

# An Analysis of Challenges to Achieving Sustainable Practices in Nigeria's Construction Sector

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## Abstract

This study investigates the key barriers to the adoption of sustainable construction practices in Nigeria, focusing on regulatory, organizational, social, cultural, and technological factors. Utilizing a mixed-methods approach, the research combines qualitative case studies and interviews with quantitative survey data to identify these challenges. The findings highlight the multifaceted and interconnected nature of these barriers, with regulatory challenges—such as outdated building codes, insufficient legislative support, and bureaucratic inefficiencies—emerging as the most significant. Social and cultural resistance to change, coupled with limited public awareness of sustainable construction benefits, further complicate adoption. Technological challenges, including high costs of green materials and a shortage of skilled professionals, are also key obstacles. The study suggests that Nigeria can draw valuable lessons from other developing countries, such as South Africa, India, and Indonesia, where similar challenges have been addressed through proactive policies and innovative practices. Recommendations for overcoming these barriers include modernizing building codes, strengthening leadership in sustainability within the construction sector, and launching comprehensive public education campaigns to shift societal attitudes. The study further advocates for increased investment in green technologies and the development of local supply chains to reduce costs and enhance the accessibility of sustainable construction materials. By adopting these strategies, Nigeria can promote sustainable building practices and contribute to global knowledge on overcoming barriers to sustainability in developing economies.

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## INTRODUCTION

The construction sector plays a pivotal role in the economic development of many countries, including Nigeria, contributing significantly to the nation's GDP and employment. However, the sector also accounts for a substantial share of environmental degradation, particularly in terms of resource consumption, waste generation, and carbon emissions (Uchegara et al., 2022). As global environmental concerns rise, the focus on sustainable construction has gained prominence as a key strategy to mitigate the sector's negative impacts (Akindele, et al., 2023). Sustainable construction practices, which aim to reduce environmental harm while promoting resource efficiency, are increasingly recognized as crucial for the long-term development of urban infrastructure (Medayese et al., 2023). Despite growing awareness of these benefits, the adoption of sustainable construction in Nigeria remains limited, with various barriers hindering its widespread implementation.

These barriers are multifaceted, involving regulatory, organizational, social, cultural, and technological factors. In terms of regulatory challenges, outdated building codes, lack of enforcement, and bureaucratic inefficiencies obstruct the implementation of green building standards (Atanda & Olukoya, 2019). Organizational barriers, including weak leadership commitment and a lack of formal sustainability policies, further exacerbate the issue (Oyewobi & Jimoh, 2024). Social and cultural resistance to new construction methods, combined with limited public understanding of the benefits of sustainable practices, also impede progress (Suleman et al., 2023). Moreover,

technological constraints, such as the high costs of sustainable materials and insufficient technical expertise, complicate the transition to more sustainable construction practices (Akinshipe et al., 2019).

Nigeria's challenges in adopting sustainable construction are not unique. Developing economies such as India, Brazil, and Indonesia face similar obstacles in integrating sustainability into their construction sectors (Al-Raqeb et al., 2024; Santana et al., 2023). However, the Nigerian context presents distinctive challenges that set it apart from other nations. For instance, the country's rapid urbanization, coupled with a history of inadequate infrastructure development, places an increased demand on the construction sector to provide sustainable solutions that can accommodate both economic growth and environmental responsibility. Furthermore, Nigeria's political and economic climate, marked by regulatory inconsistencies and frequent policy changes, presents additional complexities that hinder long-term sustainability goals in the construction industry (Akindele, et al., 2023).

This study focuses on understanding these barriers within the Nigerian context, with the aim of providing actionable recommendations to foster a more sustainable construction sector. By comparing the challenges faced in Nigeria with those of other developing countries, the research seeks to contribute to the global conversation on overcoming barriers to sustainable construction in similar economic contexts. Understanding these challenges is vital not only for improving construction practices in Nigeria but also for enhancing sustainability efforts across other developing economies facing comparable issue.

## LITERATURE REVIEW

### Sustainable Construction: Definition and Principles

Sustainable construction, also known as "green building," refers to environmentally responsible and resource-efficient practices across the entire lifecycle of a building, from design and construction to operation, maintenance, renovation, and eventual deconstruction (Mba et al., 2024). The overarching aim is to minimize the negative environmental impact of buildings while also ensuring economic viability and enhancing social benefits. Key principles include energy efficiency, water conservation, reducing material waste, and using eco-friendly, low-impact materials (Wang, et al., 2024). Additionally, occupant well-being is prioritized through improved indoor air quality, natural lighting, and ergonomic designs that promote physical health (McArthur & Powell, 2020).

These principles align with the United Nations Sustainable Development Goals (SDGs), which seek to meet current needs without compromising the ability of future generations to meet their own (United Nations, 2022). The integration of passive design strategies, the use of low-carbon materials, and the adoption of renewable energy technologies are essential to reducing the ecological footprint of construction activities (Ezennia, 2022; Cabeza et al., 2013). Moreover, sustainable construction emphasizes adaptability, ensuring buildings are resilient to the challenges posed by climate change and resource scarcity (Addabbo et al., 2023).

### Global Trends in Sustainable Construction

Globally, the construction industry is increasingly shifting toward sustainable practices, driven by regulatory pressures, growing environmental awareness, and market demands (Huang et al., 2020). Certification systems like LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), and Green Star have become key benchmarks for assessing building sustainability, focusing on energy efficiency, water conservation, material selection, and indoor air quality (Jiménez-Pulido et al., 2022; Mattoni et al., 2018).

The adoption of renewable energy technologies, such as solar panels, wind turbines, and geothermal heating systems, is gaining momentum to reduce reliance on fossil fuels, cut carbon emissions, and reduce long-term energy costs (Chel, A Kaushik, 2018). The global embrace of circular economy principles—emphasizing waste reduction and material reuse—also plays a pivotal role in making the construction industry more sustainable. This approach extends the lifecycle of building materials, reducing the need for virgin resources (Norouzi et al., 2021; Unegbu et al., 2024). Digital tools like Building Information Modeling (BIM) are transforming construction by enhancing design accuracy, reducing waste, and optimizing energy use. BIM allows for virtual simulations of building projects, offering a more sustainable approach to planning and resource management (Lu et al., 2017; Zhuang et al., 2021).

