East African Scholars Journal of Engineering and Computer Sciences
Abbreviated Key Title: East African Scholars J Eng Comput Sci
ISSN: 2617-4480 (Print) & ISSN: 2663-0346 (Online)
Published By East African Scholars Publisher, Kenya

Volume-7 | Issue-8 | Nov-2024 | DOI: https://doi.org/10.36349/easjecs.2024.v07i08.004

OPEN ACCESS

Original Research Article

A Framework for Implementing Green Building Practices in Abuja, Nigeria

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Article History
Received: 11.10.2024
Accepted: 16.11.2024
Published: 20.11.2024

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: The study is aimed at developing a framework for implementing green building practices in Abuja with the view to create a template for sustainable building practices in Nigeria. The study assessed the potentials in adopting green building practices in Abuja; determined the drivers and barriers to adopting green building management practices; and developed a framework for implementing green building practices in Nigeria building and construction industry. Quantitative research design was adopted while an online survey research technique was conducted using a questionnaire structured on a five-point Likert scale. A total number of 560 questionnaires, comprising 80 questionnaires each were purposively sent to seven selected professional associations in the housing and construction industry in Abuja. A straightforward random technique was applied in selecting and sending online Google linked questionnaire to housing professionals through personal email addresses and social media platforms, such as WhatsApp and Instagram. Only 526 responses were received and analysis was conducted using SPSS statistical software version 24. On the potentials in adopting green building practices in Abuja, the 1st in ranking is Environmental Sustainability where Green building practices reduce the environmental impact of buildings by minimizing waste, conserving energy and water, and reducing greenhouse gas emissions with a mean score of 4.92 while Improved Health and Well-being with a Mean of 4.33 as ranked 1st emerged as the top driver for adopting green building practices. However, the most significant barrier identified is the high upfront costs associated with green building practices with a mean score of 4.49 as ranked 1st. There is a significant potential for the adoption of green building practices in Abuja and a critical need for education and awareness initiatives targeting both developers and consumers to foster a culture of sustainability.

Keywords: Green Building, Sustainable Building, Framework, Practices, Barriers.

1. INTRODUCTION

As global concerns about climate change, resource depletion and environmental degradation escalate, the building and construction sector faces increasing pressure to implement sustainable practices. Green building practices serve as a viable solution to mitigate environmental impact while improving energy efficiency, occupant health and overall quality of life. Abuja, Nigeria's capital and a rapidly growing urban centre, presents unique challenges and opportunities for the adoption of green building practices. The Nigerian context, with its rapidly developing infrastructure and urbanisation, makes a comprehensive framework for green building necessary. Like many developing nations, Nigeria's construction industry faces a variety of difficulties, such as resource constraint, environmental deterioration, and fast urbanisation and population expansion.

Presently, Nigeria's construction industry is experiencing a noticeable shift in focus towards green building practices (Unegbua *et al*., 2024). This is in a bid to reduce environmental impact, improve energy efficiency, and foster socioeconomic development as the demand for residential, commercial, and industrial structures rises. This shift is underpinned by the understanding that sustainable construction is not just an option but a necessity, given the pressing global and local environmental challenges (Unegbua *et al*., 2024).

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Nevertheless, Nigeria's adoption of green construction practices is still uneven and insufficient, despite rising awareness and intermittent initiatives.

Most studies (including Ebekozien, Ikuabe, Awo-Osagie, Aigbavboa and Ayo-Odifiri, 2022) on green building practices in Nigeria hinges on the perceptions by professionals on the potentials, drivers and barriers to the adoption of green building practices with only few attempts at developing a model for green building implementation. Though, Ebekozien, Ikuabe, Awo-Osagie, Aigbavboa and Ayo-Odifiri (2022) developed a model for promoting green certification of buildings in Nigeria. However, no attempt has been made for Green Building framework implementation in Nigeria. Despite the acknowledged benefits of green building practices, their implementation in Nigeria remains limited. Factors such as awareness, inadequate policy frameworks, and economic constraints hinder the transition to sustainable construction methods. Implementing green solutions from the design, construction, and day-to-day running of the building will reduce its potential effect on the natural environment, the running costs of the structure, and the negative effects on the users and the communities that host the building (Sholanke and Opeyemi, 2019). This research aims to develop a comprehensive framework to facilitate the implementation of green building practices in Abuja.

2. RESEARCH OBJECTIVES

To develop a framework that guides the implementation of green building practices in Abuja, Nigeria. The study focused on the following specific objectives in order to achieve this goal:

1. To assess the current state of building practices in Abuja.
2. To identify the obstacles and drivers for implementing green building initiatives.
3. To evaluate existing policies and regulations related to sustainable construction in Nigeria.
4. To propose a framework incorporating best practices, stakeholder engagement, and local context.
5. To recommend strategies for raising awareness and building capacity among stakeholders.

3. REVIEW OF RELATED LITERATURES

Literatures were reviewed based on the following sub-headings:

3.1 Definition and Principles of Green Building

Green Building refers to the practice of designing, constructing, and operating buildings in a way that minimizes their environmental impact while promoting the health and well-being of occupants throughout their life cycle (Kibert 2016, Karimi, Adibhesami, Bazazzadeh & Movafagh, 2023; Komurlu, Kalkan Ceceloglu & Arditi, 2024). This concept encompasses various strategies aimed at improving energy efficiency, reducing resource consumption, and enhancing the sustainability of building materials. Larasati *et al*., (2020) stated the importance of implementing the concept of green buildings from the planning and design stage of a new building.

