

**GREEN BUILDING PROJECT MANAGEMENT FOR SUSTAINABLE
DEVELOPMENT IN ABUJA, NIGERIA: CHALLENGES AND PROSPECTS**

BY

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2016/1/63737TI

**DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA,
NIGER STATE**

APRIL, 2023

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF INDUSTRIAL
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TECHNOLOGY EDUCATION**

APRIL, 2023

DECLARATION

I, Abayomi David O. with matriculation number 2016/1/63737TI an undergraduate student of the Department of Industrial and Technology Education certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other University.

Abayomi David O.

2016/1/63737TI

Signature & Date

CERTIFICATION

This project has been read and approved as meeting the requirements for the award of B. Tech degree in Industrial and Technology Education, School of Science and Technology Education, Federal University of Technology, Minna.

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External Examiner

Signature/Date

DEDICATION

I dedicate this work to God Almighty for his faithfulness and for sustaining to life despite all odds and his divine and constant guidance and also Mr. Bunmi Abayomi & Mrs. Tayo Abayomi, and to my amazing siblings, Temitope Abayomi and Tofunmi Abayomi for their constant support.

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ABSTRACT

This study investigated green building project management for sustainable development in Abuja, Nigeria. It assessed the challenges that green building project management faces and means for prospects on sustainable development. Three research questions and two hypotheses tested at 0.05 level of significance for the study. A survey research design was adopted for the study. The population consist of 108 building professionals in Abuja, 53 with a 3-5 years working experience and certification and 55 with a 5 year and above working experience and certification. A 4-point scale 30 items questionnaire validated by three (3) lecturers from the Department of Industrial and Technology Education, Federal University of Technology Minna was used for data collection. Mean, standard deviation and t-test statistical tool (SPSS) were used for data analysis. Results reveals that certain factors are hindering the development of green building in Abuja. It also reveals that there is level of sustainability of green building development in Abuja is inadequate. Furthermore, there is no significant difference between the mean response of building professionals with 3-5 years working experience and certification on green building development hindered by some challenges in Nigeria built environment and there is no significant difference between the mean response of building professionals with 5 years and above working experience and certification on the perceived level of adoption and sustainability of green building practices in the construction projects. It is therefore concluded that taking into consideration the huge environmental impact of conventional buildings, the need for adoption of green building practices in the study area was examined and factors are identified as hindrances to the sustainable development of green building in project management. Furthermore, there is a new to improve the level of adoption of green building practices into construction project. Hence, it is recommended that full establishment of Green Building Council of Nigeria (GBCN) that will be responsible for awareness creation, introduction of guidelines, tools and techniques that will drive green building practices for future project.

TABLE OF CONTENT

	Pages
Cover page	i
Title page	ii
Declaration	iii
Certification	iv
Dedication	v
Acknowledgement	vi
Abstract	vii
Table of content	viii
List of Tables	xi

CHAPTER ONE: INTRODUCTION

1.1 Back ground of the Study	1
1.2 Statement of the Problem	5
1.3 Purpose of the Study	6
1.4 Significance of the Study	6
1.5 Scope of the Study	7
1.6 Research Questions	7
1.7 Hypothesis	7

CHAPTER TWO: LITERATURE REVIEW

2.1 Green building development and hindrances	9
2.2 Concept of green building in construction project	12
2.3 Green building for environmental sustainability	18

2.4 Summary of literature review	24
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CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Design of the Study	26
3.2 Area of the Study	26
3.3 Population of the Study	27
3.4 Sample and Sampling Technique	27
3.5 Instrument for Data Collection	28
3.6 Validation of the Instrument	28
3.7 Administration of the Instrument	29
3.8 Method of Data Collection	29
3.9 Method of Data Analysis	29

CHAPTER FOUR: RESULT AND DISCUSSION

4.1 Research Question I	31
4.2 Research Question II	32
4.3 Research Question III	33
4.4 Hypothesis I	34
4.5 Hypothesis II	35
4.6 Findings of the Study	36
4.7 Discussion of Findings	36

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Study	38
5.2 Implication of the Study	38
5.3 Contribution to Knowledge	39
5.4 Conclusion	39
5.5 Recommendation	40
5.6 Suggestion for Further Studies	41
REFERENCES	42
APPENDICES	46

Tables	LIST OF TABLES	Pages
3.1	Population of study	27
4.1	Mean response on the factor that are hindering green development in Abuja, Nigeria.	31
4.2	Mean response on the level of sustainability of green building development in Abuja, Nigeria.	32
4.3	Mean response on the perceived level of adoption of green building practices in construction project.	33
4.4	t-test analysis of the building professionals with 3-5years working experience and certificate (qualification).	34
4.5	t-test analysis of the respondents of building professionals with 5years and above working experience.	35

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Over the years, there has been a growth in population in many parts of the world and this has put pressure on the availability and consumption of natural resources. The increase in the population also has an impact on environmental degradation and has become a popular catchphrase in the contemporary discourse (Mensah, 2019; Webber & Sciubba, 2019).

Buildings are used in a variety of ways. Prominent among these uses are residential, commercial and industrial. Residential use provides accommodation for living; commercial uses can be office, shops and other trading premises; while industrial uses are factories, warehouse accommodation for production and assemblage purposes (Maja & Ayamo, 2021; Subramanian, 2018). Regardless of the building type, size and use as well as statutory regulations, they often have a significant negative impact on the natural environment (Oladokun, T.T., Gbadegesin, J.T. & Ogunba, O. 2019). While buildings provide countless benefits to society, they also have significant environmental impacts on the society.

There has been increasing demand for the exploration of natural resources, which has created associated impact and forced the stakeholders concerned on the need to evolve ways to mitigate the associated effects. This can be seen in the form of green building (Dania et al., 2019; Cole, 2019) that adopts the concept of sustainable construction through which buildings are constructed; by using clean and resource-efficient measures, gotten from the extraction of raw materials to component disposal in the construction industry (Ojo et al., 2021).

Green building concept has been gaining more popularity in the developed world to serve as a standard to lessen the environmental impact of not only existing building stock but also in the constructions of new ones (David, O.N. & Olabode, E.O. 2015). Green building design and construction describes the practice of using resources more efficiently while creating healthier and more energy efficient buildings. “Green or sustainable buildings use key resources like energy, water, materials, and land more efficiently than buildings that are just built to code. With more natural light, and better air quality, green buildings typically contribute to improved productivity, health and comfort of people and environment.

Green building has also been characterized as building with a conscious effort to minimize negative and emphasize positive impacts on both the indoor and outdoor environment. It touches all aspects of the building process from demolition, design, site placement, construction, renovation, operation, and maintenance. The components of green building are energy efficiency and renewable energy; environmentally preferable building materials and specifications; waste reduction; toxins reduction; indoor air quality; and smart growth (development and conservation strategies that protect the natural environment and make communities more attractive, economically stronger and more socially diverse.

The ideas and plans instituted by these world events have inspired actions by many countries to implement and incorporate sustainability principles within their built industry (David, O.N. & Olabode, E.O. 2015). The Brundtland Report, along with other reports and commissions that followed, created an organizational context in which the practices of green building could become not just accepted, but implemented in the developed and developing world (Oladokun, T.T., Gbadegesin, J.T. & Ogunba, O. 2019), noted that it was not only the wider global awareness of the need to change the way we build our cities that has allowed green building practices to move from

a little-known concept, but advocated mainly by environmentalists, more towards the mainstream. It was also the greater understanding that built environments have a huge impact on the ecological health of the planet and on the personal health of individuals and communities, and that we have a direct ecological stake and economic interest as well as a social responsibility to protect these endowments well into the future.

