Perceived Barriers to Implementing Sustainable Construction Practices among Small and Medium-Sized Enterprises (SMEs) in Nigeria

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Abstract: Adopting sustainable construction practices is critical for mitigating the environmental impact of the construction industry, yet Small and Medium-Sized Enterprises (SMEs) in Nigeria face significant challenges in embracing these practices. Despite the industry's substantial contribution to the country's economy, the integration of sustainability within SMEs remains limited, raising concerns about the sector's long-term environmental sustainability. This study aims to identify and analyse the perceived barriers to sustainable construction practices among SMEs in Abuja, Nigeria. Using a quantitative research design, data were collected through structured questionnaires from 116 SME owners, managers, and key decision-makers. The analysis revealed that financial constraints, lack of expertise, regulatory challenges, and technological complexity are the most significant barriers hindering the adoption of sustainable practices. The study also found no statistically significant differences in the perception of these barriers between small and medium enterprises, suggesting that these challenges are widespread across different enterprise sizes. The findings highlight the need for comprehensive policy interventions, financial support, and targeted training programs to help SMEs overcome these barriers. This study provides valuable insights for policymakers and industry stakeholders and contributes to the broader discourse on promoting sustainability in the construction industry.

Cite This Article: Idris, A., Okeniyi, A.B., Ajibade, Y.A., Ujong, J.A. & Abdulraheem, A.A. (2024). Perceived Barriers to Implementing Sustainable Construction Practices among Small and Medium-Sized Enterprises (SMEs) in Nigeria. *Journal of Sustainability and Environmental Management*, 3(4), 173-183.

1. Introduction

Sustainability in construction has emerged as a critical issue in addressing global environmental challenges. The construction industry significantly contributes to environmental degradation, accounting for nearly 39% of global energy-related carbon dioxide (CO_2) emissions, a statistic highlighting the urgent need for sustainable practices within the sector (UNEP, 2019). Sustainable construction, which involves the integration of environmental considerations throughout the lifecycle of a construction project, is increasingly recognised as essential for mitigating the environmental impact of the construction industry (Atombo et al., 2015). In Nigeria, the construction industry plays a pivotal role in the country's economic development, contributing approximately 3% to the national GDP and employing a substantial portion of the workforce (National Bureau of Statistics, 2018). However, despite the recognised importance of sustainability, the adoption of sustainable construction practices in Nigeria remains limited, particularly among Small and Medium-Sized Enterprises (SMEs), which constitute the majority of the construction sector (Bello et al., 2025; Oyewobi et al., 2011; Daniel et al., 2018).

SMEs are often considered the backbone of the construction industry, particularly in developing countries like Nigeria, where they account for a significant portion of employment and economic activity (Olawumi & Chan, 2018). These enterprises, however, face numerous challenges that hinder their ability to adopt and implement sustainable construction practices. The most commonly

identified barriers include financial constraints, a lack of technical expertise, regulatory challenges, perceived complexity and high initial costs of sustainable technologies, logistical difficulties related to the procurement and supply of sustainable materials, limited market demand for sustainable construction, and an organisational culture that may not prioritise sustainability (Tokbolat et al., 2020; Ogunmakinde et al., 2017; Bello et al., 2024a,b). Financial constraints are particularly problematic for SMEs in Nigeria, where access to capital is often limited, and the high upfront costs associated with sustainable practices, such as the purchase of green technologies and materials, can be prohibitive (John et al., 2023; Oyewobi et al., 2011).

Moreover, the lack of technical expertise within SMEs exacerbates these financial challenges. Many SMEs lack the knowledge and skills to effectively implement sustainable practices, often requiring specialised training and education that may not be readily available in developing countries (Loosemore & Reid, 2019; Banihashemi et al., 2017). This knowledge gap is further compounded by the perceived complexity of sustainable technologies, which can be intimidating for smaller firms that may not have the technical capacity to integrate these innovations into their existing operations (Tokbolat et al., 2020). Regulatory challenges also present a significant obstacle, as environmental regulations in Nigeria are often perceived as complex, costly, and challenging to navigate, particularly for SMEs that may lack the resources to ensure compliance (Daniel et al., 2018; Oyewobi et al., 2011). The constantly evolving nature of these regulations adds another layer of difficulty, creating an environment of uncertainty and risk for SMEs (Rostami et al., 2015).

In addition to these internal challenges, external factors such as logistical difficulties and limited market demand for sustainable construction further hinder SMEs' adoption of green practices. The fragmented nature of the construction supply chain in Nigeria can make it difficult for SMEs to procure sustainable materials in a cost-effective and timely manner, particularly in regions where the infrastructure for green construction is underdeveloped (Ogunmakinde et al., 2017; Daniel et al., 2018). Furthermore, while there is a growing global interest in sustainable construction, this demand is not yet fully realised in Nigeria, particularly among clients who may prioritise cost over environmental considerations (Olawumi & Chan, 2018). This limited market demand reduces the incentive for SMEs to invest in sustainable practices, as the perceived return on investment may not justify the initial costs (Revell & Blackburn, 2007).