### Sustainable Construction in Nigeria

Nigeria, with its rapidly urbanizing population, faces significant challenges in adopting sustainable construction practices. While there is increasing awareness, actual implementation is constrained by financial limitations, lack of technical expertise, and weak regulatory frameworks (Ifije & Aigbavboa, 2020). Professionals in the Nigerian

construction sector are becoming more aware of sustainability's importance; however, challenges such as high upfront costs, limited access to green materials, and inadequate technical training impede broader adoption (Mba *et al.*, 2024).

Urban centers are leading the way in implementing sustainable practices, largely driven by high-profile projects, access to resources, and better information. However, rural areas face slower progress due to infrastructural gaps and financial constraints. Notably, renewable energy sources like solar power are becoming more common in off-grid communities, providing a viable solution to unreliable energy supplies (Ozoegwu *et al.*, 2017; Ogunsanya *et al.*, 2019; Balon *et al.*, 2024). Additionally, the use of sustainable building materials, such as compressed earth blocks, is being explored to address housing shortages while minimizing environmental damage (Ezennia, 2022; Unegbu *et al.*, 2024).

Government policies promoting environmental sustainability have been introduced but often suffer from poor enforcement due to corruption and bureaucratic inefficiencies (Herrera, 2019). There is an urgent need for stronger regulatory frameworks and improved enforcement mechanisms to enable wider adoption of sustainable practices, particularly in rapidly urbanizing regions (Ozoegwu *et al.*, 2017).

## Barriers to Sustainable Construction

The barriers to sustainable construction in Nigeria are multifaceted and can be categorized into economic, regulatory, technological, and socio-cultural challenges. Financial constraints are perhaps the most significant barrier, as sustainable construction methods often involve higher initial costs compared to conventional building techniques (Akçay, 2023). In many developing countries, including Nigeria, access to financing for green projects is limited, and there are few government incentives to encourage developers to adopt sustainable practices (Oke *et al.*, 2024; Unegbu *et al.*, 2024).

Regulatory and policy challenges further hinder progress. Although there have been efforts to establish regulations that promote sustainability in the construction sector, these regulations are not consistently enforced, and penalties for non-compliance are minimal (Herrera, 2019). In addition, many existing policies are outdated and do not adequately address the specific challenges of green construction in Nigeria, where rapid urbanization is exacerbating environmental degradation (Karji *et al.*, 2020).

Technological and infrastructural challenges are also prevalent. The availability of sustainable materials and technologies is limited, and their cost can be prohibitive, especially for smaller construction firms (Norouzi *et al.*, 2021). Additionally, there is a shortage of skilled professionals who are trained in sustainable construction techniques, which further complicates the adoption of green building methods (Porcid & Mohanasundaram, 2024).

Social and cultural factors also play a crucial role in the slow adoption of sustainable construction practices. In many parts of Nigeria, there is resistance to change, and traditional building methods continue to be favored over newer, more sustainable techniques. Limited public awareness of the benefits of sustainable construction contributes to this resistance, highlighting the need for educational campaigns to increase understanding and support for green building initiatives (Akadiri, 2015; Unegbu *et al.*, 2024).

## Benefits of Sustainable Technologies and Materials

Sustainable construction technologies and materials provide significant benefits in terms of reducing environmental impacts, enhancing energy efficiency, and creating healthier indoor environments. One of the most critical benefits is the reduction of carbon emissions. The construction industry is a major contributor to global greenhouse gas emissions, with conventional building materials, such as traditional cement, being particularly harmful due to their energy-intensive production processes. In contrast, low-carbon concrete, which incorporates industrial by-products such as fly ash and slag, significantly reduces the carbon footprint associated with construction activities. Meng & Gallagher (2012) demonstrated that using low-carbon concrete can reduce embodied carbon emissions by up to 20% without compromising structural integrity. In the UK, for example, this material has been widely adopted to lower the carbon intensity of new buildings (Fenner *et al.*, 2018).

Another major advantage of sustainable technologies is their contribution to energy efficiency. Technologies such as solar panels, geothermal systems, and energy-efficient glazing play a pivotal role in reducing operational energy consumption, leading to substantial cost savings for building owners over time. Solar photovoltaic (PV) systems, for instance, are now a widely used component in energy-efficient buildings. Research has shown that solar PV systems can reduce building energy costs by up to 40% over the lifecycle of the building (Ayarkwa *et al.*, 2022). Countries like Germany have been at the forefront of solar energy integration in building design, where the use of renewable energy technologies has significantly reduced reliance on fossil fuels and helped achieve national carbon reduction targets (Nikyema & Blouin, 2020; Kumar *et al.*, 2022). The Passivhaus standard, also developed in Germany, exemplifies how the combination of advanced insulation, airtight construction, and heat recovery systems

has reduced the heating and cooling energy consumption of buildings by up to 90% (Nikyema & Blouin, 2020; Komurlu et al., 2024; Elkhayat et al., 2024).

Water conservation is another benefit derived from sustainable construction practices. Technologies such as greywater recycling systems and low-flow fixtures help minimize water usage, addressing water scarcity issues in regions where freshwater resources are limited. Australia, for example, has successfully implemented greywater systems in residential and commercial buildings, resulting in water savings of up to 50% compared to conventional systems (Lima et al., 2021; Tazmeen & Mir, 2024). Such innovations not only reduce operational costs but also contribute to the sustainable management of water resources, particularly in regions prone to drought.

