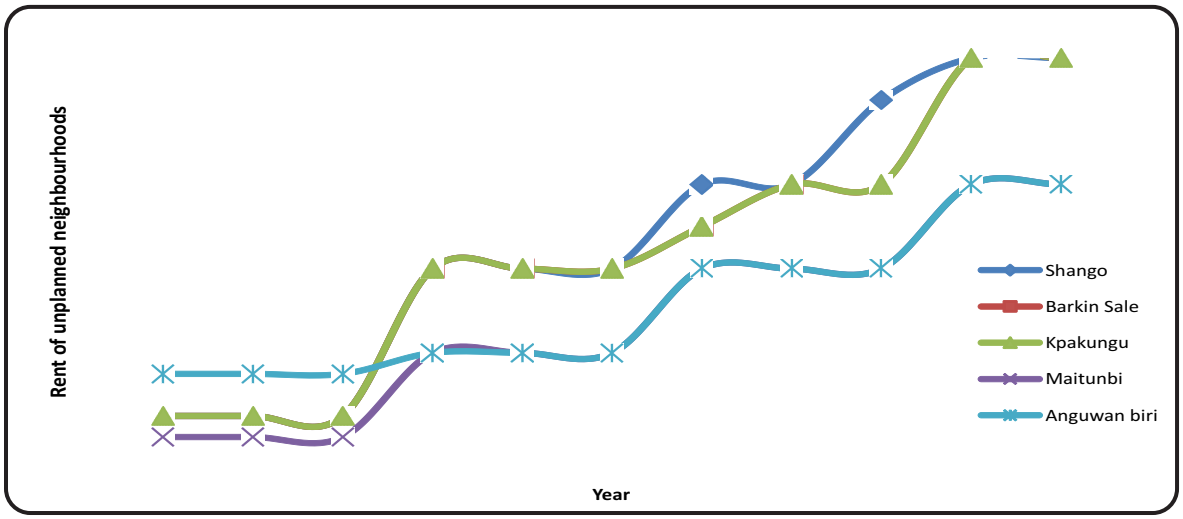

Figure 2 Trends in Property Rents (2 & 3 Bedroom) for Unplanned Neighbourhoods, 2004-2015.

Findings And Recommendation

There exist wide difference in-terms of infrastructural provision in both planned neighbourhoods and unplanned neighbourhoods of Minna with Gini-coefficient of 0.64-0.66.for planned and 0.63-0.64 for unplanned negibourhood. It was discovered that both planned and unplanned neighbourhood are being deprived adequate provision of basic infrastructure. Development control measures are poorly enforced in areas like Maitumbi, Shango, Anguwan Biri and Barkin-Sale, making the settlement degenerate into slum neighbourhood. It was found that there was continuous increase in rent payable between 2004-2014, and evident that there is a significant variation in residential property rent receivable/payable across the planned and unplanned settlements.

It is therefore recommended that Government should increase the source of funding infrastructure provision by partnering with international organisation for equitable distribution of infrastructural facilities in the entire residential neighbourhood of Minna. Also the development control should be thoroughly enforced to create an enabling environment for residential property investment. There is need for government to shift from the old master plan approach in town planning and adopt new trends like the guided land development (GLD), sustainable city programme (SCP) etc

Conclusion

This study sought to assess the impact of development control measures on residential property rental values in Minna metropolis. if development control is strictly implemented it will motivate both the residential property investors to invest and tenants to get biffiting residential accommodation. Conclusively, it is undoubtedly convinced that, if all the recommendation outlined above are well attended to there is to be a harmonious and peaceful environment that will anchor sustainable real estate growth and development.

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Stakeholders' Perception of the Success of Tertiary Education Fund Construction Projects

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Abstract

Projects funded by the Tertiary Education Trust Fund (TETfund) at the Ahmadu Bello University, Zaria, from 2009 – 2011 was assessed in this study in order to determine stakeholders' perception of the projects' satisfaction. The study utilized primary and secondary data. The secondary data were obtained from existing literature on project success and project stakeholders while the primary data was obtained through interviews with key stakeholders and, from checklist and questionnaires. Results of the study revealed that, delay in progress payment, escalation in price of materials, insufficient supply of materials and low technical skill of the project leader are the topmost factors hindering satisfaction of the projects, as most of them were discovered to be unsuccessful. However, furniture, structural stability and ventilation were the highest ranked to be satisfactory by end users. The study recommends synergy between the various stakeholders involved; from project inception stage to project completion stage.