Despite the growing body of literature on sustainable construction, much of the existing research has focused on larger firms or has provided only a limited analysis of the specific challenges faced by SMEs, particularly in the context of developing countries like Nigeria (Banihashemi et al., 2017). Studies that do address sustainability in SMEs often rely on qualitative approaches, which, while valuable, lack the quantitative rigour needed to measure the extent to which these barriers impact SMEs and to identify which barriers are most critical (Olawumi & Chan, 2018). Moreover, there is a significant gap in the literature

regarding the interaction between these barriers and how they collectively influence the decision-making processes within SMEs. For instance, while financial constraints and lack of expertise are commonly identified as major barriers, the relationship between these factors and other challenges, such as regulatory compliance and market demand, has not been thoroughly explored.

This study aims to address gaps in understanding the awareness and barriers to implementing sustainable construction practices among SMEs in Nigeria. Despite the growing emphasis on sustainability within the construction sector, little research has quantitatively assessed SMEs' awareness of these practices and the specific barriers they face in adopting them. This research seeks to fill this gap by focusing on seven key barriers—financial constraints, lack of expertise, regulatory challenges, technological complexity, logistical challenges, market demand, and organisational culture—while also assessing SMEs' awareness of sustainable construction practices.

The primary objectives of this study are to:

i.   Assess the level of awareness of sustainable construction practices among SMEs in Nigeria.
ii.   Identify and quantify the key barriers SMEs perceive that hinder the adoption of sustainable construction practices.

The justification for this study lies in SMEs' crucial role in the Nigerian construction industry and the potential environmental and economic benefits that could be realised through their increased awareness and adoption of sustainable practices. By identifying these barriers and understanding the level of awareness, this research aims to support SMEs in overcoming these challenges and contribute to broader sustainability efforts in the Nigerian construction industry.

2. Literature review

2.1. Sustainability in Construction

Sustainability in construction has become a critical focus area in the global effort to mitigate environmental degradation. The construction industry is one of the most extensive natural resources and energy consumers, accounting for nearly 39% of global energy-related carbon dioxide (CO_2) emissions (UNEP, 2019). Sustainable construction aims to reduce the environmental impact of construction activities by adopting practices that promote energy efficiency, resource conservation, and waste reduction across the entire lifecycle of a building, from design and construction to operation, maintenance, and eventual demolition (Shurrab et al., 2019).

The concept of sustainable construction is closely linked to the broader framework of sustainable development, which emphasises the need to meet present-day needs without compromising the ability of future generations to meet theirs (Idris & Bello, 2023; Kibert, 2016). In practical terms, sustainable construction involves using environmentally friendly materials, energy-efficient technologies, and processes that minimise the consumption

of resources and the production of waste (Bello et al., 2023; Chel & Kaushik, 2018). Furthermore, sustainable construction practices contribute to the creation of healthier living environments, reduce operating costs over the lifecycle of a building, and enhance the overall resilience of buildings to climate change impacts (Murtagh et al., 2020).

Despite the clear benefits of sustainable construction, its widespread adoption remains limited, particularly in developing countries (Bello et al., 2024c). The slow uptake of sustainable practices is often attributed to financial, technical, and regulatory challenges and the lack of awareness and demand for sustainable construction from clients and end-users (Ametepey et al., 2015). Addressing these challenges requires a concerted effort from all stakeholders in the construction industry, including government agencies, construction firms, and clients, to create an enabling environment that supports adopting sustainable practices.

While much of the research on sustainable construction has focused on technical and financial barriers (Shurrab et al., 2019), there is a notable gap in examining how awareness of sustainable practices influences SMEs' decision-making. Incorporating awareness could change the perception of financial feasibility and provide opportunities for collaboration to overcome regulatory hurdles. This gap is particularly crucial in developing economies, where SMEs may not fully understand sustainable practices' long-term cost savings and environmental benefits.

2.2. The Role of SMEs in the Construction Industry

Small and Medium-Sized Enterprises play a vital role in the global construction industry, particularly in developing economies where they are often the primary providers of construction services (Mustafa Kamal & Flanagan, 2012). SMEs dominate the construction sector in Nigeria, contributing significantly to economic growth and employment. SMEs are characterised by their flexibility, responsiveness to local market conditions, and ability to deliver projects on a smaller scale, which makes them indispensable in the construction industry (Oyewobi et al., 2023).

Despite their importance, SMEs in the construction industry face unique challenges that differentiate them from larger firms. These challenges include limited access to finance, a lack of technical expertise, and difficulties complying with complex regulatory frameworks (Sallem et al., 2017). Moreover, SMEs often operate with narrow profit margins, making it difficult to invest in new technologies or practices that may appear more costly, such as those associated with sustainable construction (Boakye et al., 2020).

The role of SMEs in promoting sustainable construction is crucial, given their significant presence in the industry. However, SMEs' adoption of sustainable practices is often constrained by a range of barriers that must be addressed to enable these enterprises to contribute effectively to the sustainability agenda (Alkilani & Loosemore, 2022).

Understanding these barriers and developing targeted strategies to overcome them is essential for advancing sustainability in the construction industry, particularly in countries like Nigeria, where SMEs dominate.

Despite the barriers faced, SMEs' awareness of sustainable practices could significantly influence their ability to overcome financial and technical obstacles. While the literature has primarily focused on financial barriers, limited attention has been given to how awareness may facilitate overcoming these challenges. This study intends to fill this gap by exploring how raising awareness can lead to increased investment in sustainability, even within resource-constrained SMEs.