Manaco (2024), Larasati *et al*., (2020), Liu, Zhang, Guo, Osmani & Demian, (2019), and Liu *et al*., (2019) identified principles of green building to include sustainable site design which focuses on optimizing land use to reduce ecological disruption; energy efficiency which uses bio-climatic approach in optimising energy efficiency in design; water conservation which focuses on reduction of water consumption; material selection which aims at using locally sourced, recycled, or renewable materials; indoor environmental quality which maximises natural lighting, ventilation and eliminating the use of toxic materials; building certifications and standards which makes use of certifications such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method); the Green Building Standard, to provide frameworks and benchmarks for designing and constructing green buildings, promoting best practices within the industry; and smart building technologies which makes use of the integration of technology in building systems enhances energy efficiency and resource management.

3.2 Green Building Management Practices

According to Aghili *et al*., (2016), green building management practices are comprehensive set of methods or techniques to protecting the environment and to reduce building's negative impact on the environment. They further assert that key to a successful green building is management. Therefore, the advancement of the sustainability agenda requires effective and efficient operation of green building, hence decreasing building's operating costs and realising increase in return of investment. Based on the review on various green building standards in the world, the study by Aghili *et al*., (2016), proposed five key practices to manage green building effectively: sustainable procurement; sustainable operation; resources management; repair and maintenance management; and environmental health.

In addition, Leung (2023) identified some of these practices to involve the integration of green marketing strategies, green technology development, and sustainable construction methods to enhance building and organisational performance. Marzouk and Thabet (2023) stated that collaborative frameworks utilizing automated simulations and third-party certification assessments facilitate performance-based decision-making in green construction management. Also, Al-Saffar and Salman (2014) asserted that the adoption of sustainable construction practices is crucial in mitigating environmental impacts and promoting resource efficiency in building projects. Maintenance management in green building projects is vital for ensuring proper upkeep and addressing potential issues to prevent failures throughout the building's lifetime

(Kibert, 2016). These practices focus on aspects like environmental proactivity, employee motivation, and sustainable construction methods, ultimately leading to improved environmental and economic performance in green buildings.

3.3 Global Trends and Best Practices

Global trends and frameworks that have been established to promote best practices in green buildings include LEED, BREEAM, Sustainable building tool of Canada (SBTool), German Sustainable building Certificate (DGNB), Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) of Japan, Green Star of Australia, BCA Green Mark of Singapore and Green Star Tool developed by the Green Building Council of Australia (GBCA). These standards and frameworks have shown that green buildings can reduce operational costs, increase property values, and promote occupant health and safety (Guney *et al*., 2018).

The growth of green building practices in developing countries is receiving government support through its policies. For example, the Kenyan Parliament approved tax incentives for green bonds issuance in 2019, (Ibid, 2019). Also in 2020, Kenya issued a decree through the State Department of Housing & Urban Development in the Ministry of Transport that all affordable housing development projects under the "Big 4" agenda must meet the EDGE Green Buildings standard, (EDGE, 2020). In 2021, the Architectural Association of Kenya (AAK) launched a Green Building certification tool (Safari Green Building Tool) that assesses construction projects to establish their environmental performance (EDGE, 2023).

Another significant trend is the integration of advanced technologies like Building Information Modelling (BIM) and Life Cycle Assessment (LCA). The combination of BIM and LCA, often referred to as Green BIM, is being increasingly employed to optimize building performance across its entire life cycle. This integration facilitates a more holistic and efficient design process, allowing for better decision-making and resource management from the initial planning stages through to the building's end of life. The adoption of Green BIM helps to ensure that sustainability is embedded in every phase of the building's life, leading to improved environmental outcomes and operational efficiencies (Marzouk & Thabet, 2023).

Moreover, green management practices are becoming essential for achieving comprehensive organizational success in the construction industry. Practices such as Green Marketing Strategy (GMS) and Green Technology Development (GTD) are crucial components of this shift. GMS involves promoting and communicating the environmental benefits of green building practices to stakeholders, thereby enhancing the company's reputation and competitive edge. On the other hand, GTD focuses on the innovation and implementation of new technologies that reduce environmental impact and improve sustainability metrics. Together, these practices contribute to what is known as Green Performance Success (GPS) and Financial Performance Success (FPS), reflecting both environmental and economic gains for organizations (Dalla & Dalla, 2021). These trends signify a substantial movement towards more sustainable and environmentally responsible practices in the construction industry. By leveraging green building rating systems, integrating advanced technological tools like BIM and LCA, and adopting comprehensive green management strategies, the industry is not only improving its environmental footprint but also enhancing its overall performance and sustainability.

3.5 Green Policy Adoption in Nigeria

The practice of sustainable construction is a global movement with countries developing plans, strategies, and policies to implement and utilize in their construction industries. This movement involves all stakeholders in the industry (Isang, 2023). Nigeria has recognized the importance of sustainable construction as a means of addressing environmental challenges and enhancing the quality of life for its citizens. The country has made significant progress in adopting green building policies and regulations, marking a notable shift towards sustainability in the construction industry. Isang (2023) highlighted that the country has experienced three distinct periods of sustainable construction (SC) development. During these periods, there has been rapid growth in awareness, although the implementation of sustainable practices has been more moderate, particularly in major cities.