Keywords: *End users, Project success and stakeholders.*

INTRODUCTION

Clients invest in projects to derive benefits, which might be immediate or later. Thomas and Mullaly (2008) stressed that a project can be termed successful when sponsors derive benefit from the investment made. Peters (1999) submitted that there is the need to examine whether a project is successful or not successful for the client benefit. Construction project development involves numerous parties, various processes, different phases and stages of construction, with the aim of concluding the project successfully (Takim & Akintoye, 2002). According to Wai (2002); Takim and Akintoye (2002) the traditional method of assessing construction project involves the use of time, budget and quality.

Williams (2005) argued that factors such as complexity and uncertainty of project may result in overruns of project cost and duration of completion. Mohammed *et al.,* (2008) cautioned that a construction project might be completed as scheduled, within budgeted sum and specification but might not meet users' satisfaction and requirement. A way out was proposed by Samiaah, Hamzah and Zakaria (2010) to adopt new measures such as the assessment of stakeholders satisfaction level which can bring on board the users of the projects. This agrees with Roshana and Hamimah (2008) who stressed the adoption of new criteria that can be used to measure a project success with involvement of the stakeholders to assess project satisfaction. According to Takim and Akintoye (2002) a project stakeholder is any individual or group of people that can influence the project performance. In this research, the stakeholders here are: the contractors, consultants and end users. And, the paper assessed TETfund projects at the Ahmadu Bello University, Zaria, from stakeholders' viewpoints.

REVIEW OF LITERATURE

2.1 Project success delivery

All construction project usually have both project inception and completion phases. According to Saidu and Shakantu (2016) a building project phases encompass: project design, project planning, project construction and project completion and handing over phases. Assaf and AL-hejji (2006) submitted that challenges that might inhibit project delivery are not limited to inadequate planning and scheduling, insufficient experience, altering of the project scope, divergent views in the co-ordination and communication between stakeholders and time-consuming information flow pattern between the

stakeholders. Yang and Peng (2008) opined that client's demand for a project to be delivered as scheduled, within stipulated time and required quality should be in line with contractual duties, obligations and responsibilities.

Shehu and Akintoye (2010) found evidence in their study that the major challenges to project delivery in the construction industry are: non commitment from project management team, lack of proper coordination by relevant stakeholders, inadequate knowledge relating to portfolio and risks management technique, lack of cross-sectional communication, lack of adequate techniques to measure project success and financial constraints.

Pinto and Slevin (1987) in a study conducted on critical project factors submitted that the factors should include: mission of project, support of the key management, timeliness and schedules, clients view, user satisfaction, early resolution of glitches that arise and information flow across levels. Jugdev and Müller (2005) have a contrary view about project success factors; they believed that it should involve other stakeholders involved in the project. But Mallak *et al.* (1991) believed that various stakeholders will have different project success factors due to individuals influence.

Again, Turner and Zolin (2012) submitted that project success factors should extend beyond project completion phase, in order to have a better understanding of project from end users perspective. Bandar (2011) put forward that cost, quality, time and users satisfaction should be used to measure a project success.

The challenge of evaluating project success is obvious. Anderson *et al.* (2006) linked various perspectives on project success factors to the inherent characteristics noted with construction projects. Al-Sedairy (1994) believed that having a frosty relationship between stakeholders occurs very often. Bandar (2011) agreed with Lim and Mohamed (1999) and Al-Sedairy (1994) argued that a project can be termed successful if it completed within planned cost, time and quality of the project and benefits derived during the life cycle. Lack of proper coordination might limit the level of success to be achieved in a project life cycle. When adequate provisions are not made at any stage of a project life cycle, it might impact negatively on a project (Chan & Kumaraswamy, 1997).

This was noted to be caused by insufficient

planning at the various project stages (Lim and Mohamed, 2000). A measure to prevent overrun to cost, time, quality and satisfaction was proposed in the research conducted by Koushki *et al.,* (2005) put forward the need to employ a formidable project team who will work harmoniously in the interest of the client.