2.3. Barriers to the Adoption of Sustainable Practices in SMEs

SMEs' adoption of sustainable construction practices is hindered by several key barriers, which are interconnected and often exacerbate each other. Financial constraints are among the most significant barriers, as the initial costs associated with sustainable construction such as the purchase of eco-friendly materials, energy-efficient technologies, and certification processes can be prohibitive for smaller firms with limited access to capital (Abdulraheem & Isa, 2024; Chan et al., 2018). Additionally, SMEs often lack the technical expertise required to implement sustainable practices effectively, which can deter them from adopting such practices even when financial resources are available (Omopariola et al., 2024).

Regulatory challenges also play a critical role in hindering SMEs' adoption of sustainable practices. In many developing countries, including Nigeria, environmental regulations are perceived as complex and burdensome, particularly for SMEs that may lack the resources to navigate and comply with these regulations (Onyekwere, 2023). The perceived complexity and high costs associated with sustainable technologies further contribute to the reluctance of SMEs to embrace sustainability. These technologies often require specialised knowledge and skills, which may not be readily available within SMEs, leading to concerns about the feasibility of implementing these technologies (Meijer et al., 2019).

Logistical challenges related to the procurement and supply of sustainable materials also hinder SMEs' adoption of sustainable practices (Omopariola et al., 2024). Sustainable materials are often more expensive and less readily available than conventional materials, particularly in regions where the infrastructure for green construction is underdeveloped (Kibert, 2016). Furthermore, the limited market demand for sustainable construction reduces the incentive for SMEs to invest in green practices, as the perceived return on investment may not justify the initial costs (Hwang et al., 2018). Finally, organisational culture within SMEs can significantly impact the adoption of sustainable practices. Suppose sustainability is not seen as a priority by the leadership of the SME. In that case, it is unlikely to be integrated into the company's operations

(Omopariola et al., 2024)—table 1 summarises the barrier's components.

In addition to financial and technical challenges, awareness has been largely overlooked as influencing SMEs' decision-making. This study suggests that better awareness of available sustainable practices, long-term cost benefits, and regulatory incentives could empower SMEs to overcome the financial and logistical hurdles they face. Moreover, the role of organisational culture in enabling or hindering sustainability adoption cannot be overstated; awareness at the leadership level can shift priorities towards more sustainable practices.

Table 1: SME barriers towards sustainable construction practices

Code	Physical Property	Result
B1	Financial Constraints	High initial costs associated with sustainable materials, technologies, and certifications, coupled with limited access to capital for SMEs.
B2	Lack of Expertise	Insufficient technical knowledge and skills within SMEs to implement and manage sustainable construction practices effectively.
B3	Regulatory Challenges	Complex and costly environmental regulations are difficult for SMEs to navigate and comply with, particularly in developing countries.
B4	Technological Complexity	The difficulty and high costs of implementing sustainable technologies often require specialised knowledge and skills.
B5	Logistical Challenges	Difficulties in sourcing and procuring sustainable materials, especially in regions with underdeveloped infrastructure for green construction.
B6	Market Demand	Limited client demand for sustainable construction practices reduces SMEs' incentive to invest in sustainability.
B7	Organisational Culture	Key decision-makers attitudes and priorities often drive the lack of prioritisation of sustainability within the organisational culture of SMEs.

Source: Authors adapted

3. Materials and methods

This study used quantitative research to explore the perceived barriers to adopting sustainable construction practices among Small and Medium-Sized Enterprises (SMEs) in Abuja, Nigeria. A descriptive research approach was employed to systematically capture SMEs' current perceptions and challenges in the construction industry. Given the city's role as a significant hub for construction activities, the target population included owners, managers, and key decision-makers within SMEs in Abuja. Abuja's relevance to this study lies in its rapid urbanisation, making it an ideal setting to examine sustainability issues in construction.

A purposive sampling method selected 116 respondents with relevant industry experience and knowledge of sustainability challenges. The sample size of 116 respondents was deemed sufficient to provide reliable insights into the barriers faced by SMEs. The adequacy of this sample size is supported by previous studies in similar contexts that have used sample sizes of comparable numbers (Aka et al., 2024; Abdulraheem et al., 2024a; Olanrewaju et al., 2024) and have demonstrated that reliable insights can be drawn from this range, particularly in qualitative and mixed-methods research.

Data were collected through a structured questionnaire administered via Google Forms, which is suitable for quantitative research due to its ability to reach a broad audience and facilitate standardised data collection (Creswell and Creswell, 2017). Google Forms was chosen over other survey methods for its cost-effectiveness, ease of use, and ability to reach a geographically dispersed sample. It offers real-time data collection, automatic organisation of responses, and user anonymity, which encourages honest responses. Questionnaires are particularly effective in this context as they enable the collection of quantifiable data, which can be systematically analysed to draw meaningful conclusions (Saunders et al., 2016).

The data analysis was conducted using SPSS, a statistical software in social sciences research. Descriptive statistics, such as means and standard deviations, were calculated to summarise the respondents' perceptions of barriers to sustainable construction practices. A one-sample t-test was also conducted to determine whether the perceived barriers significantly differed from a neutral midpoint, offering an overall assessment of the impact of these barriers on the adoption of sustainable practices among SMEs (De Winter, 2013). The Mann-Whitney U test was employed to assess differences in perceptions based on the size of the enterprise (small and medium). This non-parametric test is instrumental when comparing two independent groups, especially when the data do not follow a normal distribution (Nachar, 2008). The Mann-Whitney U test compares rank orders and is suitable for ordinal data. While the Mann-Whitney U test is robust to violations of normality, it does not provide information about the magnitude of differences, only whether a significant difference exists.