National policies and regulatory frameworks have been put in place to tackle various environmental challenges such as air and water pollution, deforestation, and inadequate waste management. Some green efforts and government regulatory policies include: The National Policy on the Environment (2006), National Building Code (2006), National environmental Standards and Regulations Enforcement Agency (NESREA), the National Building Energy Efficiency Guideline (2016), and the National Adaptation Strategy and Plan of Action for Climate Change in Nigeria (NASPA) underscore the commitment to promote sustainable development etc. However, research indicates that while there is potential for green building practices in Nigeria, their uptake remains limited. For instance, research conducted by Adejumo *et al*., (2022) in Ibadan, Nigeria, revealed that only 34.8% of residents in the municipality are aware of green building features. This statistic underscores the necessity for advocacy and awareness campaigns to promote the adoption of green features in residential buildings. Professionals within the built environment sector in Nigeria are strong advocates for the development of green buildings. They emphasize the critical need for public enlightenment, mandatory

training, and robust policy formulation to advance green building practices (Alohan *et al*., 2021).

The Green Building Council of Nigeria (GBCN) provides standards and certification for green buildings in Nigeria. GBCN was registered with the world green Building council (WGBC) in 2014 on a prospective membership level. Despite its registration with WGBC, it has not been able to produce its environmental rating tool for building projects in Nigeria. WSP (2014) noted that an effort was made through collaboration with the Green Star SA to produce environmental assessment tool tailored to the Nigerian context (Green Star SA for Use in Nigeria Version 1). Nduka & Sotunbo (2014) recommends the full establishment of Green Building Council of Nigeria (GBCN) that would introduce guidelines, tools or techniques that will drive green building practices for future project.

Oguntuase and Windapo (2021) identified significant obstacles such as a lack of governmental commitment, insufficient policy enforcement, and low public awareness, all of which hinder the full implementation of green building practices. Addressing these challenges requires active involvement from the government, politicians, and key construction stakeholders to ensure effective policy formulation and enforcement (Olaoye-Mann, 2022). Moreover, Oyebode (2018) explored the potential of green bonds as investment vehicles for promoting green buildings. These financial instruments can play a crucial role in achieving Sustainable Development Goals (SDGs) related to affordable housing, clean energy, responsible consumption, and climate action in Nigeria. By leveraging green bonds, Nigeria can attract investment needed to fund green building projects, thereby enhancing sustainability across the construction sector.

3.6 Drivers and Barriers to Adopting Green Building Practices

The adoption of green practices among stakeholders faces several significant barriers, including a lack of workforce expertise, reluctance to shift from traditional methods, limited awareness of the importance of green construction, issues with financial and economic feasibility, legal obstacles, deficiencies in technical knowledge, inadequate understanding of green building technologies, and insufficient proficiency in green building techniques. Researchers such as Chan *et al*., (2022), Bijivemula *et al*., (2024), Hussain *et al*., (2023), and Fahad *et al*., (2022) have identified these barriers through empirical studies conducted in various regions, including Hong Kong, Nigeria, Pakistan, and other developing countries. These studies highlight the need to address these challenges to promote sustainable practices within the construction industry.

To overcome these barriers and promote the adoption of sustainable practices, several strategies can be implemented. Firstly, bridging the green skill and knowledge gap at the academic level is essential. Enhancing training programs and curricula to include sustainability practices can foster a new generation of professionals equipped with the necessary skills (Srivastava *et al*., 2023). Additionally, Shaker *et al*., (2023) emphasizes the importance of providing resources and training, as well as aligning government policies to encourage skill development, which can significantly help small and medium-sized enterprises overcome barriers to sustainability adoption. The widespread adoption of green practices offers multiple benefits for stakeholders, including improved operational performance, a better corporate image, and long-term sustainability. By fostering environmental awareness and integrating green innovations, businesses can achieve sustainable development that supports economic growth, environmental conservation, and social well-being.

4. METHODOLOGY

A study on Green Building Practices in Abuja, Nigeria was carried out in an attempt at developing a framework for implementing green building practices in Abuja Nigeria housing and construction industry. The study employed a quantitative research design in order to collect sufficient data and understand the different aspects of green building practices among housing and construction professionals in Abuja. Additionally, an online survey research technique was employed, whereby participants were asked to rate the degree to which they agreed or disagreed with the presented topics. This resulted in the creation of a structured questionnaire that was based on a five-point Likert scale. The questionnaire had 10 items and was divided into two sections: a demographic component asking questions about the respondents' age, gender, and professional and academic backgrounds while the second part's goal was to assess stakeholders' involvements in green building practices. A total number of 560 questionnaires, comprising 80 questionnaires each were purposively sent to seven selected professional associations in the housing and construction industry in Abuja namely, Nigerian Institute of Building (NIOB), Nigerian Society of Engineers (NSE), Nigerian Institute of Architects (NIA), Nigeria Institute of Quantity Surveyors (NIQS), Nigeria Institution of Estate Surveyors and Valuers (NIESV), Nigeria Institute of Town Planners (NITP) and Nigeria Institute of Land Surveyor (NILS) respectively. To sample the responders, a straightforward random technique was used. Through an online Google linked questionnaire, the survey was created. These surveys were distributed through personal email addresses and social media platforms, such as WhatsApp and Instagram. Only 526 responded to the survey. The analysis was conducted using SPSS statistical software version 24. Results of Cronbach's coefficient alpha test on 142 tested items showed a reliability of 0.853.