Project Stakeholders

All projects have their particular stakeholders, who`s actions have impact on the project. The Project Management Institute (2004) put forward project stakeholders to be individuals and organisations that are actively involved in the project or, whose interest may be affected as a result of project completion. There is need to measure project success from various perspectives.

Davis (2014) argued that a good method to measure a project success is by assessing project success from various stakeholders involved in a project by assessing time, cost, quality using stakeholders' satisfaction level, collaboration, similarity in objectives, finished project, capabilities of the project manager, accrued benefits from the project and top management inputs. In a study carried out by Alaghbari *et al*. (2007) on project performance and success, they concluded that inadequate level of dedication and dexterity of the project stakeholders affects the level of project success. A large project might be completed and commissioned as programmed and estimated but might fail in the eye of a key stakeholder. Brady and Davies (2010) in their study believed that the Heathrow Terminal 5 project was not successful, due to the glitches experienced after the project was commissioned.

They further stressed that the public who happens to be a key stakeholder, were faced with a lot of challenge immediately the facility was put in use even though the project was completed in good time and within the contract cost. Emuze (2012) proposed that adequate system for decision making between stakeholders project success. Randolph (2012) noted that working harmoniously with the host, regular information flow, reviewing project events and systems and providing avenue to strike out grievances that might arise will enable various stakeholders work harmoniously.

End users

Soliciting end user opinion when evaluating project performance has often been done in developed economies, unlike in the

underdeveloped world where awareness is still low (Amaratunga & Baldry, 2002). Emuze (2012) suggested the following criteria to assess user satisfaction of a project; functionality, accessibility, productivity, aesthetics, cost effectiveness, security and health safety. The inclusion of end users in the planning and designing stage is import for project success. Pinto and Pinto (1991) promoted the use of user's satisfaction through satisfaction with their interpersonal relations with project team members. Chan. and Chan (2004) advocated for a further study on the various levels at which the end users are satisfied with the project.

Komet, Olomolaiye and Harris (1995 suggested the use of safety, time and flexibility of project to assess project success. Songer and Molenaar (1997) noted the need the following criteria to be used to measure a project success: user's aspiration, specifications and the quality of work carried. Some projects evaluation efforts might not see the need for the inclusion of end users.

Leaman (2004) attributed this to apprehension to the project delivery team for them not be held accountable in case of eventuality. Sadeh, Dvir and Shenhar (2000) argued that when a project meets an end user`s need in terms of task enhancement and time of project completion it can be termed successful.

RESEARCH METHODOLOGY

The study used interview and questionnaire for data collection from consultant, contractors and end users of the projects. Purposive sampling was adopted in distributing questionnaires. Clients representatives here were the unit heads in architecture, quantity surveying and civil engineering departments. A total number of twenty-five (25) questionnaires were administered to various consultants, client`s representatives and contractors. Interviews were conducted with end users, which were majorly the head of department in faculties that presently occupy completed project sponsored by the Tertiary Education Trust Fund.

The project reviewed were those completed between 2009 and 2011, this was because the university main financier the TETfund has not been disbursing funds. A 5-point Likert scale was adopted to seek information from respondents where: 1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree and 5= Strongly agree.

The Likert scale was transformed to Mean

Item Score (MIS).

FINDINGS AND DISCUSSION

Stakeholders Satisfaction

S/no		(MIS)	Rank
1.	**Contractual Relationship**		
i.	Communication between project stakeholders	3.6	1st
ii.	Communication system between project participants	3.1	2nd
iii.	Control mechanism of project activities	2.8	3rd
2.	**Consultants Related Factors**		
i.	Consultant co-operation to solve problem	3.6	1st
ii.	Consultants commitment to ensure construction works are done according to specification	3.2	2nd
iii.	Consultant commitment to monitor project progress	2.8	3rd
3.	**Contractor Related Factors**		
i.	Technical skills of the project team leader	3.4	1st
ii.	Project team leader capability to adapt to changes in project	3.2	2nd
iii.	Project team leader early and continuous involvement in the project	3.0	4th
iv.	Motivating skills of the project team leader	2.8	5th
4.	**Client Related Factors**		
i.	Client ability to brief on the project	3.4	1st
ii.	Client emphasis on low construction cost	3.2	2nd
iii.	Client interference during construction	3.2	2nd
iv.	Client ability to brief the project objective	2.8	4th