The use of sustainable materials also enhances indoor environmental quality (IEQ), which has a direct impact on the health and well-being of building occupants. Sustainable materials, such as non-toxic paints, natural fiber-based insulation, and eco-friendly adhesives, help improve indoor air quality by reducing the emission of volatile organic compounds (VOCs) and other harmful chemicals. Numerous studies have indicated that improved IEQ can boost occupant productivity and reduce absenteeism. For instance, in office environments, improved air quality has been linked to productivity increases of 8% to 11%, as well as significant reductions in sick leave (Ametepey et al., 2015; Lima et al., 2021). These health and productivity benefits further underscore the importance of integrating sustainable materials into building designs.

## **Global Success in Implementing Sustainable Construction Technologies**

The successful implementation of sustainable construction technologies and materials in various countries serves as a valuable reference point for nations like Nigeria, where sustainability efforts are still developing. Countries such as Germany, the United States, and Sweden provide illustrative examples of how sustainable practices can be scaled up across regions.

In Germany, the Passivhaus standard represents one of the most successful applications of sustainable construction technologies globally. Passivhaus buildings are designed to consume minimal energy for heating and cooling, thanks to a combination of advanced insulation, high-performance windows, and airtight construction methods. These buildings typically achieve energy savings of up to 90% compared to conventional buildings (Nikyema & Blouin, 2020). This standard has been adopted for both residential and commercial buildings, setting a global benchmark for energy efficiency in construction.

In the United States, California has pioneered energy efficiency in construction through its Title 24 Energy Efficiency Standards. These standards mandate the use of energy-efficient technologies, such as smart lighting systems and high-performance windows, which have been widely adopted across the state. As a result, buildings in California consume approximately 30% less energy than those in the rest of the United States (Nasereddin & Price, 2021; Fenner et al., 2018). California's success demonstrates the effectiveness of combining policy-driven mandates with technological advancements to achieve substantial energy savings and environmental benefits.

In Sweden, the use of sustainable timber in construction, coupled with prefabrication technologies, has gained significant traction. The Skellefteå Cultural Centre, one of Sweden's most prominent timber buildings, is an excellent example of how sustainable materials can be integrated into large-scale projects without sacrificing functionality or aesthetics. Timber construction not only reduces the carbon footprint but also contributes to the circular economy by utilizing a renewable resource. Sweden's approach to sustainable timber construction provides a model that could be replicated in other countries seeking to reduce the environmental impact of their building industries (Lima et al., 2021; Tazmeen & Mir, 2024).

## **Relevance to Nigeria's Construction Industry**

Nigeria can draw valuable insights from these global examples. The country's abundant solar potential, coupled with local resources such as compressed earth blocks, positions it well to adopt sustainable practices. Solar energy systems could reduce reliance on unreliable power grids, and using locally sourced low-carbon materials would minimize transportation costs and environmental impact (Ifije & Aigbavboa, 2020). Overall, the adoption of sustainable construction technologies offers substantial environmental, economic, and health benefits, as demonstrated in countries like Germany, the U.S., and Sweden. For Nigeria, leveraging these global practices, adapting them to local contexts, and addressing existing barriers can help drive the country toward more sustainable construction practices.

## Theoretical Frameworks for Analyzing Barriers

Several theoretical models are relevant to understanding the barriers to sustainable construction. The Technology-Organization-Environment (TOE) framework is widely used to explain the factors that influence the adoption of new technologies and practices by organizations. This framework divides influencing factors into three categories: technological, organizational, and environmental (Akçay, 2023). In the context of Nigeria, the TOE framework helps explain why some firms are more willing to adopt sustainable practices than others based on the availability of technology, organizational support, and environmental pressures (Zhai, et al., 2014). Institutional Theory offers another valuable lens for analyzing the adoption of sustainable practices. This theory focuses on how external institutions, such as regulatory bodies, industry standards, and cultural norms, influence organizational behavior. In Nigeria, weak regulatory institutions and limited enforcement capacity have been significant barriers to the adoption of sustainable construction practices (Oke et al., 2024).

Additionally, the Diffusion of Innovations (DOI) theory provides insight into how new ideas, practices, or technologies spread within an organization or society. The DOI framework identifies several factors that influence adoption, including perceived benefits, the compatibility of the innovation with existing systems, the complexity of the innovation, and its observability (Herrera, 2019). This framework is particularly useful in understanding the slow adoption of sustainable construction practices in Nigeria, where socio-cultural resistance and economic constraints hinder progress.

## Research Gaps

Despite the growing body of literature on sustainable construction, several research gaps remain. There is a lack of comprehensive studies that simultaneously examine financial, regulatory, technological, and socio-cultural barriers to sustainable construction, particularly in developing countries (Akçay, 2023). Moreover, long-term performance data on sustainable buildings in Nigeria is scarce. Research tracking the energy savings, cost-effectiveness, and occupant health outcomes of green buildings over their lifecycle is essential for substantiating the benefits of sustainable construction (Oke et al., 2024).

Further research is also needed to evaluate the impact of specific policy interventions on the adoption of green building practices in Nigeria. Comparative studies across regions would provide valuable insights into which policies are most effective in promoting sustainable construction (Ahmed & Okeke, 2023). Additionally, there is a need for more studies that focus on the social and cultural factors that influence the adoption of sustainable practices, as these are often overlooked despite their importance in shaping public attitudes and behaviors toward green building (Akadiri, 2015; Ayarkwa et al., 2022).

## METHODS

### Research Design

This study employed a mixed-methods approach, integrating both quantitative and qualitative methodologies to explore the barriers to sustainable construction in Nigeria. This combination was chosen to provide a comprehensive understanding, as the quantitative data captured broad statistical trends, while the qualitative insights offered deeper, context-rich perspectives from professionals within the industry (Creswell & Plano-Clark, 2017). The research was conducted in three distinct phases: an extensive literature review, a structured survey distributed to construction professionals, and semi-structured interviews with key industry stakeholders. Employing multiple approaches allowed for data triangulation, increasing the reliability and validity of the findings (Saunders et al., 2019).