5. FINDINGS AND DISCUSSION

5.1 Demographic Data

Table 1 presents the demographic data of the respondents ranging from their gender, age, educational qualifications, professional affiliation, management status and years of work experience in the built industry. On the gender of the respondents, most of the respondents (71.29%) are male, while 28.71% are female. This suggests that the housing and construction industry in Nigeria may be dominated by men, which may have implications for the way green building practices are implemented and managed. Most of the respondents (59.13%) fall within the age range of 40-49 years, followed by 22.62% in the 30-39 years range. This suggests that the industry is dominated by middle-aged individuals with significant experience and expertise. The younger age groups (20-29 years and 50 and above) are underrepresented, which may indicate a lack of opportunities for younger professionals or a lack of awareness about green building practices among older professionals. Most of the respondents (57.60%) hold a Higher National Diploma (HND) or a bachelor's degree, while 38.97% hold a Master's or Doctoral degree. This suggests that the industry values formal education and has a high level of academic qualification among its professionals. Most of the respondents (33.65%) were NSE affiliated followed by NIOB at 27.92%. This suggests that these professional bodies play a significant role in the industry and may have a significant influence on the adoption of green building practices. Most of the respondents (62.55%) are in middle management, followed by top management at 10.46%. This suggests that there is a significant representation of middle-level managers in the industry, who may have a significant impact on decision-making related to green building practices. Finally, most of the respondents (33.65%) have 11-15 years of experience, followed by 26.81% with 20 years or more experience. This suggests that the industry has a significant number of experienced professionals who may be well-positioned to implement green building practices.

5.2 Potentials in Adopting Green Building Practices in Abuja

Table 2 presents the analysis on the potentials in adopting green building management practices in Nigeria's housing and construction industry. The objectives are ranked based on their mean scores, which range from 2.01 to 4.92. The grand mean is 3.27. The 1st in ranking is Environmental Sustainability where green building practices reduce the environmental impact of buildings by minimizing waste, conserving energy and water, and reducing greenhouse gas emissions with a mean score of 4.92 followed by the potential of enhancing occupants' health as ranked 2nd with a mean score of 4.84. These suggest that green buildings can reduce exposure to toxins, improve air quality, and provide natural light and ventilation, leading to improved occupant health. However, bottom-ranked potentials at 13th are job creation with a mean score of 2.50 which suggest that the green building industry is creating new job opportunities in fields such as sustainable design, construction, and operations while the least potential as ranked 14th is the potential of enhancing reputation with a mean score of 2.44. These suggest that Organizations that adopt green building practices can enhance their reputation and demonstrate their commitment to sustainability and social responsibility.

Table 1: Demographic data of the respondents

Characteristics	Frequency	Percent
Gender		
Male	375	71.29
Female	151	28.71
Total	526	100
Age		
20 - 29	19	3.61
30 - 39	119	22.62
40 - 49	311	59.13
50 and above	77	14.64
Total	526	100
Educational Qualification		
Primary/Secondary	0	0.00
NCE/Diploma	18	3.42
HND/Degree	303	57.60
MSc/PhD	205	38.97
Total	526	100
Professional Affiliation		
NIESV	18	3.44
NIOB	146	27.92
COREN	176	33.65
NIA	132	25.24
NITP	7	1.34
NIQS	44	8.41
NILS	0	0.00
Total	523	100
Management Status		
Top Management	55	10.46
Middle Management	329	62.55
Lower Management	142	27.00
Total	526	100
Years Of Experience		
1 – 5	29	5.51
6 – 10	84	15.97
11 – 15	177	33.65
16 – 20	95	18.06
20 and above	141	26.81
Total	526	100

Source: 2024

The findings suggest that stakeholders in Abuja's housing and construction industry recognize the importance of environmental sustainability, occupant health, customer satisfaction, and cost savings as key benefits of adopting green building practices. A study by Nkini, Nuyts, Kassenga, Swai and Verbeeck (2024) on the adoption of green building practices in Tanzania found that environmental sustainability and occupant

health were also ranked as top benefits, but with slightly lower mean scores of 4.60 and 4.40, respectively. A study by Chukwu (2018) on the feasibility of adopting green building rating system in Nigeria found that environmental sustainability and cost savings were ranked as top benefits, but with slightly difference. The differences in findings may be attributed to variations in research methods, sample populations, and contextual factors. However, the overall trend suggests that stakeholders in the housing and construction industry recognize the importance of environmental sustainability, occupant health, and cost savings as key benefits of adopting green building practices.