However, the critical question that needs to be addressed is whether the increased pace in the adoption and practice of green building practices in the developed world can be inculcated into sustainable real estate development in the developing country like Nigeria. In other words, the consumer's acceptance, patronage and practices of green building in the construction industry in Nigeria is fundamental to its success and thus, demands more thorough studies to ensure that resources are well deployed, rather than misused, in sustainable real estate development and management.

Furthermore, a glimpse of industry-based reviews and perhaps a handful of academic researchers (Oladokun, T.T., Gbadegesin, J.T. & Ogunba, O. 2019, Otegbulu, A.C., 2011, Otegbulu, A. C., Osagie, J.U., & Afe Y.O. 2011, David, O.N. & Olabode, E.O. 2015) have conducted studies to substantiate the need for either the practices or establishment of green building system. The negative environmental impact of buildings on the environment has led to a clamour for improved practice. The challenge of implementation of ecological principles to the entire construction projects lifecycle is as a result of such clamour and it has been linked to the evolution of a relatively new and evolving concept termed "green building". Green building has been recognized as an essential practice for improving negative environmental outcomes of buildings.

The building sector has been accounted to be responsible for about 25- 40% of energy usage, 30-40% of material resources consumption, 30-40% of waste production and 30-40% of greenhouse

gases released to atmosphere globally (Umar and Khamidi, 2019). It is further revealed that about 30% of recently built or retrofitted buildings suffer from sick building syndrome which in turn exposes occupants to unhealthy environmental conditions. However, the imperative of environmental performance of building calls for systems that can assess the environmental impact of buildings.

Green building rating systems are developed to prevent the above problems from occurring. Also, different sustainability and green building literatures (Ali and Al Nsairat, 2009; Portalatin, et al. 2010; Adegbile, 2013) have documented further benefits of green building rating systems in terms of raising awareness of buildings negative environmental impact to players in design and construction sectors; setting benchmarks for building environmental practices to safeguard the minimum performances standard; inspiring new designs, ideas and technical solutions; creating healthier and more productive places, and reducing building operations cost. Some of these benefits could also be harnessed in construction projects in Nigeria if green building rating systems and practices were to be integrated into our construction system.

Fortunately, construction professionals are gradually becoming aware of the concepts of green building principles. Several studies (Ameh, Isijiola and Achi, 2019; Nwokoro and Onukwube, 2011; Abolore, 2012 and Waniko, 2021) on sustainability have been conducted in Nigeria by some researchers. These studies focused in assessing the level of awareness of green building practices and its accruable benefits in construction projects in Nigeria. A recent study of (Waniko, 2021) also revealed that construction professionals are aware of green building concepts and rating systems but do not have a documented corporate philosophy for dealing with green building issues in their organizations. These results suggest a nonexistence of rating system for implementation of green building principles in projects, which is a cause for concern. The ideas and plans instituted

by these world events have inspired actions by many countries to implement and incorporate sustainability principles within their built industry. Subset to this principle is green building. However, through green building concept the construction industry can contribute in a positive and proactive manner to environmental protection.

Numerous studies (Udechukwu and Johnson 2008; Nwokoro and Onukwube 2011; Otegbulu 2011; Abolore 2012 and Adegbile 2013) on sustainability and in particular green building have been conducted in Nigeria by some researchers. Studies of Nwokoro and Onukwube (2011) has assessed the current practices and challenges of sustainable construction, Otegbulu (2011) analyzed the effects of green design on environmental sustainability including its implication and occupier's preferences with respect to building components and services to ascertain the level of their appreciation of green elements. Wherein, the study found that Nigerians are not green conscious in building design and environmental management. Abolore (2012) compared the perception of the building professionals/developers of sustainability in building construction industry in Nigeria and Malaysia. A similar study by Udechukwu and Johnson (2008) suggested that adherence to green principles of design increases the bottom line of economic, environmental and human value. Furthermore, Adegbile (2013) study proposed a green building rating system applicable to Nigerian construction industry.

1.2 Statement of the Problem

The background suggests that not much attention is given to green building project management. The findings from the study of green construction in Nigeria conducted revealed that important factors considered for sustainable construction include quality of working conditions, strengthening and enforcement of relevant laws and regulations, and design for flexibility and adaptability.

Therefore, the problem is this: green elements carried out revealed that incidences of flooding, loss of property, and poor electricity were traced to unsustainable building design. This study adopts cost effectiveness and environmental technology; effective use of existing landscape; efficient use of water; use of recycle and environmentally friendly building materials; use of energy efficient and eco-friendly equipment and careful orientation; low energy lightening design; quality indoor air for human safety and comfort as green building indicator in its investigation to determine general level of awareness of green building practices.

1.3 Purpose of the Study

The main purpose of study is to determine the challenges and the way forward for sustainable development of green building project in Nigeria, specifically, the study intends to:

- I. To determine the factors that are hindering green building development in Abuja
- II. To determine the sustainability of green building development in Abuja
- III. To determine the perceived level of adoption of green building practices in construction project

1.4 Significance of the Study

The study is aligned to previous research (see Ali and Al Nsairat 2009; Adegbile 2013) and provides further evidence that the knowledge base of built environment professionals is on the increase. It can be inferred from the results of this study that the more knowledgeable the built environment professionals are the more the adoption of green practices in construction projects in Nigeria. Implication of these findings for policy makers in government and practitioners is in the full development of assessment scheme for rating buildings.

This study will be of great importance to the following groups, clients and practitioners. Green building is thus embraced to prevent the negative impacts of buildings and structures on the built

environment. These impacts are felt in four broad areas. First, impacts related to the aspects of built environment include siting, design, construction, operation, maintenance and renovation. Second, the impact is in form of the consumption of energy, water, materials and natural resources. Third, building generates environmental effects such as waste, air pollution, water pollution, indoor pollution, heat islands, storm water runoff and noise. Lastly, the ultimate effects of building activities result in being harmful to human health, environment degradation and loss of resources. Taking into consideration the huge environmental impact of conventional buildings, the need for adoption of green building practices in the study area was examined. However, if stakeholders in the built environment in Nigeria cannot identify with the need for green features and are not particularly interested in adopting green features in their daily practices, the idea of green building may only remain a myth in Nigeria.

1.5 Scope of the Study

This study is delimited to the green building project management; challenges and the way forward for sustainable development in Abuja Metropolis. Many individuals and organization in the construction industry, contractor, and consulting firms including clients, will benefit enormously from this research work. This because a solution will be found at the end to the challenges that hinders the sustainable development.

1.6 Research Question

1. What are the factors that are hindering green building development in Abuja?
2. What is the level of sustainability of green building development in Abuja?
3. What is the perceived level of adoption in green building practices in construction project?

1.7 Hypothesis

The following null hypothesis were formulated at 0.05 level of significance.

H0₁ There is no significant difference between the mean response of building professionals with 3 – 5 years working experience and certificate (qualification) on green building developments hindered by some challenges in the Nigerian built environment.

H0₂ There is no significant difference between the mean response of building professionals with 5 years and above working experience and certificate (qualification) on the perceived level of adoption and sustainability of green building practices in construction project.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews the related literature under the following subheadings:

- Green Building: Developments & Hindrances
- Concepts of Green Building in Construction Projects
- Green Building for Environmental Sustainability

2.1 Conceptual Framework

Construction of green building entails tailoring a building and the site to the local climate, site conditions, cultural and community in order to reduce resource consumption, augment resource supply, and enhance the quality and diversity of life, while optimizing all these in an integrated design. In other words, it is a total quality management approach to building so as to ensure the achievement of synergistic design through interdisciplinary teamwork (D Dahiru, K Bala and AD Abdul'Azeez 2013); it is neither, an assemblage of environmental components nor a piecemeal modification of an already designed standard building, rather, it is a building philosophy in which natural and resource efficient features are incorporated in a building.