Table 1: Stakeholders criteria for project satisfaction

Table 1 shows stakeholders criteria for project satisfaction. For contractual relationship that respondents ranked communication between the project stakeholders as 1st with a mean score of 3.6. Regarding consultant related factors, consultant cooperation to solve problem and consultant commitment to ensure the construction work are done according to specification were ranked 1st and 2nd respectively with a mean score of 3.6 and 3.2 respectively. In contractors related factors, technical skills of the project team leader was ranked first with a mean of 3.4 while motivating skills of the project team leader was ranked 5th with a mean of 2.8. For client related factors, client ability to brief project objective was ranked 1st with a mean of 3.4 while client ability to make project decision was ranked 4th with a mean score of 2.8.

S/no	Elements of works in the projects	(MIS)	Rank
1	Furniture	4.6	1st
2	Structural stability	4.6	1st
3	Ventilation	4.6	1st
4	Toilets facilities	4.4	4th
5	Floor tiling	4.4	4th
6	Electrical fittings	4.4	4th
7	Doors and windows	3.8	7th
8	Painting	3.2	8th
9	Spatial environment	2.2	9th

User Satisfaction

Table 2: End user's satisfaction of the projects

Table 2 brings forward the level of user satisfaction with the various elements of the projects executed. From the table above, structural stability, ventilation and furnishing were ranked 1st having a mean score of 4.6. Toilet facilities, floor tiling and electrical fittings were ranked 4th by the respondents with a mean score of 4.4. Doors and windows were ranked as 7th with a mean score of 3.8 while end users ranked panting as 8th, with a mean score of 3.2. It can be said that, the users are mostly satisfied with the structural stability, ventilation and furnishing.

S/no	Factors	(MIS)	Rank
1.	Escalation of materials price	4.6	1st
2.	Insufficient supply of materials	4.6	1st
3	Delay in progress payment	4.6	1st
4	Technical skill of the project team leader	4.5	3rd
5	Project team leader experience	4.4	4th
6	Overall management actions	4.4	4th
7.	Economic environment	4.4	4th
8	Consultant commitment to ensure that construction work is done according to specification	3.8	5th
9	Motivating skills of the project team leader	3.6	6th
10	Quality control of materials	3.2	7th

Factors militating against the success of the projects

Table 3: Factors militating the success of the projects

Table 3 depicts the factors that mitigate the success of the projects. The respondents' ranked delay in progress payment, escalation in materials price and insufficient

supply of materials as 1st with a mean of 4.6. Again, quality control of construction materials was ranked 8th as least militating factor against success of the project.

S/No	Project	Status	Remarks
1	A	Completed within planned cost, time and quality	Successful
2	B	Completed within planned cost, time and quality	Successful
3	C	Completed within planned cost, time and quality	Successful
4	D	Completed within planned cost, time and quality	Successful
5	E	Not completed within planned cost, time and quality	Unsuccessful
6	F	Not completed within planned cost, time and quality	Unsuccessful
7	G	Completed within planned cost, time and quality	Successful
8	H	Completed within planned cost, time and quality	Successful
9	I	Not completed within planned cost, time and quality	Unsuccessful
10	J	Not completed within planned cost, time and quality	Unsuccessful
11	K	Not completed within planned cost, time and quality	Unsuccessful
12	L	Completed within planned cost, time and quality	Successful
13	M	Not completed within planned cost, time and quality	Unsuccessful
14	N	Not completed within planned cost, time and quality	Unsuccessful
15	O	Completed within planned cost, time and quality	Successful
16	P	Not completed within planned cost, time and quality	Unsuccessful
17	Q	Not completed within planned cost, time and quality	Unsuccessful
18	R	Completed within planned cost, time and quality	Successful
19	S	Not completed within planned cost, time and quality	Unsuccessful
20	T	Not completed within planned cost, time and quality	Unsuccessful
21	U	Not completed within planned cost, time and quality	Unsuccessful
22	V	Completed within planned cost, time and quality	Successful
23	W	Completed within planned cost, time and quality	Successful
24	X	Completed within planned cost, time and quality	Successful
25	Y	Not completed within planned cost, time and quality	Unsuccessful
26	Z	Not completed within planned cost, time and quality	Unsuccessful
27	A1	Not completed within planned cost, time and quality	Unsuccessful
28	A2	Not completed within planned cost, time and quality	Unsuccessful