Table 2: Potentials in Adopting Green Building Practices in Abuja, Nigeria

Benefits of Green Building Practice	Mean	Rank
Environmental Sustainability: Green building practices reduce the environmental impact of buildings by minimizing waste, conserving energy and water, and reducing greenhouse gas emissions.	4.92	1
Enhanced Occupant Health: Green buildings can reduce exposure to toxins, improve air quality, and provide natural light and ventilation, leading to improved occupant health.	4.84	2
Increased Customer Satisfaction: Companies that adopt green building practices can improve customer satisfaction through improved indoor air quality, reduced noise pollution, and enhanced overall comfort.	4.71	3
Reduced Maintenance Costs: Green buildings can reduce maintenance costs through the use of durable materials, reduced wear and tear, and improved maintenance scheduling.	4.54	4
Increased Employee Productivity: Studies have shown that green buildings can improve employee productivity, morale, and overall well-being.	4.02	5
Increased Property Value: Green buildings can increase property value and attract tenants who are willing to pay a premium for sustainable and healthy spaces.	3.97	6
Improved Indoor Air Quality: Green buildings prioritize indoor air quality, which can improve occupant health and productivity.	3.66	7
Cost Savings: Green buildings can reduce operating costs through energy efficiency, reduced water consumption, and lower maintenance costs	3.49	8
Reduced Water Consumption: Green buildings incorporate water-efficient systems and technologies, reducing water consumption and conserving this valuable resource.	3.35	9
Increased Energy Efficiency: Green buildings incorporate energy-efficient systems and technologies, reducing energy consumption and reliance on fossil fuels.	3.28	10
Reduced Liability: Green buildings can reduce liability risks associated with environmental degradation and occupational health hazards.	3.27	11
Enhanced Resale Value: Green buildings can increase resale value and appeal to buyers who are looking for sustainable properties.	2.67	12
Job Creation: The green building industry is creating new job opportunities in fields such as sustainable design, construction, and operations.	2.50	13
Enhanced Reputation: Organizations that adopt green building practices can enhance their reputation and demonstrate their commitment to sustainability and social responsibility.	2.44	14
Reduced Waste: Green buildings prioritize waste reduction, recycling, and proper disposal of materials, reducing the environmental impact of construction and operation.	2.20	15
Government Incentives: Many governments offer incentives, such as tax breaks or grants, to encourage the adoption of green building practices.	2.17	16
Improved Communication: Green building practices can improve communication among stakeholders, including employees, customers, and suppliers.	2.16	17
Enhanced Leadership Position: Organizations that adopt green building practices can demonstrate their leadership position in the industry and set an example for others to follow.	2.01	18
Improved Brand Image: Companies that adopt green building practices can enhance their brand image and attract customers who value sustainability.	2.01	19
Grand mean	3.27	

Source: 2024

5.3 Drivers to the Adoption of Green Building Practices in Abuja

Data in Table 3 represents the drivers to the adoption of green building practices in Abuja. According to the data in table 3, Improved Health and Well-being with a mean of 4.33 as Ranked 1st emerged as the top reason for adopting green building practices. The focus on health and well-being highlights a growing recognition of the impact that the built environment has on occupants' physical and mental health.

Table 3: The drivers to the adoption of green building practices in Abuja

Drivers	Mean	Rank
Improved Health and Well-being: By reducing exposure to toxins, improving indoor air quality, and providing natural light and ventilation.	4.33	1
Environmental Sustainability: To reduce their environmental impact, improve indoor air quality, and promote sustainable development.	4.28	2
Incentives: To take advantage of government incentives, such as tax breaks or grants, for adopting green building practices.	4.00	3
Enhanced Reputation: To enhance their reputation and demonstrate their commitment to sustainability and social responsibility.	3.83	4
Cost Savings: To reduce operating costs, energy consumption, and water consumption.	3.54	5
Comfort and Productivity: To enhance their comfort and productivity by providing a healthy and sustainable work environment.	3.38	6
Suppliers/Vendors: To promote sustainable development by sourcing materials and services from environmentally responsible suppliers.	3.25	7
Environmental Regulations: To comply with environmental regulations and standards, such as energy efficiency standards or green building certification programs.	3.22	8
Environmental Concerns: To address community concerns about environmental issues, such as air pollution or water contamination.	3.08	9
Increased Property Value: To increase the value of their property and attract tenants who are willing to pay a premium for sustainable and healthy spaces.	3.00	10
Quality of Life: To improve the overall quality of life in the community by promoting sustainable development and reducing environmental impacts.	2.98	11
Corporate Social Responsibility: To demonstrate their company's commitment to sustainability and social responsibility.	2.97	12
Public Image: To promote their commitment to sustainability and environmental protection.	2.80	13

Source: 2024

Reducing exposure to harmful toxins, improving indoor air quality, and facilitating natural light and ventilation are crucial elements of green building design that contribute to better health outcomes. Studies have shown that green buildings can significantly improve occupants' health by reducing respiratory issues and other health problems linked to poor indoor air quality (Tran, Park & Lee, 2020). Research indicates that elements such as better ventilation, use of non-toxic materials, and abundant natural light contribute positively to both perceived and actual well-being among inhabitants (Kujundzic, Stamatovic Vuckovic & Radivojević, 2023). In Nigeria, where urbanization is rapid and housing conditions for many can be suboptimal, prioritizing health-promoting features in building designs can lead to a more productive workforce and lower healthcare costs. Therefore, stakeholders might consider health as a pivotal element when deciding to invest in green building initiatives. Following closely by a mean score of 4.28 as ranked 2nd is environmental sustainability, emphasizing the need to minimize environmental impacts and promote sustainable development. This reflects a broader, more global consciousness regarding climate change and resource depletion, and the responsibilities of the construction industry in addressing these challenges. A myriad of studies underscores the importance of sustainability in building practices. Incorporating sustainable practices reduces a building's carbon footprint and supports broader environmental goals, including efficient energy use and the preservation of natural ecosystems (Wong & Zhou, 2015). In the Nigerian context, shifting towards environmentally sustainable construction practices could help mitigate issues such as deforestation and urban pollution. Moreover, as international standards gain traction, this can enhance local practices and encourage compliance, ultimately leading to improved global competitiveness of the Nigerian construction industry.