To achieve synergy in green building, all the professionals that would be involved in the planning, design and construction of such building must be brought early (at the design stage), for professional input in the design of green building from the beginning to undertakes Site Analysis and Environmental Impact Assessments (D Dahiru, K Bala and AD Abdul'Azeez 2013). Every project or development comes with its unique benefits, challenges and factors that hindered its success; Green Building developments in Nigeria are not an exception. “To be sustainable, buildings should usefully last for many generations. This requires some knowledge of the future

climate and the resources available to maintain the operations, in particular the energy consumption, of buildings”. This practice is a two-three decades old trend, but with insufficient data about the costs and absence of measured building performance data from currently operating sustainable designed buildings. Industry professionals, in both the design and construction disciplines, are generally slow to change, tend to be risk-adverse, lack sound knowledge, experience, and understanding of how to apply ecology to construction design; moreover, environmental or economic benefit of some Green Building approaches has not been scientifically quantified.

Lisa and Morris (2004); opined that the first question often asked about sustainable design is: what does “green” cost? Typically meaning does it cost more? This raises the question: more than what? more than comparable buildings? more than the available funds? Or more than the building would have cost without the sustainable design features? The answers to these questions have been thus far elusive, due to the lack of hard data. Morris (2007); argued that “The most common reasons cited in studies for not incorporating green elements into building designs is the increase in first cost”.

While report in 2007 stated that “there is no one size that fits all answer to the question of the cost of green”. However, the appreciation of the significance of non-technical issues has grown, giving recognition to Economic and Social sustainability concerns as well as Cultural heritage of the building environment as being equally important and provide further challenges. Many housing estates developments in the Abuja FCT, Nigeria do not reflect the desired housing needs of the end-users, the developers’/ clients’ lack of comprehensive data about the financial obligations with regards to incorporating green features into renovation or proposed projects which has impact on the total development cost which in turn affects end-users / occupants in terms of rental value,

sales value, envisaged savings due to green elements, Future asset value of the green building etc. (Salisu Gidado Dalibi, Hadiza Balarabe and Jamilu Bala MaiAuduga 2016)

Incompatibility of interests amongst stakeholders caused conflicts and disputes in construction. Incorporating the various interests of stakeholders should be extremely important for the preparation of green specifications, construction and maintenance. Green building projects design and construction is new in Nigeria and is characterized by the problem of lack of shared perception and agreement on the objectives and success/failure of the green building projects by stakeholders (Salisu Gidado Dalibi and Hassan Ali Kumo 2016); also different set of criteria for success/failure for the project (Kumo, Hassan Ali 2012). As such, each stakeholder perceives the success according to a hierarchy of dimensions, which comply with their personal agenda. The initial emphasis of sustainability was on technical issues such as materials, building components, construction methodologies and energy related design concept.

However, recognition of Economic and Social sustainability concerns as well as cultural heritage of the built environment as being equally important (Abolore, A.A. 2012). Sustainable world progress is dependent upon continued Economic, Social, Cultural, and Technological progress. These four main factors; Economic, Social, Cultural and Technological factor, each of which is found to have a significant effect towards adopting Green Building Technology. The awareness of green building by the general public will form the market-driven power for such developments especially in the urban area. Nevertheless, the difficulties include: Lack of basic data of using Green Building assessment system, Lack of professionals, Lack of interest from real estate developers and Difficulty of having a unified green building assessment standard.

Building materials have been playing an important role in the construction industry, no field of engineering is conceivable without their use (Udosen, J. U., & Akanni, P. O. 2010). The cost of

building materials poses a significant threat to both the construction industry and people aspiring to own houses. The setback witnessed in housing efforts in Nigeria was hinged on the high cost of imported materials used for construction. A report of UNCHS (1993) found that building materials remain the most significant input in project development; with green buildings, most of the material components are not locally produced or manufactured in Nigeria e.g., solar panels, switchable glazing, water conserving appliances and grey water systems etc.

SOME HINDRANCES TO GREEN BUILDING DEVELOPMENTS

- i. Technical know-how (Green Building requisite knowledge among the built environment professionals & the scarcity of Green Building certified professionals)
- ii. Lack of green building cost data and other performance related data.
- iii. The perception of green building as an expensive concept (perceived increased cost for incorporating Green Building features)
- iv. Green Building as a new change (which comes with its associated risks)
- v. Cultural, Economic, Social and Technological (CEST) barriers.
- vi. Divergent interests and views of success factors and success criteria of Green Building developments among stakeholders.
- vii. Green Buildings awareness.
- viii. Lack data for using Green Building assessment systems.
- ix. Lack of Locally or a single unified/standard Green Building assessment system.
- x. In-availability of local Green Building material and other components and high cost of imported Green Building materials.

2.2 Concepts of Green Building in construction project

Various studies on green building have used various terminologies to denote the concept of green building. Green building involves the practices that reduce the environmental impact of components of the built environment which include: green building, green architecture, sustainable building, high performance building and low impact development. This is clearly supported by the assertion presented in Fischer (2019). The study points out the differences in meaning ascribed to green building from standard practices to those aimed at environmental impact. Fischer (2019) views green building as integrated building practices that significantly reduce the environmental footprint of building in comparison with standard practices. In a similar vein, Ahn, Pearce, Wang & Wang (2019) termed green building as healthy facilities designed and built in a resource efficient manner, using ecologically based principles. Another definition describes green building practice as a process to creating buildings and infrastructure in a way that minimizes the use of resources, reduce harmful effects on ecology and create a better environment for occupants.

Other definitions as given by Kamana and Escultura (2011) define green building or sustainable building as an outcome of a design which focuses on increasing the sufficiency of resource use: energy, water and materials while reducing building impacts on human health and environment during the building's lifecycle through better location, design, construction, operation, maintenance and removal. Pan, Dzung and Yang (2011) added that a green building is an outcome of a design philosophy which focuses on increasing the efficiency of resource use. Thus, it can be deduced from the definitions, that green building is a form of practice(s) in which buildings are designed and built without causing environmental degradations throughout the entire building lifecycle exhibiting high level of environmental, economic and social performance. However, the potential for improving the environment by harnessing the expertise and practices available in built

environment makes green building a viable option. These definitions of green building are in line with the way green building is used in the present study.

The concept of green building has been adopted by many nations as a viable option of preserving resources and sustaining the environment (Samer, 2013). Documentations on green building suggest that green building has been used worldwide and according to Reed, Bilos, Wilkinson, and Schulte (2019) developments on green building practices are traceable to UK's Building Research Establishment (BRE) that pioneered the first assessment scheme called Building Research Establishment Environmental Assessment Method (BREEAM) in the year 1990 followed by USA Green Building Council's Leadership in Energy and Environmental Design (LEED) in 1996. As this concept has taken a global phenomenon, most developed and developing countries have resulted in adopting it of which Nigeria is no exception. Nwokoro and Onukwube (2011) study identified the prevailing laws promulgated by Federal Government of Nigeria to safeguard the Nigerian environment. These laws include: Federal Environmental Protection Agency Act of 1988 (FEPA), National Policy on Environment (NPE) of 1989 and Environmental Impact Assessment Act of 1992 (EIA Act).

Also, there were concerted efforts by professional bodies and private organizations indicating their commitments towards sustainable buildings. Shaba and Noir (2014) documented the existence of Green Building Council of Nigeria (GBCN) at prospective membership level with World Green Building Council. The report revealed that the newly established council is yet to produce any rating tool thus necessitating willingness by Green Building Council of South Africa (GBCSA) to allow the adoption of Green Star SA in rating Nigerian buildings pending when Green Building Council of Nigeria (GBCN) will establish and has the capacity to develop and operate its own

rating system. The concept of green building is advocated for use in building development and operations so that environmental degradation caused by building practices will be minimized.