### Data Collection Methods

A survey (Table 1) was designed and distributed to professionals within the Nigerian construction industry, including architects, engineers, contractors, and project managers. The questionnaire aimed to identify the perceived barriers to sustainable construction practices, using structured questions on a 5-point Likert scale to facilitate statistical analysis (Bryman, 2016). The Likert scale ranged from 1 = "Strongly Disagree" to 5 = "Strongly Agree."

The survey sample was selected through stratified random sampling, which ensured that professionals from a wide range of roles (e.g., engineers, architects, contractors), company sizes, and geographical regions of Nigeria were included. The rationale behind this was to ensure comprehensive representation of all regions, including urban and rural areas, and to capture the diversity of experiences within the industry. Given Nigeria's large size and the varying

levels of awareness and adoption of sustainable construction practices in different regions, the stratified sampling method allowed for more balanced and accurate representation.

**Table 1.** Questionnaire Survey

SN	Question	Source	Label
<b>General Information (GI)</b>			
1	What is your current position within the construction industry?	Adapted from Oke et al. (2019)	X01
2	How many years have you worked in the construction industry?	Adapted from Ifije & Aigbavboa (2020)	X02
3	How large is your organization in terms of the number of employees?	Adapted from Bryman (2016)	X03
4	In which region of Nigeria does your organization primarily operate?	Adapted from Balon et al. (2024)	X04
5	Have you been involved in any sustainable construction projects?	Adapted from Ershad et al. (2021)	X05
6	What types of sustainable construction practices has your organization implemented?	Adapted from Lima et al. (2021)	X06
7	What is your level of awareness regarding sustainable construction practices?	Adapted from Karji et al (2020)	X07
<b>Financial Barriers (FB)</b>			
8	How significant are the initial costs associated with sustainable construction as a barrier to its adoption?	Adapted from Lima et al. (2021)	X08
9	Do you think there is sufficient funding available for sustainable construction projects in Nigeria?	Adapted from Ershad et al. (2021)	X09
10	How would you assess the government's provision of financial incentives for sustainable construction?	Adapted from Jarada et al. (2024)	X10
11	Are there financial risks associated with investing in sustainable construction in Nigeria?	Adapted from Ifije & Aigbavboa (2020)	X11
12	How do you perceive the long-term financial benefits of sustainable construction compared to traditional methods?	Adapted from Meng & Gallagher (2012)	X12
13	Does your organization consider the return on investment when deciding on implementing sustainable practices?	Adapted from Oke et al. (2019)	X13
14	What financial barriers do you believe are the most critical in hindering sustainable construction in Nigeria?	Adapted from Bryman (2016)	X14
<b>Regulatory Barriers (GPR)</b>			
15	To what extent do current building codes and standards contribute to advancing sustainable construction in Nigeria?	Adapted from Kineber et al. (2022)	X15
16	In your opinion, does the regulatory framework in Nigeria effectively encourage the adoption of sustainable construction practices?	Adapted from Balon et al. (2024)	X16
17	How often does your organization face challenges with regulatory compliance in sustainable construction projects?	Adapted from Akadiri (2015)	X17
18	What is your perception of the enforcement of sustainable construction regulations by local authorities?	Adapted from Bryman (2016)	X18
19	How would you rate the clarity and accessibility of information regarding sustainable construction regulations?	Adapted from Ifije & Aigbavboa (2020)	X19
20	Have you encountered any bureaucratic delays when seeking approvals for sustainable construction projects?	Adapted from Oke et al. (2019)	X20
21	What improvements do you suggest for the regulatory framework to better support sustainable construction in Nigeria?	Adapted from Lima et al. (2021)	X21
<b>Technological Barriers (ATE)</b>			

22	How accessible are sustainable construction materials and technologies in Nigeria?	Adapted from Meng & Gallagher (2012)	X22
23	Does your organization have the technical expertise required to implement sustainable construction practices?	Adapted from Lima <i>et al.</i> (2021)	X23
24	How significant is the role of technological innovation in overcoming barriers to sustainable construction?	Adapted from Ayarkwa <i>et al.</i> (2022)	X24
25	Have you faced challenges related to the cost of sustainable construction technologies?	Adapted from Ifije & Aigbavboa (2020)	X25
26	What is your perception of the availability of training programs for sustainable construction technologies in Nigeria?	Adapted from Ershad <i>et al.</i> (2021)	X26
27	How do you rate the support from technology suppliers in terms of service and maintenance of sustainable construction equipment?	Adapted from Ametepey <i>et al.</i> (2015)	X27
28	What technological barriers do you believe are the most critical in hindering sustainable construction in Nigeria?		X28
	Social/Cultural Barriers (SCB)	Adapted from Ayarkwa <i>et al.</i> (2022)	
29	How significant is the resistance to change among stakeholders in adopting sustainable construction practices?	Adapted from Yao <i>et al.</i> (2023)	X29
30	How knowledgeable do you think the general public and clients are about the advantages of sustainable construction?	Adapted from Jarada <i>et al.</i> (2024)	X30
31	Do cultural preferences for traditional construction methods hinder the adoption of sustainable building practices?	Adapted from Oke <i>et al.</i> (2019)	X31
32	How significant do you consider the influence of social norms on the acceptance of sustainable construction in Nigeria?	Adapted from Ifije & Aigbavboa (2020)	X32
33	How do you view the role of educational institutions in fostering sustainable construction practices?		X33
34	How important do you think community engagement is in the successful implementation of sustainable construction projects?	Adapted from Lima <i>et al.</i> (2021)	X34
35	What social or cultural barriers do you believe are the most critical in hindering sustainable construction in Nigeria?	Adapted from Ayarkwa <i>et al.</i> (2022)	X35
	Organizational Culture (OC)	Adapted from Ershad <i>et al.</i> (2021)	
36	How supportive is your organization's leadership towards the adoption of sustainable construction practices?	Adapted from Bryman (2016)	X36
37	Does your organization have a formal policy or strategy for sustainable construction?	Adapted from Ametepey <i>et al.</i> (2015)	X37
38	How would you rate the level of awareness and training provided to employees about sustainable construction practices?	Adapted from Ifije & Aigbavboa (2020)	X38
39	How does your organization handle resistance to sustainable practices among employees?	Adapted from Oke <i>et al.</i> (2019)	X39
40	Are sustainable practices integrated into your organization's core values and mission?	Adapted from Ifije & Aigbavboa (2020)	X40
41	How often are sustainability performance metrics used to evaluate projects in your organization?	Adapted from Bryman (2016)	X41
42	What organizational cultural barriers do you believe are the most critical in hindering sustainable construction in Nigeria?	Adapted from Oke <i>et al.</i> (2019)	X42