The relatively low score for corporate social responsibility with a mean score of 2.97 as ranked 12th suggests that organizations may not fully recognize or prioritize the broader societal impacts of their operations. While the concept is gaining traction globally, local interpretations in the Nigerian context may be underdeveloped. Research indicates that companies frequently struggle to integrate CSR into strategic frameworks (Arena, Azzone & Mapelli, 2018). The lack of emphasis on CSR in building practices can reflect a disconnect between corporate objectives and community needs. The low rating for this driver may point to an opportunity for education and awareness campaigns aimed at construction firms. Strengthening the ties between construction practices and local community benefits could foster a culture of responsibility that enhances public support and alignment with sustainable development goals. Public Image with a Mean score of 2.80 as ranked 13th is the lowest-rated driver indicates that stakeholders are less motivated by the perception of public image or the branding advantages of adopting green practices. This could suggest a lack of consumer awareness or the belief that the current market does not

prioritize sustainability. Studies have shown a correlation between corporate practices and public perception, indicating that firms with a positive public image enjoy better market access and consumer loyalty (Islam, Islam, Pitafi, Xiaobei, Rehmani, Irfan & Mubarak, 2021). However, without direct consumer demand for sustainability, companies may not feel compelled to change.

The findings indicate a need for increased awareness among both consumers and businesses about the benefits of environmentally friendly practices. Public relations efforts and education on the importance of green buildings could help drive market demand and, consequently, change practices. The findings also suggest that stakeholders prioritize environmental sustainability and occupant health and well-being when considering the adoption of green building practices. Furthermore, the study also highlights the lack of consideration for corporate social responsibility and public image as key factors in adopting green building practices. This is consistent with other research studies that have found that stakeholders may not prioritize corporate social responsibility and public image when considering the adoption of green building practices (Zhang, Oo & Lim, 2019). Hence, the need for policymakers to provide incentives and support for adopting green building practices, such as tax breaks or grants, to encourage stakeholders to adopt sustainable practices.

5.4 Barriers to adoption of Green Building Practices in Abuja

The most significant barrier identified as illustrate on table 4 below is the high upfront costs associated with green building practices with a mean score of 4.49 as ranked 1st. This includes investments in sustainable materials, innovative design, and energy-efficient technology. The initial financial burden can be substantial, particularly in a developing economy like Nigeria, where resources can be constrained. Research consistently shows that the initial costs of green buildings can deter developers, despite long-term savings in energy and maintenance costs (Adrian-Cosmin, Sorin & Simon, 2023). For many developers, especially smaller firms, the immediate financial outlay may feel risky or unjustifiable without a clear demand or legislative support that alleviates this burden. In Nigeria, where housing deficits and economic challenges are prevalent, addressing this barrier is crucial. Policymakers might consider implementing financing mechanisms, subsidies, or incentives that lower the initial investment required for green building initiatives. This could stimulate the adoption of sustainable practices and ultimately contribute to fostering a more resilient and environmentally friendly construction industry in Nigeria. Closely following the upfront costs is the lack of public demand for green buildings in Nigeria with a mean score of 4.23 as ranked 2nd. This barrier suggests that stakeholders—developers and builders—might hesitate to invest in sustainable practices due to uncertainty about market acceptance or consumer willingness to invest in more costly but beneficial green buildings. Previous studies have shown that consumer awareness and demand play an essential role in driving the market for green building (Sahioun, Bataineh, Abu-AlSondos & Haddad, 2023). If potential occupants do not prioritize sustainability, developers are unlikely to invest in green features. In environments where awareness of environmental issues is limited, public demand remains low. To overcome this barrier, public awareness campaigns educating citizens about the benefits of green buildings—such as improved health, energy savings, and environmental benefits—are essential. Engaging the community in discussions about sustainability can help cultivate a market for green building practices, thereby incentivizing builders and developers to adopt these approaches.

The lowest-ranked barrier identifies security concerns as a deterrent to adopting green building practices with a mean score of 2.45 as ranked 13th. While it is essential to consider the safety of innovative materials and new technologies, this barrier appears to have less influence compared to others, possibly due to the prevailing nature of the larger barriers like upfront costs and market demand. Although security concerns related to new technologies have been noted in different contexts, they are often secondary to more pressing barriers such as cost, demand, and regulatory support. When stakeholders see promising returns on investments or regulatory support, security concerns may diminish. The second lowest-ranked barrier is the lack of widely recognized certification schemes for green buildings in Nigeria with a mean score of 2.42 as ranked 14th respectively. This lack prevents developers from easily demonstrating their commitment to sustainable practices, potentially limiting their appeal in the market. Research has shown that clear certification and rating systems significantly contribute to the marketability of green buildings (Li, Feng, Liu & Yang, 2023). Certification provides credibility and reassures both investors and consumers of the building's green credentials. Countries with robust certification schemes often see higher rates of green building adoption. Establishing formal green building certification schemes tailored to the local context would enhance transparency and credibility in the construction sector. Collaboration between government entities and industry stakeholders can develop such schemes to stimulate demand and guide best practices in sustainable construction. This will inform potential buyers about the advantages of investing in certified green buildings.