Previous studies of (Augenbroe and Pearce, 2009; Zhang, Plattern and Shen, 2011; Nwokoro and Onukwube, 2011; Otegbulu, 2011) have identified major principles of green building. According of Augenbroe and Pearce, (2009) fifteen (15) elements of green building have been identified to include: energy conservation measures, land use regulations and urban planning polices, waste reduction measures, resource conservation strategies, indoor environmental quality, friendly energy technologies, re-engineering design process, proactive role of material manufactures, better measure and account for costs, new kinds of partnership and projects, adoption of incentive programs, education and training and recognition of commercial buildings as productivity assets. Also in Zhang, Plattern, and Shen (2011) some green building principles identified include: energy efficiency, water efficiency, material efficiency, indoor environmental enhancement as well as operations and maintenance optimization are categorized as principles of green building practice.

Furthermore, this study classifies green elements into two strategies of architectural (passive) and mechanical (active). Active strategy refers to building design that does not require mechanical equipment for heating or cooling, which deals directly with the building envelope (air permeability, exterior walls, doors, windows and roofing), how it is oriented in other to optimize solar gain and loss and thus reduce energy consumption and life time costs, the use of sustainability sources and low carbon emissivity while in contrast, active design strategy refers to the use of artificial mechanical or electric green technologies to heat, cool or light a space which may include air conditioning, artificial lighting, elevators, escalators, pumps and fans. Also, Nwokoro and Onukwube (2011) identify nine (9) elements that increase the sustainability of the built environment which include: energy efficiency, integrated design, indoor air quality, thermal

comfort, visual comfort, site sustainability, acoustic comfort, spatial comfort and building integrity.

The study of Otegbulu (2011) equally highlights eleven (11) dimensions of green design to include: energy and water efficiency, waste reduction, building operation, construction, maintenance, occupant health and productivity, storm water management, climate and environmental integration. However, there is similarity in the different principles of green building identified by the various researchers. A green building will not necessarily have all the above stated principles, since no building can be totally green (Otegbulu, 2011). Therefore, the study will adopt: energy efficiency; water efficiency; environmental and resource conservation; recycling and waste reduction; site sustainability; indoor air environmental quality, maintenance and building optimization in its investigation.

Data obtained represents the perspectives of stakeholders to adoptability of green building principles to construction projects in Nigeria. The realization of green building practice in the built environment has challenges, these challenges when mitigated would encourage sustainable practices in the built environment.

The aim of the study is to explore the situation of green building marketability and the business rationale of stakeholders to invest in the green building market. The results are similar to what was obtained by Ahn et al (2019) that was carried out in USA and Hong Kong. Studies indicate that the main barrier in achieving green building practices lied on the initial construction cost of green projects when compared to conventional building.

A related study on the Chinese construction industry by Zhang et al (2011) that surveyed the costs and barriers in applying the green elements to the process of developing property projects. Results

of this study indicated that there exist higher costs for green appliance design and energy savings material at the design stage. The nature of the barriers found out include: insufficient policy implementation effort, technical difficulty during the construction process, risks because of different contract form and site change practices and behaviour, unfamiliarity with green technologies which results in delays in the design and construction process. The study of Umar and Khamidi (2019) on the support for green building awareness initiatives in Malaysia was based on the public but not a profession issues.

The report revealed that although there are guidelines being developed for execution of green building concepts but there were some uncertainties in the application of the document as a result of unfolded sections that mitigate their achievement. This study advocated a shift in position in order to keep pace with the trend of development in the developed economies. The study of Alnaser and Flanagan (2019) which targeted policy makers, architects and contractors on the need of sustainable buildings construction in the kingdom of Bahrain is aimed to initiate sustainable construction on single issue of energy: photovoltaic and wind energy. The study revealed the most significant reasons why solar and wind energy are not forced to be integrated into buildings by policy makers. Barriers to this include: low cost of electricity; availability of oil and natural gas; solar and wind electricity are more economical if they are used for rural areas, while most of the buildings in Bahrain are close to the national grid facility.

Also other barriers include: lack of experience and knowledge of local engineers and technicians in solar and wind technology (installation and maintenance); absence of the awareness of public and investors on advantages of using solar or wind energy, especially when dealing with the cost of kWh as well as cost of each Watt from solar and wind electricity; no taxation system in Bahrain, especially in electricity consumption and its environmental sequences; absence of future strategic

plans, regulations and schemes to encourage the user to opt for sustainable building construction and initial cost of building-integration photovoltaic or wind energy.

On the part of architects, the study revealed that they possess no knowledge about the potentials of solar and wind energy and their cost implications compared to conventional electricity. Furthermore, the survey reported a high optimism by the contractors in adopting the technology by engaging subcontractors to overcome challenges.

According to Hankinson and Breytenbach (2012) that integrating green innovation into the built environment is a “mischievous” problem, which makes identifying of barriers as essential. This study pointed out that Stieg (2006) presented similar observations in referring to the practice of sustainable design as both difficult and complex. It further suggests that designers should understand the social and moral obligations associated with sustainable design while acknowledging that the practice of sustainable design presents various difficulties. Research conducted in the United States of America (USA) and Australia suggested that although there was interest in sustainable design, its frequency of application is poor (Hankinson and Breytenbach, 2012), these authors identified multiple barriers to incorporate sustainable design into practice. These include perceived cost and time to source materials, education and training, understanding and in-house experts. Studies also identified client resistance knowledge of materials, limited material selection and authenticity of suppliers along with understanding of the impact of materials, accurate and accessible information and appropriate tools.

Other barriers that were identified include: client demands, client knowledge and call backs from clients, accurate and accessible information and appropriate tools, recovery of long-term saving not reflected in service fee structure, potential extension of project schedule, insurance and liability problems with offering warranty on non-standard green materials or methods, conflicts of public

policy and/or regulations, and a lack of integrated work environments and communication among all construction stakeholders. The scientific and technological knowledge base for green building is also limited in Nigeria, which is not surprising given the recent origin of the discipline (Roy and Gupta, 2008; Ahn et al, 2019; Fischer, 2019). These barriers are relevant to the present study as this research explores all factors affecting adoptability of green building in construction projects in Nigeria.

2.3 Green Building for Environmental Sustainability

The sustainability concept was initially introduced by the World Commission on Environment and Development in its publication “Our Common Future”. According to the Brundtland (1987), sustainable development is defined as the idea that human societies must live and meet their needs without compromising the ability of future generations to meet their own needs. The basis of sustainability involves the use of renewable resources at a rate that does not exceed its rate of renewal and the use of non-renewable at a rate that does not exceed their substitution capacity.

Since human activities are increasingly becoming a significant concern to stakeholders because of their detrimental effects on the environment, interest in sustainability is growing. Sustainability is the development that satisfies the yearnings of people today without affecting the needs of people in the future. Therefore, a sustainable green building must satisfy the present and future needs of the people while achieving energy efficiency and reducing the impact on the built environment. Thus, as commendable as this is, some challenges inhibit the successes or achievements of having a building that satisfies the above objective. Nevertheless, the concept, which began in developed countries because of the desire to have a building different from conventional practice, is gradually being embraced in developing countries.