Case studies were selected based on their relevance to sustainability practices, geographical diversity, and the type of construction projects involved. The selection of case studies was guided by the need to reflect both large-scale urban developments and smaller-scale projects, ensuring that the challenges and successes of implementing

sustainable practices across a variety of project types and locations were captured. These case studies were identified from project documents, on-site observations, and interviews with project teams (Yin, 2018).

### Sampling Techniques and Participant Selection

A combination of purposive sampling for interviews and stratified random sampling for the survey was employed. Purposive sampling ensured the inclusion of key stakeholders with extensive experience and influence in the construction industry, such as public officials, private developers, and sustainability-focused organizations (Patton, 2015). For the survey, stratified random sampling was used to ensure balanced representation across different roles (e.g., engineers, architects, contractors), company sizes, and regions of Nigeria. This ensured that both urban and rural regions were adequately represented, addressing any potential urban-centric bias in the survey respondents.

### Limitations of the Methodology

Several limitations were noted in this study. One limitation is the reliance on self-reported data from surveys and interviews, which may be subject to response bias. Measures such as anonymity and confidentiality were employed to mitigate this risk (Kock et al., 2021). Another limitation is that purposive sampling was used for the interviews and case studies, potentially limiting the generalizability of findings. While purposive sampling was effective for gathering in-depth insights, future research could employ larger and more diverse samples to enhance generalizability (Etikan et al., 2015). Additionally, the cross-sectional nature of the study meant that data was collected at a single point in time, potentially missing temporal shifts in barriers and attitudes toward sustainable construction. Future studies could employ longitudinal designs to better understand how barriers evolve over time (Hassett & Paavilainen-Mäntymäki, 2013).

## RESULTS AND DISCUSSION

### Response Rate and Demographics

The survey achieved an impressive response rate of 75%, with 150 out of 200 distributed questionnaires being returned. Wu et al. (2022) emphasizes that response rates exceeding 70% are considered highly reliable for research. This indicates the relevance of the study and the high level of engagement among Nigerian construction professionals, especially given the current focus on sustainability.

Table 2 provides an overview of the demographic profile of respondents. Engineers formed the largest group of respondents (40%), followed by architects (30%), project managers (20%), and contractors (10%). Notably, 60% of respondents had over 10 years of experience in the industry, highlighting the depth of expertise present among participants. The respondents also represented a wide range of organizational sizes, from small (30%) to medium (40%) and large firms (30%), primarily operating in urban areas (70%), where most of Nigeria’s construction activities are concentrated. This diversity ensures that the data is representative of the industry’s challenges across various professional roles and regions in Nigeria.

**Table 2.** Demographic Profile of Respondents

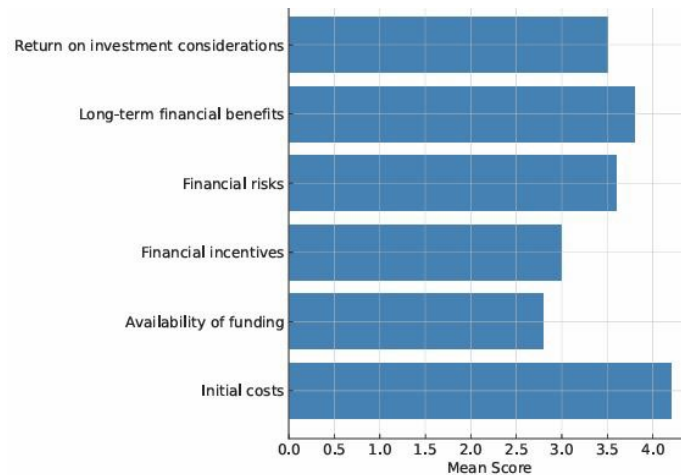
SN	Demographic Category	Percentage (%)
1	Professional Role	
2	Engineers	40
3	Architects	30
4	Project Managers	20
5	Contractors	10
6	Years of Experience	
7	Less than 5 years	10
8	5-10 years	30
9	More than 10 years	60
10	Organization Size	

11	Small (1-50 employees)	30
12	Medium (51-200 employees)	40
13	Large (201+ employees)	30
14	Region of Operation	
15	Urban	70
16	Rural	30

## Financial Barriers

Financial barriers were identified as one of the most significant hurdles to adopting sustainable construction in Nigeria. Confirmatory Factor Analysis (CFA) validated the reliability of financial barriers as a critical constraint, with robust model fit indices (CFI = 0.91, RMSEA = 0.05). Figure 1 presents the findings for financial barriers, with initial costs identified as the most substantial deterrent (mean score = 4.2). This supports existing literature, such as Lima et al. (2021), which highlights high upfront costs as a key factor preventing widespread adoption of sustainable practices, particularly in developing countries.

Further analysis revealed that the availability of funding for sustainable construction was rated low (mean score = 2.8), underscoring the need for more financial support mechanisms from both the public and private sectors (Ershad et al., 2021). Financial incentives, similarly rated low (mean score = 3.0), further emphasize the necessity of governmental intervention to drive green construction practices. Multiple regression analysis confirmed that financial barriers significantly influenced the likelihood of adopting sustainable practices ( $\beta = -0.42$ ,  $p < 0.01$ ). These findings are in line with studies from Althoey et al. (2023), which also noted that financial incentives play a pivotal role in promoting sustainability across the construction sector.