4. Results and discussion

4.1. Characteristics of respondents

The demographic profile in Table 1 offers a robust foundation for the study, ensuring that the derived insights are relevant and comprehensive. The distribution of respondent roles, with a significant proportion being owners, founders, and managers (75% collectively), indicates that the data reflects the perspectives of those with decision-making power within their SMEs. This is crucial, as their views on barriers to sustainable construction practices will likely be informed by practical experience and strategic considerations. The balance between small (55%) and medium-sized enterprises (45%) in the sample ensures that the study captures a diverse range of organisational contexts, which is vital for understanding how barriers to sustainability might differ based on company size. Additionally, the respondents' substantial industry experience, with 70% of SMEs operating for over five years, suggests that the data reflects the views of well-established enterprises likely to have encountered various challenges in adopting sustainable practices. The educational background of the respondents, with a majority holding at least a bachelor's degree, further supports the adequacy of the demographic data. This educational level suggests that respondents have a baseline understanding of industry trends and sustainability issues, which adds credibility to their responses regarding the perceived barriers. However, the varying levels of awareness of sustainable construction practices, particularly the moderate awareness reported by the majority, highlight a critical area for further investigation and potential intervention, as shown in Figure 1.

Table 2: Characteristics of respondents

Demographic Variable	Category	Frequency	Percentage
Respondent Role in the SME	Owner/Founder	46	40%
	Manager	41	35%
	Project Supervisor	17	15%
	Other (e.g., Engineer, Consultant)	12	10%
Size of the SME	Small enterprise (< 50 employees)	64	55%
	Medium Enterprise (50-249 employees)	52	45%
Years of Operation	Less than 5 years	35	30%
	5-10 years	46	40%
	More than 10 years	35	30%
	Building Construction	58	50%
	Civil Engineering	29	25%
	Renovation and Remodelling	17	15%
	Other (e.g., Infrastructure, Consultancy)	12	10%
Level of Education	Diplomas	12	10%
	Master's degree	29	25%
	Bachelor's Degree	58	50%
	Doctorate degree	17	15%
Awareness of Sustainable Construction Practices	Very High	12	10%
	High	23	20%
	Moderate	58	50%
	Low	17	15%
	Very Low	6	5%
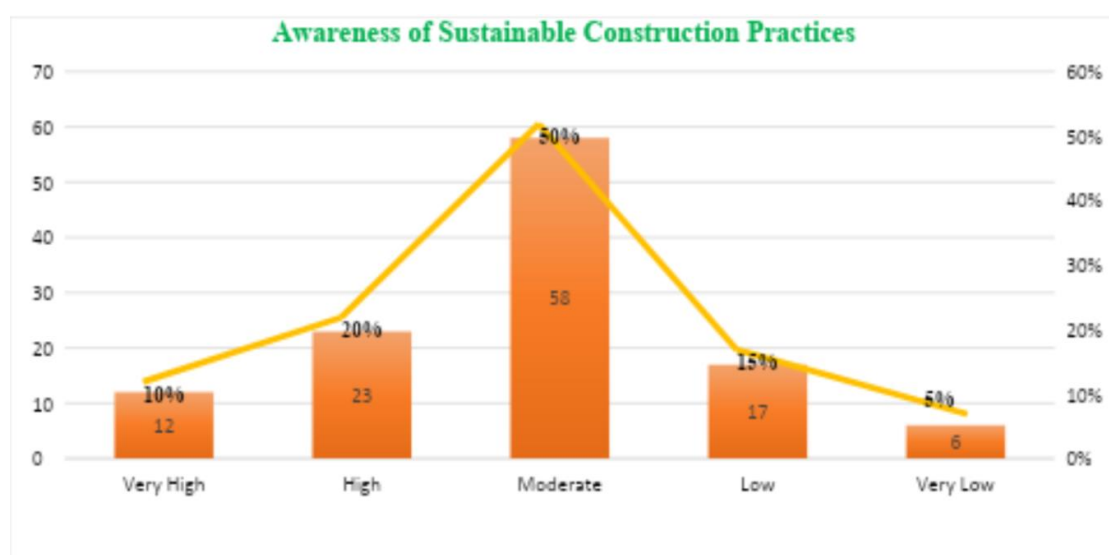
Figure 1: Level of awareness

4.2. Presentation of barriers result

The results of this study reveal several critical barriers that SMEs in Abuja face when attempting to adopt sustainable construction practices. Financial constraints emerged as a predominant challenge, with high initial costs (MIS = 4.32, SD = 0.65, t = 8.54, p < 0.001) and limited access to capital (MIS = 4.18, SD = 0.72, t = 7.89, p < 0.001) being particularly significant. These financial hurdles are not surprising, as they are frequently cited in the literature as significant obstacles for SMEs, especially in contexts where access to affordable financing is restricted. The variability in responses, as indicated by the standard deviations, suggests that while financial constraints are a common issue, the extent of the challenge may vary depending on the specific circumstances of each SME.