For a building to be efficient and effectively “green”, all stages of construction have to be considered to ensure that the materials and methods of construction adhere to certain specifications and criteria which must be met in a green building,

- i. Walls: These are several materials which can be used in constructing the walls of a building other than regular concrete or cement blocks, such as straw, rammed earth, glass, wood, etc.
- ii. Wood: Lumber is the primary structural component in homes. A material used for hundreds of years from log cabins to platform structures, this building technique is well understood using a renewable resource. Caution is warranted if considering timber use outside the bounds of sustainable harvesting. In extreme climates termites may be a problem or moisture failure to wood structures.
- iii. Straw: This is a natural material which can be collected from fields, they have insulation properties and they also help to control the heating of the interior of the building.
- iv. Roofing: Eco-friendly roofing products typically cost more than conventional roofs, but they last two to three times longer, saving you substantially over the long term. These benefits add value to your home, whether you stay there or sell it, and you are also helping promote a healthier and more sustainable world. Brown Roofs: Brown roofs, also known as biodiverse green roofs are a type of vegetated roof system designed specifically to provide a biologically diverse habitat for plants, animals, and insects. Brown roofs are installed in essentially the same way as green roofs but their growing medium is composed of recycled building materials, soil, and spoil from the site. Cool roofs, a cool roof is an alternative “green” roofing treatment that can also be used on buildings with flat roofs as well as on some with roofs that are too steeply sloped for plant material. A cool roof has

roofing material with a high reflectance to reflect heat. They are measured by their solar reflectance and the thermal emittance (the ability of the roof surface to radiate).

- v. **Air Conditioning:** Energy conservation, indoor air quality, and comfort are among the core green building issues encompassed by heating, air-conditioning and ventilation design. These interrelated systems can be complex, expensive to install, and costly to operate but green building also offers many opportunities to simplify and save costs in the long run. Central to this premise of thinking small are the many passive solar features built into a green house. HVAC design follows other fundamental building steps that can collectively reduce the size of the heating and cooling system by 30-50%. Solar orientation, insulation, window placement and design, even vegetation on the building site all directly affect heating and cooling loads. Designing a system based on real demand and not conventional practice is essential. Therefore, it is essential to incorporate this system at the design of the house, so as to fully account for all other components which can help to reduce the size of the air conditioning system required.
- vi. **Water Supply Systems:** Water efficiency is the smart use of our water resources through water-saving technologies and simple steps we can all take around the house. As residential, commercial, industrial, and other development expands, so does the use of the limited potable water supply, water that is suitable for drinking. Most buildings rely on municipal sources of potable water to meet their needs, from flushing toilets to washing dishes and landscape irrigation. High demand strains supplies and under extreme conditions necessitates water rationing. Furthermore, large amounts of wastewater can overwhelm treatment facilities, and the untreated overflow can contaminate rivers, lakes, and the water table with bacteria, nitrogen, toxic metals, and other pollutants. To avoid this

damage to the ecosystem, additional municipal supply and treatment facilities must be built, at public cost. In developed communities, water is supplied to all homes from a central storage through pipes laid underground, which can either be plastic or steel pipes. These pipes help to supply clean water to these houses as well as take away waste water and sewage back to the treatment plants. Also houses with treatment facilities can utilize rainwater by harvesting it and treating it before circulating it for house use.

THE NEED FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

Creating sustainable working environments is not just about reducing carbon emissions. Truly sustainable buildings should be designed to improve the wellbeing of the people who work in them and the communities that surround them. “Going green” is the phrase referring to corporate and individual action consciously taken to curb the harmful effects on the environment through consumer habits and lifestyles.

Access to clean modern energy services is an enormous challenge facing the African continent because energy is fundamental for socioeconomic development and poverty eradication. Today, 60% to 70% of the Nigerian population does not have access to electricity (Oyedepo, 2012). Security, climate change, and public health are closely interrelated with energy (Ramchandra, 2011). Future economic growth crucially depends on the long-term availability of energy from sources that are affordable, accessible, and environmentally friendly. The common Nigeria man does not understand the concept of “conservation of energy” and this is the guiding principle behind sustainability. That every home should be able to utilize energy, either water, air, electricity, etc. conservatively, without causing harm to the environment. The recent world's energy crisis is due to two reasons: the rapid population growth and the increase in the living standard of whole societies.

The per capita energy consumption is a measure of the per capita income as well as a measure of the prosperity of a nation (Rai, 2021). Energy supports the provision of basic needs such as cooked food, a comfortable living temperature, lighting, the use of appliances, piped water or sewerage, essential health care, educational aids, communication and transport. Energy also fuels productive activities including agriculture, commerce, manufacturing, industry, and mining. At present, environmental protection dominates as the primary objective of sustainable development (Anigbogu, 2014). In Nigeria today, most structures are constructed using cement-based materials. Cement during its manufacture and use is responsible for the emission of greenhouse gasses which are harmful to the environment. The production of cement also causes the depletion of non-renewable natural resources. The incremental rate of construction has pervaded most urban centres in Nigeria, with most of such buildings inhabited with the barest facilities in place (Olufunto and Olatunde, 2013).

Architects, planners, environmentalists and engineers should be oriented on issues such as energy consumption, use of environmentally friendly materials and design concepts that reduce environmental impacts and ensure sustainability. Energy and poverty reduction are not only closely connected with each other, but also with the socioeconomic development, which involves productivity, income growth, education, and health (Nnaji C et al, 2010). There are various problems which must be overcome before Nigeria can truly have a sustainable environment, some of them are talked about below.

A. **ENERGY SUPPLY:** Nigeria is the largest oil producer in Africa and is among the world's top five exporters of liquefied natural gas. Despite the relatively large volumes of oil it produces, Nigeria's oil production is hampered by instability and supply disruptions, while the natural gas sector is restricted by the lack of infrastructure to monetize natural gas that is currently

flared. It's important to note that estimates of traditional biomass consumption are imprecise because biomass sources are not typically traded in easily observable commercial markets. The electrification rate in Nigeria is estimated at 41%, leaving approximately 100 million people in Nigeria without access to electricity (U.S. Energy Information Administration).

- B. **WASTE MANAGEMENT:** There have been very little done by successive governments or relevant agencies with regards to environmentally sustainable waste disposal. Indiscriminate dumping of waste by individuals and government agencies is rife. Only in the past couple of years has the Lagos State Government developed and is implementing a waste management strategy. LAWMA has drastically helped to manage the disposal and transportation of waste in the state.
- C. **DESIGN AND BUILDING INNOVATION:** This requires special attention to extending green building to the many areas in Nigeria facing shortages in affordable housing, including those with climatic conditions or other circumstances that present unique challenges. Construction is a major and primary sector of the Nigerian economy and its consideration of the issues of sustainability covers a huge spectrum of the sector (Nwafor, 2006). Thus, the role buildings play is fundamental to the realization of sustainable development. The specific problem of creating sustainable shelter in sustainable human habitats is visible in both rural and urban centers of developing countries. Although sustainability is fast assuming a global trend, the position of architecture in actualizing the sustainable development goals in developing countries is not encouraging (Olufunto and Olatunde, 2013).

2.4 SUMMARY OF LITERATURE REVIEW

While the definition of what constitutes a green building is constantly evolving, there are many definitions for a green building that are widely used in the market place. Green building, green

architecture, sustainable building, high-performance building, and low-impact development are among the terms used to denote practices that reduce the environmental impact of components of the built environment. Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction.

This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is a sustainable building and an outcome of a design philosophy which focuses on increasing the efficiency of resource use, including energy, water and materials, while reducing building impacts on human health and the environment during the building's life cycle, through better siting, design, construction, operation, maintenance and removal. Thus, green building is a form of practice(s) in which buildings are designed and built taken into consideration Life Cycle Assessment (LCA) without causing environmental degradations throughout the entire building lifecycle while exhibiting high level of environmental, economic and social performance. It should also be noted that definition of green buildings will be both subjective and specific to taste and dictates of a geographic climate as the definition of green buildings is dominated by European and North American influences where the evidence of green practices is at least visible.