Projects evaluation result

Table 4: Projects Evaluation Results

Table 4 depicts the projects evaluation result based on cost of the project, time of project completion and quality of work delivered. It could be seen from the table above that majority of the project (43%) were not completed within planned cost, time and quality.

Interview conducted with end users

The interviews questions were designed to assess the satisfaction of end users on completed projects which was financed by tertiary education trust fund. The interviews carried out centered around structural stability of the project, satisfaction with the furniture's, mechanical and electrical services.

4.4.1 Structural stability: The study sought to understand what the respondents feel about the project structural stability through visual observaion. The end users were very satisfied regarding the structural stability. They felt confident occupy the facilities provided.

4.4.2 : Satisfaction with furniture's: Majority of the respondents affirmed that they are satisfied with types of furniture's provided for them. It further enhanced their work performance.

4.4.3 : Satisfaction with mechanical and electrical services: Information was sought regarding the satisfaction regarding mechanical and electrical services. The respondents affirmed that they are not satisfied regarding the toilet and electrical facilities provided at the project they occupy. They further stated that, no attempt was made to get their opinion before carrying out the project.

Conclusion

The study evaluated the tertiary education trust funds construction projects success from a stakeholders' viewpoints. The research sought the input of the project consultants, clients and end users regarding the project success. Results emanating from the study pointed out that, the delay in progress payment, escalation in price of materials, insufficient supply of materials and level of technical skill of the project leader are the topmost factors hindering projects success. Again, furniture, structural stability and ventilation were the highest ranked to be satisfactory by end users. Furthermore, most of the project were discovered not be successful. The study recommends that there should be a synergy between the various stakeholders involved

from project inception stage to project completion stage.

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Sawdust Types Effective as Partial Replacements of Fine Aggregate in Concrete

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Abstract

The paper examined the types of sawdust suitable as partial replacements of fine aggregate in concrete. Two different types of sawdust sourced from Afara and Doka wood species were used for the experiment. DoE Method was used to design and produce three sets of concrete cube samples, i.e. Control concrete, Doka sawdust concrete and Afara sawdust concrete, each of grade 20. The cubes were subjected to compressive strength and water absorption tests. The result showed that, the control concrete, Doka and Afara sawdust concretes gained a compressive strength of 22.6 N/mm^2, 19.6 N/mm^2 and 17.6 N/mm^2, respectively. The control and Doka sawdust concretes exhibited low water absorption when compared with Afara sawdust concrete. This revealed Doka sawdust as more suitable than Afara sawdust for partial replacement of fine aggregate in concrete.

***Key Words**: Concrete, Sawdust, waste recycling.*

Introduction

Overall relevance of concrete in virtually all civil engineering practice and construction work cannot be over emphasized (Adewuyi & Adegoke, 2008). Concrete is a combination of cement, fine and coarse aggregates and water (Agbede & Menessh, 2009). The construction industry relies heavily on these materials for the production of concrete. The availability of river sand for the preparation of concrete is becoming scarce due to non-scientific method of mining the river beds (Mageswari & Vidivelli, 2010).

The consumption of sand as fine aggregate in concrete production is very high and several developing countries have encountered some challenges in the supply of sand in order to meet the increasing need of infrastructural development in recent years (Divakar, Manjunath & Aswath 2012). Therefore, the depletion of fine aggregate is a challenge to engineers and researchers to seek and develop new material relying on renewable resources or locally available materials (Murali & Ramkumar, 2012). Some of these local materials are industrial or agricultural wastes which include sawdust, coconut and palm kernel shells among others.