Table 4: Barriers to the Adoption of Green Building Practices in Abuja

Barriers	Mean	Rank
High upfront costs: Green building practices often require additional investment in design, materials, and technology, which can be a barrier for many developers and builders.	4.49	1
Lack of public demand: There may be limited public demand for green buildings in Nigeria, making it difficult for developers and builders to justify the investment.	4.23	2
Limited awareness: Many stakeholders, including builders, developers, and occupants, are not aware of the benefits and importance of green building practices.	4.21	3
Limited waste management infrastructure: Nigeria's waste management infrastructure is not well-developed, making it challenging for developers and builders to manage waste sustainably.	3.89	4
Cultural resistance: Some traditional building practices may not be easily adapted to green building principles, requiring a cultural shift in the industry.	2.87	5
Lack of collaboration: The Nigerian construction industry often lacks collaboration between stakeholders, making it difficult to share knowledge, resources, and best practices.	3.80	6
Limited access to sustainable materials: Nigeria's construction industry relies heavily on imported materials, making it difficult to access sustainable materials that are locally available.	3.63	7
Lack of government incentives: There is a lack of government incentives, tax breaks, or subsidies to encourage the adoption of green building practices.	3.48	8
Higher maintenance costs: Some green building practices may require additional maintenance costs, which can be a barrier for some developers and builders.	3.04	9
Inadequate training programs: There is a need for more comprehensive training programs that focus on green building practices, sustainability, and environmental management.	2.92	10
Inadequate enforcement: Existing regulations may not be adequately enforced, making it difficult for developers and builders to comply with environmental standards.	2.64	11
Lack of green building regulations: There is a lack of national or local regulations that specifically address green building practices, making it difficult for developers and builders to navigate.	2.56	12
Security concerns: Some developers and builders may be hesitant to adopt green building practices due to security concerns related to the use of new technologies or materials	2.45	13
Lack of certification schemes: There is a lack of widely recognized certification schemes for green buildings in Nigeria, making it difficult for developers and builders to demonstrate their commitment to sustainability.	2.42	14

5.6 Framework for Implementing Green Building Practices in Nigeria Building and Construction Industry

Figure 1 proposed a framework for implementing green building practices in Nigeria building and construction industry. The framework comprised of seven components namely; Awareness and Education, Policy Regulation, Financial Incentives, Infrastructure and Resource Development, Stakeholder Collaboration, Monitoring and Evaluation, and Capacity Building. Intensive awareness campaigns, educational training and certifications are to be conducted by Ministry of Environment through public workshops and housing and construction industry professional associations' trainings on green building practices, sustainable designs and technologies.

Nigeria policymakers could articulate and formulate adaptable and innovative green building policy systems. According to Dahiru *et al*., (2013), the practice of green building should be encouraged by the government. This is emphasised in the study by Adewolu, (2023) who suggested that the Federal Government of Nigeria and States should enact specific laws on adoption of green building concepts and strategies in Nigeria. He further recommended that the Federal Government of Nigeria should fund research on green building materials and the technology for their production in cooperation with private businesses.

Green building policies should be implemented, regulated and monitored through collaboration between the Ministry of Housing and Ministry of Environment. Incentives through tax holidays for firms, sustainable material subsidies on green building technology should be carried out by Ministry of Finance and Ministry of Environment while infrastructure on renewable energy sources must be developed and waste management encouraged by Ministries of Energy, Environment and Health respectively. Collaboration between the public and private sector is sacrosanct for implementing green building practices in Nigeria Housing and Construction Industry. Research and Development efforts should be encouraged by Ministry of Science and Technology. Compliance with green building regulations and policies should be monitored and enforced by Ministry of environment and those of Housing Ministry as capacity building is implemented through educational trainings of professionals and students in the housing and construction industry while conducting public awareness on the potentials of green buildings.