Lack of expertise was also highlighted as a significant barrier. The findings suggest that many SMEs struggle with insufficient technical knowledge (MIS = 4.12, SD = 0.75, t = 7.45, p < 0.001) and training (MIS = 4.05, SD = 0.68, t = 7.12, p < 0.001), which are crucial for the effective implementation of sustainable practices. This barrier is compounded by the reliance on external consultants (MIS = 3.88, SD = 0.82, t = 6.10, p = 0.002), which, sometimes necessary, can increase operational costs and create dependency issues. The statistically significant results for these barriers underline the critical need for capacity-building initiatives to equip SMEs with the necessary skills and knowledge to adopt sustainable practices independently.

Regulatory challenges are another substantial barrier identified in the study. Complex compliance requirements (MIS = 4.25, SD = 0.67, t = 8.20, p < 0.001) and the lack of government support (MIS = 4.10, SD = 0.73, t = 7.50, p < 0.001) were particularly problematic, reflecting broader issues within the regulatory environment that SMEs must navigate. The bureaucratic hurdles (MIS = 4.00, SD = 0.70, t = 7.00, p < 0.001) and inconsistent enforcement of regulations (MIS = 3.85, SD = 0.80, t = 6.05, p = 0.002) add layers of difficulty, making it challenging for SMEs to commit to sustainability. These regulatory barriers are consistent with previous research, which often highlights the complexity and costliness of compliance as deterrents to sustainable practices in the construction industry.

Table 2: Barriers towards SME implementation

Code	Barrier Category	Specific Barriers	MIS	SD	t	df	Sig. (2-tailed)
B1	Financial Constraints	High Initial Costs	4.320	0.650	8.540	115	0.000
		Limited Access to Capital	4.180	0.720	7.890	115	0.000
		Uncertain Return on Investment (ROI)	3.950	0.800	6.340	115	0.001
		High Cost of Compliance	4.200	0.700	7.640	115	0.000
B2	Lack of Expertise	Insufficient Training	4.050	0.680	7.120	115	0.000
		Limited Technical Knowledge	4.120	0.750	7.450	115	0.000
		Dependence on External Consultants	3.880	0.820	6.100	115	0.002
		Lack of Awareness of Best Practices	3.900	0.780	6.250	115	0.001

B3	Regulatory Challenges	Complex Compliance Requirements	4.250	0.670	8.200	115	0.000
		Lack of Government Support	4.100	0.730	7.500	115	0.000
		Bureaucratic Delays	4.000	0.700	7.000	115	0.000
		Inconsistent Regulatory Enforcement	3.850	0.800	6.050	115	0.002
B4	Technological Complexity	Advanced Technology Integration	3.920	0.760	6.400	115	0.001
		High Costs of Technology	4.150	0.710	7.600	115	0.000
		Rapid Technological Changes	3.750	0.840	5.800	115	0.004
		Lack of Technical Support	3.850	0.780	6.000	115	0.003
B5	Logistical Challenges	Supply Chain Issues	4.100	0.730	7.450	115	0.000
		Transportation Costs	4.050	0.700	7.200	115	0.000
		Storage and Handling	3.920	0.750	6.500	115	0.001
		Inconsistent Material Availability	3.850	0.780	6.000	115	0.002
B6	Market Demand	Low Consumer Awareness	3.800	0.820	5.900	115	0.004
		Price Sensitivity	4.000	0.770	6.800	115	0.000
		Competitive Pressure	3.950	0.750	6.500	115	0.001
		Limited Market Differentiation	3.700	0.850	5.600	115	0.005
B7	Organisational Culture	Resistance to Change	4.050	0.700	7.100	115	0.000
		Lack of Leadership Commitment	4.000	0.720	7.000	115	0.000
		Insufficient Communication	3.850	0.780	6.000	115	0.002
		Short-Term Focus	3.900	0.800	6.200	115	0.001

Technological complexity also poses a significant challenge. The high costs associated with adopting new technologies (MIS = 4.15, SD = 0.71, t = 7.60, p < 0.001) and the rapid pace of technological change (MIS = 3.75, SD = 0.84, t = 5.80, p = 0.004) create significant obstacles for SMEs. These barriers highlight a critical gap in the support available to SMEs, particularly regarding access to affordable, sustainable technologies and ongoing technical support. The variability in perceptions within this category suggests that while some SMEs may be more technologically advanced, others are struggling to keep up, further exacerbating the challenges related to sustainable construction.

Logistical challenges and market demand also surfaced as noteworthy barriers, with issues like supply chain disruptions (MIS = 4.10, SD = 0.73, t = 7.45, p < 0.001) and low consumer awareness (MIS = 3.80, SD = 0.82, t = 5.90, p = 0.004) being significant. These challenges reflect the broader market and infrastructure difficulties that SMEs face, which can be particularly acute in emerging economies like Nigeria. The moderate standard deviations suggest a consistent experience of these barriers across the sample. Lastly, organisational culture was identified as an internal barrier to adopting sustainable practices. Resistance to change (MIS = 4.05, SD = 0.70, t = 7.10, p < 0.001) and insufficient communication (MIS = 3.85, SD = 0.78, t = 6.00, p = 0.002) were notable issues. These findings emphasise the need for organisational change management strategies that foster a culture of sustainability within SMEs. The significant p-values indicate that

respondents universally recognise these barriers, underscoring their importance in promoting sustainable practices in the industry.