The critique and the review carried out on the green building rating system has shown that developmental processes through the construction of buildings, their associated life cycles, and the use of relevant technology products would negatively impact the environment around the world. Previous studies along these lines and the positions made by the World Green Building Council (WGBC) demonstrate this. This is clearly seen in the effects that the construction and use of buildings on the environmental, social, and economic indicators that determine the sustainability

process. Given the awareness of government and stakeholders around the world about unforeseen effects buildings could have on the environment, various green building rating systems were developed, and more are still joining the catalogue of those in existence

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Design of the Study

The research design to be adopted for this study is descriptive survey research design. Survey research is the process of carrying out qualified observation which involve asking of questions to sample the opinion of the public at large or one specific group. Therefore, this design is used by the researcher to assess thoughts and opinions of knowledgeable respondents on the assessment of the hindrances to green buildings and the way forward for sustainable development in Abuja, Nigeria.

3.2 Area of the Study

The study was conducted in Federal Capital Territory (F.C.T Abuja) which was formed in 1976 from parts of Nasarawa, Niger and Kogi State. The territory is bordered by the states of Niger to west and North, Kaduna to Northeast, Nasarawa to east and South and Kogi to southwest. It is lying between latitude 8.25° and 9.20° north of the equator and longitude of 6.45° and 7.39° east of Greenwich meridian. Abuja is home to a large number of construction companies, contractors, and suppliers that can provide the necessary resources, knowledge, and expertise to conduct the research. This allows for a comprehensive review of green building project management for sustainable development in Abuja: challenges and prospects in construction industry and the opportunities for improvement. Additionally, Abuja is located in a region with a strong and reliable construction companies, making it easier to access information in regards to green building in construction companies. Abuja is geographically located in the central region of the country.

3.3 Population of the Study

The research population comprises of 124 building professionals which consists of builders, architects, structural engineers, quantity surveyors and project manager in construction companies in FCT, Abuja.

Table 3.1

S/N	Building professionals	3-5yrs	5yrs & above
1.	Builders	11	13
2.	Architects	10	15
3.	Structural engineer	10	12
4.	Quantity Surveyors	12	15
5.	Project managers	10	16
	TOTAL	53	71
			124

3.4 Sample and Sampling Techniques

Simple random sampling is an extensively used sampling method in scientific research. Simple random sampling is selected for population which are highly homogenous where the members of the research are randomly selected to participate in the research (Bhardwaj, 2019). A random sampling technique will be used for the selection of the construction companies in the building construction industries.

3.5 Instrument for Data Collection

A comprehensive questionnaire was designed and administered to the respondents for data collection and analysis. To ensure consistency in respondent feedback, all questionnaires contain closed-ended questions. The instrument was designed to obtain responses from building professionals on green building project management for sustainable development in Abuja, Nigeria; challenges and prospects. The questionnaire is divided into two parts (I and II). Part I consist of respondents “personal data”, containing information about years of experience, qualification and part II is grouped into (A, B, C and D) Section A consists of 10 items which sought to elicit information on the extent of green building application at building construction companies in FCT, Abuja. Section B consists of 10 items which sought to elicit information on the benefits of green building at building construction companies in FCT, Abuja. Section C consist of 10 items which sought out elicit information on the challenges of green building in project management at building construction companies in FCT, Abuja. Section D also consist of 10 items which sought to elicit information on the way forward for sustainable development application in project management at building construction companies in FCT, Abuja.

3.6 Validation of the Instrument

The instrument was designed and constructed by the researcher. To ensure the validity of the instrument, it was validated by three lecturers from the Federal University of Technology Minna, Department of Industrial and Technology Education. They were asked to read the test items and offer criticism, suggestions, and make recommendations to ensure that the test captures the objectives of the test. The critiques, suggestions and recommendations on the validates were used to make final corrections on the instrument before it was administered to the respondents.

3.7 Administration of the Instrument

The questionnaire was administered by the researcher with the help of two research assistants. The research assistants were educated on the contents of the instrument. Concepts were explained and the standards of responses discussed. A total of 124 copies of the questionnaire were distributed and 108 copies (87%) were duly returned after two weeks and used for analysis.

3.8 Method of Data Collection

Data was collected using structured questionnaires with closed-ended questions using a four-point rating scale. The distribution and collection were done by the research assistants from the companies under the directive of the researcher.

3.9 Method of Data Analysis

The data collected by the researcher was analyzed using mean, standard deviation and t-test as statistical tools. A four-point rating scale was employed with the following response.

Alternative Value		Abbreviation	Rating
Strongly Agree	=	“SA”	4
Agree	=	"A”	3
Disagree	=	“D”	2
Strongly Disagree	=	“SD”	1

$$\frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$$

The mean response of each item was obtained by using the following formula

$$\bar{X}_1 = \frac{\sum FX}{N}$$

Where

Σ = Summation of

X = normal value of option (mean)

N = number of response of an item

F = frequency of response of each option

\bar{X}_2 = Grand mean of each item

Decision Rule

To determine the level of acceptance, mean response. 2.50 And above was considered agreed or accepted. While mean response of 2.49 and below was equally considered disagreed or rejected. For testing hypothesis ± 1.67 will be the critical value, any item that has its t- value equal or less than t- critical was considered not significant, and any item that has its calculated t- value above t- critical was considered significant.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter deals with the presentation and analysis of data with respect to the research questions formulated for this study, the result of this data analysis for the research questions are presented first, followed by those of the hypotheses tested for the study.

4.1 Research Question 1

What are the factors that are hindering green building development in Abuja?

Table 4.1: Mean response on the factors that are hindering green building development in Abuja
N₁=53 N₂=55

S/N	ITEMS	X ₁	X ₂	X _T	REMARK
1	Non-availability of local materials	3.30	2.98	3.14	Agreed
2	Lack of awareness by developers	3.08	3.00	3.04	Agreed
3	Lack of adequate research on green building	2.85	2.78	2.82	Agreed
4	Lack of adequate knowledge and technical	2.58	3.00	2.79	Agreed
5	Lack of interest in sustainable building	2.77	2.73	2.75	Agreed
6	Energy and environmental challenges	2.89	2.98	2.93	Agreed
7	High initial construction cost of green building	2.92	2.91	2.92	Agreed
8	enabling laws to promote its development	2.85	2.51	2.68	Agreed
9	High cost of imported green building materials	2.94	2.67	2.81	Agreed
10	Divergent interests and views of professionals in built environment	3.17	2.70	2.94	Agreed

KEY

X₁ = Mean of 3-5years

X₂ = Mean of 5years and above

X_T = Average mean of respondent

N₁ = Number of 3-5years

N₂ = Number of 5years and above

RMK = Remarks

The data presented in the Table 4.1 above shows that the respondents agreed with items 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, with a mean score above 2.50. this means that all items are the factors that are hindering green building development in Abuja

4.2 Research Question 2

What is the level of sustainability of green building development in Abuja?

Table 4.2 Mean response on the level of sustainability of green building development in Abuja
N₁=53 N₂=55

S/N	ITEMS	X₁	X₂	X_T	REMARK
1	Financial incentives	3.09	3.44	3.27	Agreed
2	Education on sustainability	2.60	2.51	2.55	Agreed
3	Design and operational sustainability	2.81	2.55	2.68	Agreed
4	Planning policy	3.32	3.51	3.41	Agreed
5	Green procurement	3.44	3.38	3.41	Agreed
6	Awareness of sustainable construction	2.74	2.58	2.66	Agreed
7	Improved enforcement	2.87	2.51	2.69	Agreed
8	Use of renewable energy	2.96	2.67	2.82	Agreed
9	Use of recycle building materials	3.19	3.26	3.23	Agreed
10	Data challenges	3.09	3.44	3.27	Agreed

KEY

X₁ = Mean of 3-5years

X₂ = Mean of 5years and above

X_T = Average mean of respondent

N₁ = Number of 3-5years

N₂ = Number of 5years and above

RMK = Remarks

The data presented in the Table 4.1 above shows that the respondents agreed with items 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, with a mean score above 2.50. this means all the items affects the level of sustainability of green building development in Abuja.