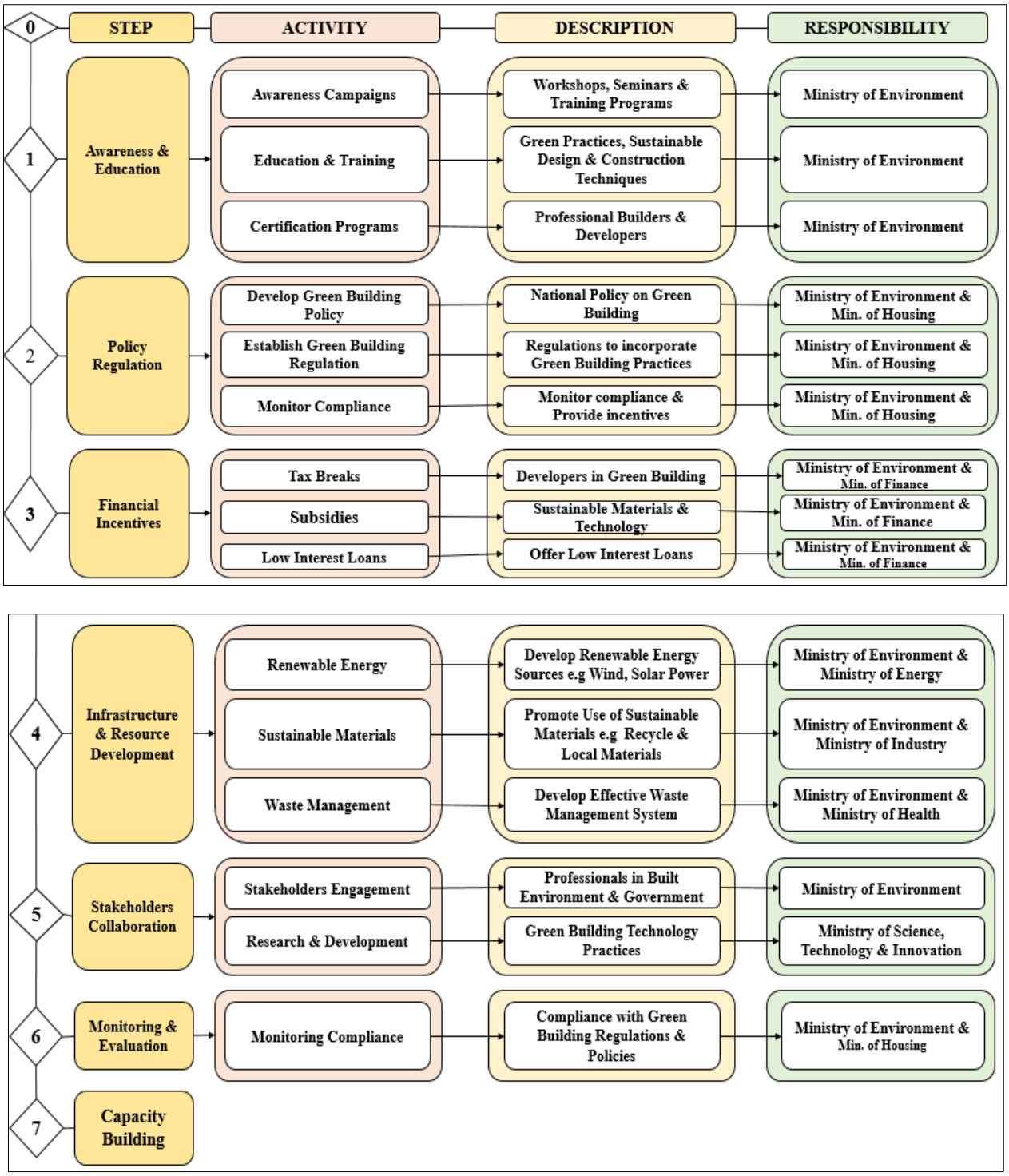

Figure 1: Proposed Framework for Green Building Practice in Nigeria

6. CONCLUSION AND RECOMMENDATIONS

The study concludes that there is significant potential for the adoption of green building practices in Abuja, driven primarily by concerns for environmental sustainability and occupant health. While stakeholders recognize the benefits of green buildings, substantial barriers, particularly high upfront costs and limited public demand, inhibit broader implementation. The findings indicate a critical need for education and awareness initiatives targeting both developers and consumers to foster a culture of sustainability. Furthermore, the results highlight gaps in corporate social responsibility and public perception of green practices among stakeholders, suggesting that these areas need further development to align corporate objectives with community benefits. The findings reinforce the relevance of establishing a structured framework to implement green building practices effectively, addressing both the identified potentials and barriers,

ensuring the contributions of the sector toward sustainable development goals.

Based on the findings of the study, the following recommendations are proposed:

1. Financial Incentives and Support:

Policymakers should develop financing mechanisms such as subsidies, tax breaks, and low-interest loans to help mitigate the high upfront costs associated with green building practices. This financial support could make green building projects more feasible for developers and encourage widespread adoption.

2. Public Awareness Campaigns:

Education and outreach initiatives should focus on raising awareness of the benefits of green buildings, particularly among potential occupants and developers. Engaging community members in discussions about health and environmental benefits can create demand and support for sustainable practices.

3. Training and Capacity Building:

Comprehensive training programs for Architects, builders, Engineers, developers, and other built environment professionals as well as construction workers on green building techniques, materials, and technologies are essential. These programs can build local expertise and foster a more informed workforce capable of implementing sustainable practices. The establishment of recognized certification schemes for green buildings tailored to the local context is crucial. This would help enhance marketability, provide clearer benchmarks for sustainability, and assure consumers of the commitment to sustainable practices.

4. Collaboration among Stakeholders:

Foster collaboration between government agencies, industry stakeholders, and community organizations to share knowledge, resources, and best practices. Collaborative efforts can help streamline efforts towards sustainable building practices and create a unified approach to addressing the challenges faced by the sector.

By implementing these recommendations, stakeholders can help to create an environment conducive to the adoption of green building management practices, thereby promoting sustainability and contributing positively to Nigeria's construction and housing industry.

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Cite This Article: Ruth M. Ashen, Manbyen N. Rimtip, Mark Y. Davou (2024). A Framework for Implementing Green Building Practices in Abuja, Nigeria. *East African Scholars J Eng Comput Sci*, *7*(8), 104-115.