4.3. Analysis of variance (Mann-Whitney U test)

The Mann-Whitney U test results indicate that no perceived barriers to sustainable construction practices show statistically significant differences between small and medium enterprises, as all p-values are above 0.05. This suggests that both groups experience similar financial constraints, lack of expertise, regulatory challenges, technological complexity, logistical challenges, market demand, and organisational culture barriers. The uniformity of these perceptions implies that the challenges SMEs face in adopting sustainable practices are consistent across different enterprise sizes. The lack of significant differences also suggests that policy interventions, training programs, and support mechanisms designed to address these barriers can be applied broadly across the SME sector without needing customisation based on enterprise size. This finding underscores the importance of developing comprehensive strategies that can effectively support all SMEs in overcoming these common barriers to sustainability, ensuring that efforts to promote sustainable practices in the construction industry are inclusive and impactful for businesses of all sizes.

Table 3: Mann-Whitney U test

Code	Physical Property	Mann-Whitney U test (p-values)
		Small/Medium (p-values)
B1	Financial Constraints	0.082
B2	Lack of Expertise	0.071
B3	Regulatory Challenges	0.085
B4	Technological Complexity	0.095
B5	Logistical Challenges	0.105
B6	Market Demand	0.115
B7	Organisational Culture	0.072

4.4. Discussion of result

The findings of this study reveal significant barriers to adopting sustainable construction practices among SMEs in Abuja, Nigeria, with financial constraints emerging as the most pressing challenge. This aligns with the work of Chan et al. (2018), who emphasised that the high initial costs associated with sustainable materials and technologies, combined with limited access to capital, create substantial obstacles for SMEs. The financial difficulties these enterprises face are compounded by the uncertain return on investment (ROI), which discourages adopting costly sustainable practices.

The study also highlighted the lack of expertise as a critical barrier, corroborating the findings of Omopariola et al. (2024), who noted that SMEs often struggle with insufficient technical knowledge and skills necessary for implementing sustainable construction practices. As observed in this study, the dependence on external consultants increases operational costs and highlights the need for targeted training programs to build internal capacities within SMEs. This is consistent with the assertions of Loosemore and Reid (2019) and Abdulraheem et al. (2024b), who underscored the knowledge gap as a significant impediment to sustainability in the construction sector.

Regulatory challenges were also a significant obstacle, particularly the complexity and cost of compliance with environmental regulations. This finding echoes Onyekwere (2023), who pointed out that SMEs in developing countries like Nigeria often perceive environmental regulations as burdensome, leading to difficulties in compliance. The inconsistent enforcement of these regulations further exacerbates the challenges SMEs face, creating an environment of uncertainty that hinders the adoption of sustainable practices.

Technological complexity, including the high costs of adopting new technologies and the rapid pace of technological change, was identified as another significant barrier. This is in line with Meijer et al. (2019), who highlighted the perceived difficulty of integrating sustainable technologies into existing operations, particularly for SMEs that may not have the necessary technical support. The challenges related to technological complexity suggest a critical gap in the support structures available to SMEs, which could be addressed through initiatives that provide affordable access to sustainable technologies and ongoing technical assistance.

Interestingly, the Mann-Whitney U test results indicated no statistically significant differences between small and medium enterprises in their perceptions of these barriers. This suggests that the challenges of adopting sustainable practices are pervasive across different enterprise sizes, supporting the view of Boakye et al. (2020) that fundamental barriers such as financial constraints and regulatory challenges affect all SMEs similarly, regardless of size. This finding has important implications for policy and practice, as it suggests that interventions to promote sustainability can be designed to broadly address these barriers across the SME sector without the need for differentiation based on enterprise size.

4.5. Practical Implications

Overcoming the barriers to sustainable construction in SMEs is crucial for the growth of the Nigerian construction industry. While financial, technical, regulatory, and market-related challenges persist, SMEs can leverage existing resources and strategies to implement sustainable practices effectively.

i.   Financial Constraints

SMEs can access affordable financing through collaborations with local banks offering green loans or microfinancing options for SMEs adopting sustainable practices. Many banks already offer loans for small businesses, and partnering with government programs could make these funds more accessible for green projects. Cost-saving measures such as energy-efficient construction techniques or local sustainable materials can also reduce operational costs over time, incentivising SMEs to invest in sustainability even within limited budgets.

ii.   Lack of Expertise

To address the skills gap, SMEs can engage in free or low-cost online training programs offered by industry bodies, universities, or NGOs focused on sustainable construction. Platforms like Coursera or edX provide accessible training in green construction techniques, which can be a starting point for SMEs with limited access to in-person training programs. Additionally, SMEs can hire consultants on a project-by-project basis, focusing on high-priority projects to gain necessary expertise without committing to full-time hires.

iii.   Regulatory Challenges

SMEs can partner with industry associations to better understand and comply with complex regulations. Associations often have resources to guide SMEs through the regulatory process, ensuring compliance without significant financial strain. Collaborating with regulatory bodies to stay informed about upcoming changes and taking advantage of government incentives for early adoption can help SMEs avoid regulatory hurdles.

iv.   Logistical Challenges and Market Demand

To overcome logistical issues, SMEs can join cooperative purchasing groups or networks, allowing them to buy sustainable materials in bulk, thus reducing costs. Furthermore, SMEs can market their sustainability efforts to attract environmentally conscious clients, using online platforms and industry-specific networking events to showcase their green credentials.