4.3 Research Question 3

What is the perceived level of adoption of green building practices in construction project?

Table 4.3 Mean response on the perceived level of adoption of green building practices in construction project
N₁ =53 N₂ =55

S/N	ITEMS	X ₁	X ₂	X _T	REMARK
1	Use of renewable energy	2.66	2.50	2.58	Agreed
2	Use of recycle building materials	3.30	3.44	3.37	Agreed
3	Use of existing landscapes	3.19	2.91	3.05	Agreed
4	Green building is thought to come at a high price	3.19	2.89	3.04	Agreed
5	Green building supplies are readily available locally	3.42	3.51	3.46	Agreed
6	Tendency to maintain practices	3.22	3.47	3.35	Agreed
7	Design and operational concerns	2.98	2.84	2.91	Agreed
8	Green building doesn't provide enough flexibility	3.04	3.04	3.04	Agreed
9	Lack of awareness	3.13	3.29	3.21	Agreed
10	Adequate orientation	2.66	2.50	2.58	Agreed

KEY

X₁ = Mean of 3-5years

X₂ = Mean of 5years and above

X_T = Average mean of respondent

N₁ = Number of 3-5years

N₂ = Number of 5years and above

The data presented in the Table 4.1 above shows that the respondents agreed with items 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, with a mean score above 2.50. this means the all the items affects the perceived level of adoption of green building practices in construction projects.

4.4 Hypotheses One

Table 4.2.1: t-test analysis of the respondents of building professional with 3-5 years working experience (qualification) on the green building development hindered by challenges in Abuja, Nigeria.

Hypothesis 1

S/N	ITEMS	SD₁	SD₂	T-test	REMARK
1	Non-availability of local materials	0.91	0.97	1.77	NS
2	Lack of awareness by developers	0.94	1.00	0.40	NS
3	Lack of adequate research on green building	0.84	0.88	0.41	NS
4	Lack of adequate knowledge and technical	1.08	0.94	-2.12	S
5	Lack of interest in sustainable building	0.97	0.95	0.25	NS
6	Energy and environmental challenges	0.64	0.85	-0.66	NS
7	High initial construction cost of green building	0.70	0.88	0.10	NS
8	enabling laws to promote its development	0.84	0.99	1.92	NS
9	High cost of imported green building materials	0.84	1.04	1.49	NS
10	Divergent interests and views of professionals in built environment	0.87	0.79	2.91	S

Table 4.2.1: presents test of this hypotheses

Key

SD₁= Standard deviation of male students

SD₂= Standard deviation of female students

S= satisfied

NS= Not Satisfied

The result shown in table 4.2.1 above indicates the respondents of building professional with 3-5 years working experience (qualification) on the green building development hindered by challenges in Abuja, Nigeria. Data revealed that items 1,2,3,5,6,7,8,9, has a calculated t-value less than the t-critical value of ± 1.98 , hence hypothesis for these items were upheld at 0.05 level of significance. Except for item 4 and 10 which has a t-calculated value above the t-critical value ± 1.98 , thus H_0 was not accepted for this items.

4.5 Hypothesis Two

Table 4.2.2: t-test analysis of the respondents of the building professional with 5 years and above working experience and certificate (qualification) on the perceived level of adoption of green building practices in construction project.

SN	ITEMS	SD ₁	SD ₂	T-test	REMARK
1	Financial incentives	0.93	0.98	-1.87	NS
2	Education on sustainability	0.73	0.99	0.55	NS
3	Design and operational sustainability	0.69	0.98	1.63	NS
4	Planning policy	1.03	1.09	-0.93	NS
5	Green procurement	0.49	0.99	0.36	NS
6	Awareness of sustainable construction	0.74	1.10	0.86	NS
7	Improved enforcement	0.83	0.90	2.15	S
8	Use of renewable energy	0.90	1.19	1.43	NS
9	Use of recycle building materials	0.65	0.99	-0.47	NS
10	Data challenges	0.93	0.98	-1.87	NS

Table 4.2.2: presents test of this hypotheses

Key

SD₁= Standard deviation of male students

SD₂= Standard deviation of female students

S= Satisfied

NA= Not Satisfied

The result shown in table 4.2.2 above indicates the building professional with 5 years and above working experience and certificate (qualification) on the perceived level of adoption of green building practices in construction project. Data revealed that items 1,2,3,4,5,6,8,9, and 10 has a calculated t-value less than the t-critical value of ± 1.98 , hence hypothesis for these items were upheld at 0.05 level of significance. Except for item 7 which has a t-calculated value above the t-critical value ± 1.98 , thus H_0 was not accepted for these items.

4.6 Findings of the Study

The findings of the study on green building project management for sustainable development in Abuja revealed the following:

1. **Lack of awareness and knowledge:** The study found that there was no awareness and knowledge about green building practices and sustainable development among the stakeholders in Abuja. This lack of knowledge and awareness was identified as a major challenge in implementing green building projects. Also limited local capacity as a challenge in implementing green building projects. The limited capacity was due to the absence of skilled personnel, including architects, engineers, builders, etc.
2. **High initial cost:** The study identified the high initial cost of implementing green building projects as a significant challenge. The high cost was attributed to the use of eco-friendly materials and technologies, which are more expensive than traditional building materials.

3. Regulatory challenges: The study found that there were regulatory challenges in Abuja, which hindered the implementation of green building projects. The regulatory challenges were mainly due to the absence of a comprehensive regulatory framework for green building practices.

4.7 Discussion of the Findings

Findings of the study revealed that the factors that are hindering the development of green building are the determinant to the implementation of green building practices in Abuja. It involves the use of environmentally responsible practices in the design, construction and operation of buildings to reduce the negative impacts on the environment (Alnaser and Flanagan 2019).

Abolore (2012) on the findings on green building project management for sustainable development in Abuja also stated that there is an interest in adopting green building practices in the region of Abuja. This is driven by the need to reduce the impact of buildings on the environment, improve energy and resource efficiency, and promote sustainable development.

The adoption of green building practices is still in its early stages in Abuja, with a limited number of projects that fully incorporate sustainable design principles industry (Ojo et al., 2021). However, the findings suggest that there is a growing awareness of the benefits of green building and an increasing number of projects that are incorporating some green features. Energy efficiency is a key component of green building project management. Building consume a significant impact on the environment and the operating costs. Energy efficient design features, such as improved insulation, efficient lighting and HVAC systems, can help reduce energy consumption and improve indoor air quality. David, O.N. & Olabode, E.O. 2015 identifies several barriers to the adoption of green building practices in Abuja, including the lack of awareness among stakeholders, the limited availability of green building professionals and materials, and the high cost of implementing green building practices.

D Dahiru, K Bala and AD Abdul'Azeez 2013 on green building project management is a critical element of sustainable development. It discussed the importance of integrated design, energy efficiency, material selection, water conservation and life cycle assessment in green building project management. By incorporating these practices, green building projects managers can help reduce the negative impacts on the environment.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Study

The essence of this study was to assess the challenges and prospects faced by green building project management for sustainable development in Abuja. Three research questions guided the study

1. What are the factors that are hindering green building development in Abuja?
2. What is the level of sustainability of green building development in Abuja?
3. What is the perceived level of adoption in green building practices in construction project?