Sawdust is an industrial waste in the timber industry which constitute nuisance to both health and environment when not properly managed (Elinwa & Abdulkadir, 2011). The use of sawdust as substitution for natural sand might be the right choice as an aggregate in concrete. It can considerably reduce dumping problem and simultaneously helps in the preservation of natural aggregate. In Nigeria, some of the common wood species that are used for various construction works from which sawdust is generated are Afara *(Terminalia Superba)* and Doka *(Melicia Excelsa)* (Kayode & Ogunwole, 2011). This paper assessed the influence of Doka and Afara sawdust as partial replacement of fine aggregate in concrete

Materials and Methods

The binder used for this research was ordinary Portland cement (Dangote brand). Natural river sand of 2.36 mm maximum size and crushed granite stone of 20 mm maximum size were used as fine and coarse aggregates respectively. Clean tap water fit for drinking was used for mixing the materials. The two different types of sawdust (Doka and Afara Sawdust) were obtained from local timber cutting shed in Zaria. The sawdust was sieved, washed and dried under sun before use. Cement, sand,

coarse aggregate and water used were in conformity with BS EN 197-1 (2011), BS EN 12620 (2013) and BS EN 1008 (2002), respectively.

Mix Proportion

DoE method of mix design was used to determine the mix proportions that were used for the production of concrete samples. The mix proportions are presented in Table 1.

Table 1: Mix Proportion of Concrete Samples

Concrete Samples	Cement Kg/m^3	Sand Kg/m^3	Doka wood Sawdust Kg/m^3	Afara wood Sawdust Kg/m^3	Coarse aggregate	Water content Kg/m^3	W/C ratio
Control	383	766	-	-	1390	191.5	0.5
Doka Sawdust Concrete	383	612.8	153.2	-	1390	191.5	0.5
Afara Sawdust Concrete	383	612.8	-	153.2	1390	191.5	0.5

Samples Preparation

Three sets of grade 20 concrete (Control; 20% Afara sawdust; and 20% Doka Sawdust) were produced. The 20% Doka and 20% Afara Concrete samples were produced by replacing 20% of fine aggregate. Cube molds of 100 x 100 x 100 mm were used to produce the concrete samples. After curing up to 28 days, the samples were tested for compressive strength and water absorption.

Results and Discussion

Physical Properties of Aggregates

Table 2: Physical Properties of Aggregates

Property	Fine Aggregate	Coarse Aggregate	Doka Sawdust	Afara Sawdust
Specific Gravity	2.7	2.55	1.2	1.25
Bulk Density	1585 kg/m^3	1540 kg/m^3	640 kg/m^3	365 kg/m^3
Water Absorption	2.5%	1.67%	2.7%	2.85%

Table 2 present the physical properties of fine and coarse aggregates; and Doka and Afara sawdust. It can be seen that, the fine and coarse aggregates have densities of 1585 kg/m^3 and

1540 kg/m^3 respectively, which fall within the range of normal aggregate (1520-1680 kg/m^3) as classified by Mehta and Monteiro (2014). The Doka and Afara Sawdust have densities of 640 kg/m^3 and 365 kg/m^3 which fall within the category of light weight aggregate (< 1120). In terms of water absorption, fine aggregate, coarse aggregate, Doka and Afara sawdust have water absorptions of 2.5%, 1.67%, 2.7% and 2.85% respectively. This means that, Doka and Afara sawdust have higher water absorption than fine and coarse aggregates.