By leveraging these existing resources and adopting practical, resource-efficient strategies, SMEs can overcome barriers to sustainability and contribute to a greener, more competitive construction industry in Nigeria.

4.6. Limitations

This study is not without its limitations. The research was conducted in Abuja, Nigeria, and while the findings provide valuable insights into the barriers SMEs face in this context, they may not be fully generalisable to other regions or countries with different regulatory environments and market dynamics. The reliance on self-reported data through surveys may also introduce response bias, as respondents might have overestimated or underestimated the significance of specific barriers based on their subjective experiences.

5. Conclusion

This study has comprehensively analysed the perceived barriers to implementing sustainable construction practices among SMEs in Abuja, Nigeria. The findings indicate that financial constraints, lack of expertise, regulatory challenges, and technological complexity are the most significant barriers, with no statistically significant differences in perceptions between small and medium enterprises. These results suggest that the challenges of adopting sustainable practices are consistent across different enterprise sizes, highlighting the need for broad-based interventions that address these common barriers. The study contributes to the existing literature by providing quantitative evidence of SMEs' specific challenges in the construction industry, particularly in a developing country context. The findings underscore the critical role of financial support, capacity-building initiatives, and regulatory reform in promoting sustainable practices among SMEs.

5.1. Future Study Directions

Future research could build on this study by exploring the barriers to sustainable construction practices in different regions of Nigeria or in other developing countries to provide a more comprehensive understanding of the challenges faced by SMEs globally. Comparative studies examining the barriers in both developing and developed countries could offer insights into how different economic and regulatory environments influence adopting sustainable practices. Additionally, longitudinal studies that track the impact of interventions, such as financial assistance or training programs, on adopting sustainable practices over time would be valuable in assessing the effectiveness of these strategies in overcoming the identified barriers.

5.2. Recommendation

This study highlights several barriers preventing SMEs in Nigeria from adopting sustainable construction practices, including financial constraints, lack of technical expertise, regulatory challenges, and limited market demand. The following recommendations are proposed for policymakers and industry stakeholders to address these. First, financial support is crucial to ease the high initial costs associated with sustainable construction. Policymakers should introduce low-interest loans, subsidies, and tax incentives for SMEs adopting green technologies and materials. These financial incentives would reduce the burden on SMEs and encourage them to invest in sustainable practices.

Second, capacity-building programs should be implemented to address the knowledge gap. Governments and industry associations must offer affordable training in sustainable construction methods and green certifications. These programs should empower SMEs to integrate sustainable practices into their operations effectively. Additionally, simplifying regulations is key. Policymakers should streamline environmental regulations and provide clear guidelines for SMEs to follow. Simplifying the certification process and offering incentives, such as reduced taxes for meeting sustainability standards, would motivate SMEs to comply with green building regulations.

Government bodies and large corporations can embed sustainability criteria in procurement processes to increase market demand, encouraging SMEs to adopt green practices to access larger projects. Public-private partnerships could fund large-scale sustainable infrastructure projects, providing SMEs valuable opportunities. Finally, promoting technological innovation is essential. Government subsidies for green technologies and creating innovation hubs would help SMEs access affordable, sustainable construction solutions. Additionally, leadership training should be offered to help SME owners prioritise sustainability in their organisational culture. These recommendations aim to create a supportive environment for SMEs, enabling them to overcome barriers and contribute to a more sustainable construction sector in Nigeria.

References

Abdulraheem, A. A., & Isa, R. B. (2024). A critical review of sustainable practice in the Nigerian construction industry: trends and future studies direction. *5th International Conference of School of Environmental (SETIC 2024), 1*(1), 108-114.

Abdulraheem, A. A., Agada, D. I., Ajala, O. D., & Adio, K. V. (2024a). Assessment of employees performance rating in the Nigerian construction industry. *BIMA Journal of Science and Technology (2536-6041), 8*(4A), 37-48. https://doi.org/10.56892/bima.v8i4.1143

Abdulraheem, A. A., Isa, R. B., & Abdulsalam, R. A. (2024b). Examining the awareness level of the deployment of sustainable practices in the construction industry in Abuja. *Proceedings of the International Korkut Ata Scientific Research Conference Osmaniye, Türkiye, 3*, 210-218.

Aka, A., Bello, A.O., Bamgbade, A.A. & Bilau, A.A. (2024). Age-performance consideration in the recruitment of tradespeople in Nigerian construction industry. *Engineering, Construction and Architectural Management, 31*(1), 386-404. https://doi.org/10.1108/ECAM-05-2022-0430

Alkilani, S., & Loosemore, M. (2022). Project performance measurement for small-and-medium sized construction contractors in the Jordanian construction industry. *Construction Management and Economics, 40*(10), 743-769.

Ametepey, O., Aigbavboa, C., & Ansah, K. (2015). *Barriers to successful implementation of sustainable construction in the Ghanaian construction industry. Procedia Manufacturing, 3*, 1682-1689.

Atombo, C., Cudjoe, J., Dzantor, K., & Agbo, A. A. (2015). Integration of sustainable construction in project management: A case study in Ghana. *International Journal of Construction Engineering and Management, 4*(1), 13-25.