**Figure 1.** Financial Barriers to Sustainable Construction

## Regulatory Barriers

The study found regulatory barriers to be the most critical factor impeding the adoption of sustainable construction. CFA analysis supported this finding, with excellent model fit indices (CFI = 0.92, RMSEA = 0.04). As shown in Figure 2, weak regulatory frameworks (mean score = 2.9) and ineffective building codes (mean score = 2.7) were identified as key challenges. These issues are exacerbated by bureaucratic delays (mean score = 3.4), which contribute to slowing down the approval process for sustainable projects.

The results are consistent with findings from Jarada et al. (2024), who also emphasized the inadequacy of building regulations in promoting sustainability. Moreover, the inconsistency in enforcing existing regulations (mean score = 2.8) suggests that Nigeria's regulatory framework lacks the robustness necessary to drive industry-wide change toward sustainability. Multiple regression analysis demonstrated that regulatory barriers were the strongest predictor of the failure to adopt sustainable construction practices ( $\beta = -0.55$ ,  $p < 0.01$ ), reaffirming the critical need for policy reform (Balon et al., 2024).

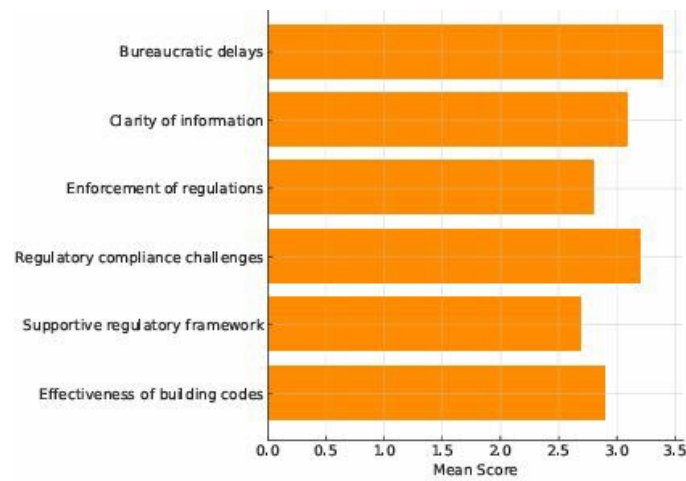


Figure 2. Regulatory Barriers to Sustainable Construction

### Technological Barriers

Technological barriers were identified as a significant, though less critical, factor in comparison to regulatory barriers. Figure 3 illustrates the technological challenges identified by respondents, with accessibility to sustainable materials receiving a moderately low rating (mean score = 3.2), while technical expertise was also rated as insufficient (mean score = 3.1). These findings align with the observations of Goh et al. (2023), who noted that developing economies often struggle with accessing eco-friendly materials and lack the technical know-how required for sustainable construction.

The cost of sustainable technologies (mean score = 3.5) further compounded these issues, echoing similar challenges faced in other developing regions such as India and Brazil, where technology costs remain prohibitive (Komurlu et al., 2024). The limited availability of training programs (mean score = 3.0) was also cited as a barrier, highlighting the need for capacity building and specialized education to equip professionals with the skills required for sustainable construction practices. Regression analysis confirmed the significant impact of technological barriers on adoption rates ( $\beta = -0.38, p < 0.01$ ).

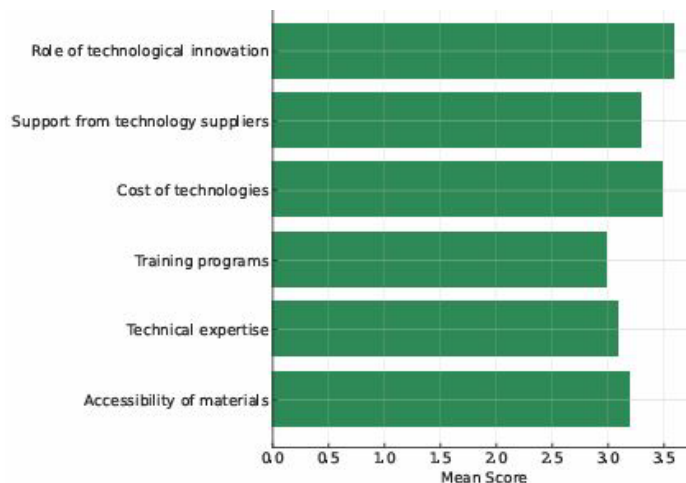


Figure 3. Technological Barriers to Sustainable Construction

### Social/Cultural Barriers

The study also identified significant social and cultural barriers, with resistance to change emerging as the most critical challenge (mean score = 4.0), corroborating Ayarkwa et al. (2022), who noted that entrenched traditional practices often hinder the adoption of new, sustainable technologies. Table 3 shows that public awareness about the benefits of sustainable construction was relatively low (mean score = 2.7), further limiting the willingness of clients and professionals to embrace green building techniques.

This lack of awareness is a significant barrier, as sustainable construction practices are often seen as costly and unnecessary, particularly in low- and middle-income countries where immediate economic returns are prioritized over long-term environmental benefits (Ershad et al., 2021). Cultural preferences for traditional building methods (mean score = 3.5) and influence of social norms (mean score = 3.2) were also highlighted, suggesting that cultural change and awareness campaigns are essential to drive sustainability in Nigeria's construction sector.

**Table 3.** Social/Cultural Barriers to Sustainable Construction

SN	Social/Cultural Barrier	Mean Score (SD)	Regression Coefficient ( $\beta$ )	p-value
1	Resistance to change	4.0 (0.8)	-0.42	<0.01
2	Public awareness	2.7 (1.2)	-0.35	<0.01
3	Cultural preferences	3.5 (0.9)	-0.3	<0.05
4	Influence of social norms	3.2 (0.8)	-0.25	<0.05
5	Role of educational institutions	3.8 (0.7)	0.3	<0.05
6	Community engagement	3.6 (0.6)	0.32	<0.05

## Organizational Culture

Organizational culture emerged as the second most critical factor, with leadership support rated highly (mean score = 3.9), confirming the vital role of leadership in promoting sustainability (Lima et al., 2021). Table 4 highlights that formal policies (mean score = 3.4) and training programs (mean score = 3.2) were rated as moderately present within organizations. This indicates that while there is growing awareness of sustainability, many organizations lack comprehensive strategies to fully integrate green practices into their operations.