Based on the data collected and analyzed for these research questions, the following findings were made;

1. Certain factors are hindering the development of green building in Abuja.
2. The level of sustainability of green building development in Abuja is inadequately low and inefficient.
3. The perceived level of adoption in green building practices in construction projects is not encouraging though it can be better.

5.2 Implication of Study

The findings of this study is of immense benefits to both building practitioners and the region's future development. The finding is a self-appraisal to building practitioners on project management on sustainable development in the aspect of green building. It can be inferred from the results of this study that the more knowledgeable the built environment professionals are the more the adoption of green practices in construction projects in Abuja. The challenges associated with limited awareness and lack of understanding of sustainability concepts among stakeholders,

limited financial resources and lack of regulatory frameworks. These challenges must be addressed to ensure the successful implementation of sustainable development in the region of Abuja. The adoption of green building practices can also help reduce the environmental impact of construction activities, improve energy, efficiency and promote the use of renewable energy sources. Moreover, the study can also inform future research efforts and guide the development of policies and regulations to promote sustainable development in Abuja.

5.3 Contribution of Knowledge

The study of green building project management for sustainable development in Abuja contributes to knowledge in several ways.

1. The findings help provides insights into the challenges and prospects of implementing sustainable development initiatives in Abuja. This knowledge can inform policymakers, industry stakeholders, and the general public in identifying the most pressing issues and potential solutions for promoting sustainable development in the region of Abuja.
2. The study sheds light on the importance of green building practices in achieving sustainable development. It highlights the benefits of adopting sustainable building practices, including reducing environmental impact, improving energy efficiency, and promoting renewable energy sources, among others. This knowledge can inform industry practices and guide the development of regulations and policies to promote sustainable building practices in Abuja

5.4 Conclusion

Conclusively, green building adoptability by the built environment professionals and clients can be enhanced by highlighting host of factors that will determine the adoption of green building practices to include: site sustainability, energy conservation, water efficiency, indoor air quality

and material conservation in construction projects. Building industry professionals had very good agreement on their ranking of the barriers of green projects and they perceived most of the barriers as limiting factors to the adoption of green practices. Professional bodies should train and educate their members on green principles to ensure awareness and knowledge of the practice. To maintain effective sustainable practice on projects, professionals need to attend seminars, conferences and training programmes to improve their knowledge of green design, construction, methods and techniques.

It was also discovered that most of the stakeholders in the built industry in Nigeria have relatively low level of awareness of the concept of green building in general. Though with this low awareness level, the respondents are of the belief that commercial green building uses energy efficiently and make use of eco-friendly equipment e.g., low energy consumption through use of natural ventilation rather than air-conditioning and uses renewable energy e.g., maximum use of natural day-lighting as opposed to conventional building.

Thus, raising awareness of green building rating systems and practices among construction professionals in construction projects has been linked to the better understanding of the goals of green building or sustainable development. The practice of green building should be embraced not only because of its humanity concerns and environmental legislation but also because of its capability to increase financial profit and long term competitiveness of building.

5.5 Recommendations

Based on the findings of this study and conclusion drawn, the following recommendations were made;

1. There is need to map out an effective system to attend to the factor that hinders green building project management for it sustainable development and introduce guidelines, tools or techniques that will drive green building practices for future project.
2. Monitor and measure sustainability performance: Regularly monitor and measure the sustainability performance of the project using metrics such as energy consumption, waste reduction, and material usage. This will help identify areas for improvement and ensure that the project is on track towards achieving sustainable development.
3. Collaborate with stakeholders: Involve all stakeholders, including contractors, suppliers, and local communities in the project. This will help create a shared vision for sustainability and ensure that everyone is committed to achieving sustainable development and also increase the level of adoption in green building practices.

5.6 Suggestion for Further Studies

The following areas for further study were also suggested:

1. Integration of green building practices into traditional project management methodologies.
2. Comparative analysis of green building project management practices in different countries.
3. Evaluation of the impact of green building project management on sustainability outcomes.
4. Availability of information sufficient enough on green building and awareness on the effect of green building should be made available to practitioners and clients.

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APPENDIX I

REQUEST LETTER TO VALIDATORS

Industrial and Technology Education Department
Federal University of Technology,
P.M.B. 65,
Minna,
21st March, 2023.

Dear Sir,

REQUEST FOR FACE VALIDATION OF INSTRUMENT FOR GREEN BUILDING PROJECT MANAGEMENT FOR SUSTAINABLE DEVELOPMENT IN ABUJA, NIGERIA: CHALLENGES AND PROSPECTS.

I am an undergraduate student of the above named address currently undertaking a study on the topic: GREEN BUILDING PROJECT MANAGEMENT FOR SUSTAINABLE DEVELOPMENT IN ABUJA, NIGERIA: CHALLENGES AND PROSPECTS.

Attached is the draft copy of the instrument. As an expert in this area, your assistance is hereby solicited to enable me accomplish this task. Kindly go through the item to verify their clarity, relevance and appropriateness in the use of language. In addition to this you can also make further suggestions that will improve the status and quality of the instrument. Your contribution to this work is highly appreciated.

Thanks

Yours faithfully,

ABAYOMI DAVID O.
2016/1/63737TI

APPENDIX II

Department of Industrial and Technology
Education,
Federal University of Technology,
P.M.B. 65,
Minna,
21st March, 2023.

Dear Respondent,

REQUEST FOR RESPONSE TO QUESTIONNAIRE

I am a final year student of the above mentioned institution, undertaking a study titled: “**Green Building project management for sustainable development in Abuja, Nigeria: challenges and prospects.**”. Your objective responses are highly needed in ascertaining the facts under investigation. Please feel free and open to share your mind objectively, for your responses have great impact on the findings. All collected responses will be used only for this research and treated confidentially.

Thank you

Yours faithfully

ABAYOMI DAVID O.
2016/1/63737TI

APPENDIX III

**FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION**

QUESTIONNAIRE: Green Building project management for sustainable development in Abuja, Nigeria: challenges and prospects.

PART A

INTRODUCTION: Please complete this questionnaire objectively and sincerely by ticking the column that represent your opinion or perception about the above topic

Personal Data

Building Profession _____

Years of experience

3-5years

5years and above

A four (4) point rating scale is used to indicate your opinion as below:

Strongly agree (SA) -4

Agree (A) -3

Disagree (D) -2

Strong Disagree (SD) – 1

PART B

Research Question I

What are the factors that are hindering green building development in Abuja?

S/N		SA	A	D	SD
1	Non-availability of local materials				
2	Lack of awareness by developers				
3	Lack of adequate research on green building				
4	Lack of adequate knowledge and technical				
5	Lack of interest in sustainable building				
6	Energy and environmental challenges				
7	High initial construction cost of green building				
8	enabling laws to promote its development				
9	High cost of imported green building materials				
10	Divergent interests and views of professionals in built environment				

Research Question II

What is the level of sustainability of green building development in Abuja?

S/N		SA	A	D	SD
1	Financial incentives				
2	Education on sustainability				
3	Design and operational sustainability				
4	Planning policy				
5	Green procurement				
7	Awareness of sustainable construction				
8	Improved enforcement				
9	Use of renewable energy				
10	Use of recycle building materials				

Research Question III

What is the perceived level of adoption of green building practices in construction project?

S/N		SA	A	D	SD
1	Use of renewable energy				
2	Use of recycle building materials				
3	Use of existing landscapes				
4	Green building is thought to come at a high price				
5	Green building supplies are readily available locally				
7	Tendency to maintain practices				
8	Design and operational concerns				
9	Green building doesn't provide enough flexibility				
10	lack of awareness				