Compressive Strength

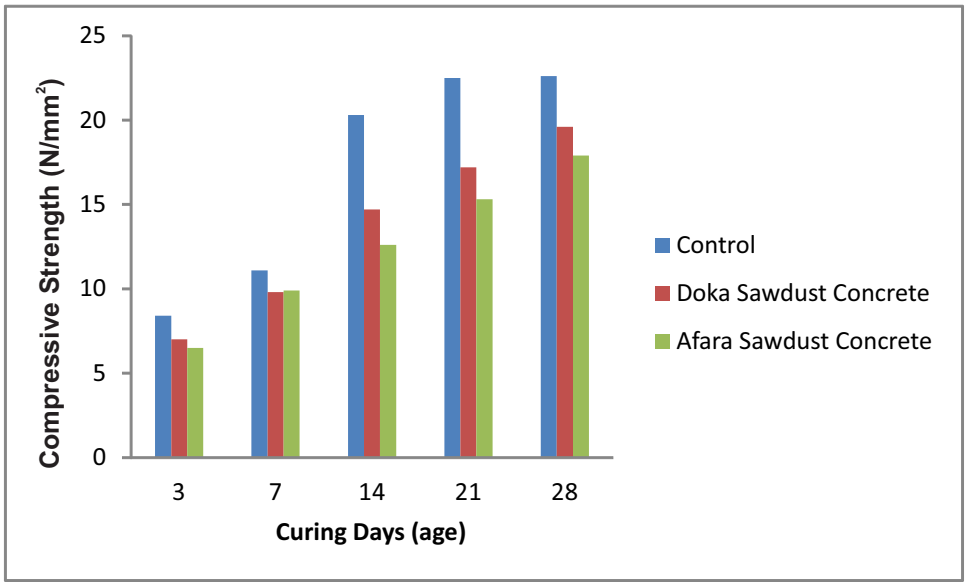

Figure 1. Compressive strength of the Concrete Samples

Figure 1 shows the compressive strength of the concrete samples. It is clear hat, the compressive strength of the concrete samples increased with age. However, the control concrete shows higher strength than Doka and Afara sawdust concrete samples. But the Doka sawdust concrete compares with that of control concrete. At 28 days the control concrete has a compressive strength of 22.6 N/mm^2 while the Doka and Afara sawdust concrete samples have compressive strengths of 19.6 N/mm^2 and 17.9 N/mm^2 respectively. This means that, the control concrete has higher compressive strength than Doka and Afara sawdust by 13.3% and 20.8% respectively. The variation in compressive strength could be attributed to the density of the sawdust as presented in Table 2.

Water Absorption

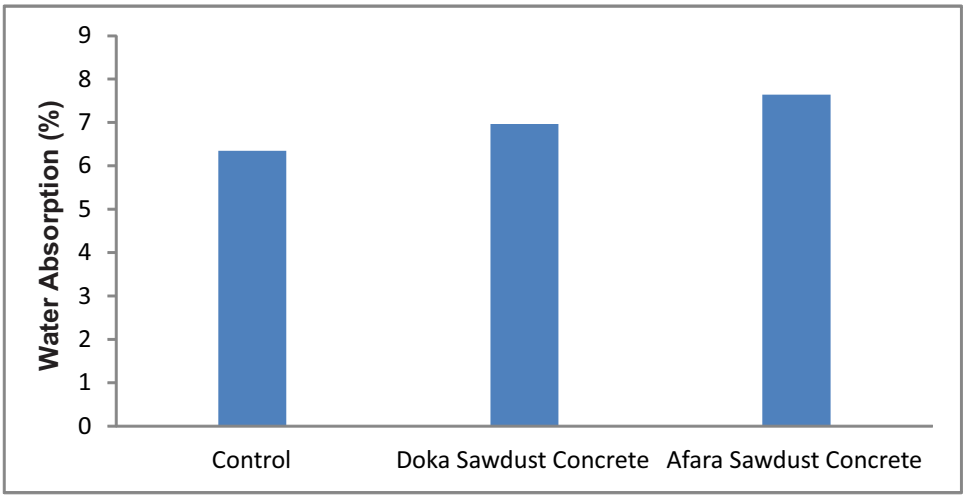

Figure 2. Water Absorption of Concrete Samples

Figure 2 present the water absorption of the concrete samples. The control concrete, Doka and Afara sawdust concrete samples have water absorption of 6.35%, 6.97% and 7.61% respectively. Afara Sawdust concrete samples have higher water absorption than the control concrete and Doka sawdust concretes by 17.42% and 9.36% respectively. This could be attributed to high water absorption capacity of the Afara Sawdust.

Conclusion

Experimental confirmation of sawdust types suitable as partial replacements for fine aggregate in concrete was done by subjecting concrete cubes to compressive strength and water absorption tests. The optimum level of fine aggregate replacement by sawdust in concrete was 20%. Doka sawdust was more suitable than Afara sawdust as partial replacement of fine aggregate in concrete as it showed higher strength and low water absorption when compared with Afara sawdust concrete.

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