Organizations that have embraced sustainability as part of their core values (mean score = 3.6) were more likely to have adopted green construction methods. The use of performance metrics (mean score = 3.3) to evaluate the success of sustainable projects further underscores the importance of institutionalizing sustainability within corporate culture (Yu et al., 2018). Regression analysis confirmed the significance of organizational culture in promoting sustainable construction ( $\beta = 0.45$ ,  $p < 0.01$ ).

**Table 4.** Organizational Culture Barriers to Sustainable Construction

SN	Organizational Culture Barrier	Mean Score (SD)	Regression Coefficient ( $\beta$ )	p-value
1	Support from leadership	3.9 (0.7)	0.45	<0.01
2	Formal policies	3.4 (1.0)	0.35	<0.01
3	Awareness and training	3.2 (1.1)	0.3	<0.05
4	Handling resistance	3.5 (0.9)	0.32	<0.05
5	Integration into core values	3.6 (0.8)	0.38	<0.01
6	Use of performance metrics	3.3 (0.8)	0.28	<0.05

## Discussion of Findings

The findings of this study underscore the multifaceted challenges hindering the widespread adoption of sustainable construction practices in Nigeria, which span financial, regulatory, technological, and social/cultural domains. These barriers, although distinct, are deeply interconnected and often compound one another, creating a complex environment for the transition to greener building practices.

### Regulatory Barriers

Among the various challenges, regulatory barriers were identified as the most significant, driven by weak building codes, unsupportive policies, and bureaucratic inefficiencies. These issues are not unique to Nigeria but are common in many developing countries, as highlighted by Herrera, (2019), who argue that the absence of robust regulatory frameworks is a significant hindrance to sustainable development. Countries like South Africa and India

have faced similar regulatory challenges. For instance, South Africa has struggled with inconsistent enforcement of building codes, and India has seen limited progress due to inadequate regulatory incentives (Komurlu et al., 2024).

In response to these barriers, policy reforms are urgently needed. Nigeria could draw from international best practices to create a more supportive regulatory framework. For example, the Passivhaus standard in Germany, which promotes energy efficiency through strict building codes, could be adapted to Nigerian conditions (Kumar et al., 2022). Moreover, developing stronger compliance mechanisms and aligning building codes with sustainable construction goals would incentivize better practices. A key recommendation is the establishment of a national regulatory body for sustainable construction, which would oversee the implementation and enforcement of green building standards, ensuring consistency and transparency.

### **Financial Barriers**

Financial constraints emerged as another significant barrier, echoing findings from Lima et al. (2021) and Ershad et al. (2021), who identified the high upfront costs and lack of financial incentives as major obstacles to the adoption of sustainable construction. While high initial costs are a common barrier worldwide, in Nigeria, the limited availability of government incentives exacerbates the issue. This financial challenge is also observed in developed countries where incentives and tax breaks are not always sufficient to overcome the cost gap between traditional and sustainable building methods (Nasereddin & Price, 2021).

To address this, financial mechanisms such as government subsidies or tax breaks for green construction projects could be modeled after successful initiatives in California (USA). California's Title 24 Energy Efficiency Standards, which include financial incentives for energy-efficient buildings, could serve as a model for Nigeria (Nasereddin & Price, 2021). Additionally, green bonds or low-interest loans targeted specifically at sustainable construction projects could be introduced to alleviate the financial burden. The Nigerian government could also collaborate with international financial institutions to secure funding for green construction projects, ensuring that financial risks are minimized for developers.

### **Technological Barriers**

Technological barriers, including the high cost of sustainable materials and the lack of technical expertise, also emerged prominently in the study. Developing countries often struggle with access to cutting-edge construction technologies, and Nigeria is no exception. As noted by Goh et al. (2023), limited availability of advanced technologies and inadequate local production capacity are significant challenges for the sector. Furthermore, the lack of specialized training programs for sustainable construction technologies compounds this issue, as the workforce remains unprepared to implement green practices effectively.

Countries like Sweden, which has successfully integrated sustainable timber into large-scale projects such as the Skellefteå Cultural Centre, provide valuable lessons for Nigeria (Tazmeen & Mir, 2024). By investing in local research and development for sustainable technologies, Nigeria could lower the costs of green materials and increase their availability. Additionally, vocational training and university-level education focusing on green construction techniques should be prioritized to equip the next generation of professionals with the skills needed to implement these practices effectively.

### **Social and Cultural Barriers**

Finally, social and cultural barriers, such as resistance to change and low public awareness, were identified as critical factors impeding the adoption of sustainable construction practices. These findings are consistent with those of Ayarkwa et al. (2022), who highlight the challenges posed by entrenched preferences for traditional building methods and the lack of awareness about the long-term economic and environmental benefits of sustainable construction.

In response, Nigeria must invest in public awareness campaigns and community engagement to shift cultural attitudes towards sustainability. Drawing on the experience of Indonesia, where public education campaigns have successfully raised awareness about energy-efficient housing, Nigeria could adopt similar strategies to educate the public on the importance of sustainable construction (Kumar et al., 2022). Additionally, engaging local communities in the design and implementation of sustainable building projects can help overcome resistance to change and ensure that the benefits of green construction are widely understood and accepted.

## Global Implications

The findings of this study not only provide insights into the barriers to sustainable construction in Nigeria but also offer lessons that can be applied in other emerging economies. Globally, countries like Germany, California (USA), and Sweden have made significant strides in overcoming similar challenges. Their experiences suggest that strong regulatory frameworks, financial incentives, access to green technologies, and public education are crucial elements for the successful adoption of sustainable construction practices. For international readers, particularly those in developing countries facing similar barriers, the study highlights the importance of adapting these global strategies to local contexts, ensuring that sustainability efforts are both feasible and effective.

This study underscores the need for a multi-faceted approach to addressing the barriers to sustainable construction in Nigeria. Regulatory reforms, financial incentives, technological investments, and public education are key to fostering a more sustainable built environment. By learning from successful examples in other countries and adapting their policies and practices to Nigeria's unique context, the country can overcome these challenges and pave the way for a more sustainable future in the construction industry.

## Study Limitations

Despite the comprehensive nature of this study, it has certain limitations. The cross-sectional design limits the ability to track changes in attitudes or barriers over time. Moreover, reliance on self-reported data may introduce response bias, as participants may provide socially desirable answers. Future research should adopt a longitudinal approach to observe changes in the barriers and facilitators of sustainable construction over time (Hassett & Paavilainen-Mäntymäki, 2013).

## Implications and Future Research Directions

This study provides several important implications for the construction industry and policymakers in Nigeria. Addressing the barriers identified requires a multi-faceted approach that includes regulatory reform, financial incentives, technological innovation, and cultural change. Policymakers should prioritize the development of policies that support sustainable construction, including financial mechanisms that reduce the upfront costs of sustainable technologies and regulations that streamline bureaucratic processes.

Future research should focus on evaluating policy interventions that can incentivize the adoption of sustainable practices. Studies exploring successful sustainability frameworks from developed countries, such as the European Union and the United States, could provide valuable insights into how these models could be adapted for the Nigerian context. Moreover, further research should investigate the effectiveness of public awareness campaigns and educational programs in changing cultural attitudes and increasing demand for sustainable construction.

Finally, there is a need for more research on the long-term economic and environmental benefits of sustainable construction in Nigeria. Longitudinal studies that track the performance of sustainable buildings over time could provide empirical data on their cost-effectiveness and environmental impact. Such studies would strengthen the case for green building practices and provide valuable data to support policy and decision-making.

## CONCLUSION

This research has provided critical insights into the barriers hindering the adoption of sustainable construction practices in Nigeria, identifying regulatory, organizational, social, cultural, and technological factors as the primary obstacles. The findings reveal that these barriers are not isolated but are deeply interconnected, with regulatory challenges emerging as the most significant. Outdated building codes, inadequate legislative support, and bureaucratic inefficiencies have created an environment where the consistent application of green building practices is difficult to achieve. To overcome these obstacles, it is essential that policymakers prioritize strengthening the regulatory framework. This includes modernizing building codes to integrate sustainability standards, enforcing sustainability mandates more rigorously, and streamlining administrative processes to eliminate bureaucratic inefficiencies that currently impede progress. These reforms will create a solid foundation for sustainable construction and encourage the industry to adopt green building practices.

Equally important is the need to shift organizational culture within the construction sector. Construction firms should take proactive steps to embed sustainability into their core values, starting with strong leadership commitment. The formalization of sustainability policies at the organizational level is crucial, as it ensures that green building practices become part of the firm's long-term strategy. Companies that integrate sustainability into their leadership

structures and policies are more likely to foster a culture of eco-friendly practices that extends to all levels of operation. Thus, it is recommended that construction firms focus on creating and maintaining a culture that prioritizes sustainability, supported by internal training programs to equip employees with the skills and knowledge necessary to implement green technologies effectively.

The study also identified significant social and cultural barriers, including resistance to change and low public awareness of the benefits of sustainable construction. These cultural challenges must be addressed through comprehensive public awareness campaigns aimed at educating the general public about the long-term economic, health, and environmental benefits of green construction. Raising public awareness is essential not only to shift societal attitudes but also to generate increased demand for sustainable building practices. These campaigns can play a key role in overcoming resistance to change and facilitating the adoption of sustainable construction practices at the grassroots level.

Technological barriers, such as the high cost of sustainable materials and the shortage of technical expertise, were also found to be critical hindrances. To address these challenges, there is a need for increased investment in green technologies and the development of local supply chains that can provide affordable, sustainable materials. At the same time, there must be a concerted effort to provide specialized training programs for construction professionals to build technical expertise in green construction methods. Collaboration between industry stakeholders, government, and technology providers is essential to driving innovation, reducing costs, and making sustainable technologies more accessible.

While these findings are particularly relevant to Nigeria, they also hold significant implications for other developing countries facing similar barriers. Countries like South Africa, India, and Indonesia have encountered similar challenges in their efforts to promote sustainable construction. In South Africa, for example, the government has implemented stricter building codes and incentives for the adoption of sustainable technologies. Similarly, India has introduced policies that offer financial incentives for green buildings, and Indonesia has successfully fostered public-private partnerships to improve access to sustainable construction materials. These international examples highlight the effectiveness of regulatory reforms, financial incentives, and collaborative efforts between various stakeholders in overcoming the barriers identified in this study. Nigeria could benefit from adopting similar policy frameworks, as well as leveraging international best practices, to overcome its own challenges in promoting sustainable construction.

Furthermore, the insights from this study are highly relevant for other developing economies with similar socio-economic and environmental contexts. As rapid urbanization, environmental degradation, and resource scarcity continue to pose significant challenges in these regions, the adoption of sustainable construction practices becomes increasingly critical. By focusing on regulatory reforms, fostering a culture of sustainability within organizations, and improving public awareness, these countries can enhance the adoption of green building practices. Such efforts would not only contribute to the achievement of national sustainability goals but also support the broader global agenda for sustainable development.

Overall, advancing sustainable construction in Nigeria, as well as in other developing economies, requires a holistic and coordinated approach that addresses regulatory barriers, encourages organizational culture change, increases public engagement, and promotes technological innovation. The recommendations outlined in this study, if implemented, could lay the groundwork for a more sustainable construction sector that benefits both the environment and the economy. Future research should focus on evaluating the long-term impact of these interventions, assessing the effectiveness of different policy measures, and exploring the role of emerging technologies and social dynamics in overcoming the barriers to sustainable construction.

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