Banihashemi, S., Hosseini, M. R., Golizadeh, H., & Sankaran, S. (2017). Critical success factors (CSFs) for integration of sustainability into construction project management practices in developing countries. *International journal of project management, 35*(6), 1103-1119.

Bello, A.O., Eje, D.O., Idris, A., Semiu, M.A. & Khan, A.A. (2024b). Drivers for the implementation of modular construction systems in the AEC industry of developing countries. *Journal of Engineering, Design and Technology, 22*(6), 2043-2062. https://doi.org/10.1108/JEDT-11-2022-0571

Bello, A.O., Isa, R.B., Afolabi, O.P., Arogundade, S. & Khan, A.A. (2023). Drivers for the implementation of circular economy in the Nigerian AECO industry: a structural equation modelling approach. *Journal of Engineering, Design and Technology.* https://doi.org/10.1108/JEDT-09-2023-0434

Bello, A.O., Isa, R.B., Oke, A.E., Arogundade, S. & Lewis, J.M.O. (2024c). Circular economy implementation in the construction industry: an examination of the barriers in a developing country. *International Journal of Building Pathology and Adaptation.* https://doi.org/10.1108/IJBPA-10-2023-0154

Bello, A.O., Khan, A.A., Idris, A. & Awwal, H.M. (2024a). Barriers to modular construction systems implementation in developing countries' architecture, engineering and construction industry. *Engineering, Construction and Architectural Management, 31*(8), 3148-3164. https://doi.org/10.1108/ECAM-10-2022-1001

Bello, A. O., Okanlawon, T. T., Ajayi, O. M., Ogunmakinde, O. E., Abdulazeez, A. M., & Isa, R. B. (2025). Appraisal of circular economy adoption among small and medium enterprises (SMEs) in the construction industry. *International Journal of Construction Education and Research.* https://doi.org/10.1080/15578771.2025.2587945

Boakye, D. J., Tingbani, I., Ahinful, G., Damoah, I., & Tauringana, V. (2020). Sustainable environmental practices and financial performance: Evidence from listed small and medium‐sized enterprise in the United Kingdom. *Business Strategy and the Environment, 29*(6), 2583-2602.

Chan, A. P. C., Darko, A., Olanipekun, A. O., & Ameyaw, E. E. (2018). Critical barriers to green building technologies adoption in developing countries: The case of Ghana. *Journal of Cleaner Production, 172,* 1067-1079.

Chel, A., & Kaushik, G. (2018). Renewable energy technologies for sustainable development of energy efficient building. *Alexandria engineering journal, 57*(2), 655-669.

Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications.

Daniel, E. I., Oshineye, O., & Oshodi, O. (2018, September). *Barriers to sustainable construction practice in Nigeria. In Proceedings of the 34th Annual ARCOM Conference* (pp. 149-158). Association of Researchers in Construction Management.

De Winter, J. C. F. (2013). Using the Student's t-test with extremely small sample sizes. *Practical Assessment, Research & Evaluation, 18*(10), 1-12.

Hwang, B. G., Shan, M., & Lye, J. M. (2018). Adoption of sustainable construction for small contractors: major barriers and best solutions. *Clean Technologies and Environmental Policy, 20*, 2223-2237.

Idris, A., & Bello, A.O. (2023). Strategies for Adoption of Circular Economy in the Nigeria Construction Industry. *Journal of Management Science & Engineering Research. 6*(2), 47-59. https://doi.org/10.30564/jmser.v6i2.5846

John, I. B., Adekunle, S. A., & Aigbavboa, C. O. (2023). Adoption of circular economy by construction industry SMEs: organisational growth transition study. *Sustainability, 15*(7), 5929.

Kibert, C. J. (2016). Sustainable construction: green building design and delivery. John Wiley & Sons.

Loosemore, M., & Reid, S. (2019). The social procurement practices of tier-one construction contractors in Australia. *Construction management and economics, 37*(4), 183-200.

Meijer, L. L. J., Huijben, J. C. C. M., Van Boxstael, A., & Romme, A. G. L. (2019). Barriers and drivers for technology commercialisation by SMEs in the Dutch sustainable energy sector. *Renewable and Sustainable Energy Reviews, 112*, 114-126.

Murtagh, N., Scott, L., & Fan, J. (2020). Sustainable and resilient construction: Current status and future challenges. *Journal of Cleaner Production, 268*, 122264.

Mustafa Kamal, E., & Flanagan, R. (2012). Understanding absorptive capacity in Malaysian small and medium sized (SME) construction companies. *Journal of Engineering, Design and Technology, 10*(2), 180-198.

Nachar, N. (2008). The Mann-Whitney U: A test for assessing whether two independent samples come from the same distribution. *Tutorials in Quantitative Methods for Psychology, 4*(1), 13-20.

National Bureau of Statistics. (2018). Construction industry statistics: Q4 2018 report. Abuja: National Bureau of Statistics.

Ogunmakinde, O. E., Sher, W. D., Maund, K., Wipulanusat, W., Panuwatwanich, K., & Stewart, R. A. (2017). *Exploring the relationships between construction phases and sustainable construction Principles.* Paper presented at the World Sustainable Built Environment Conference 2017, Hong Kong.

Olanrewaju, O. I., Bello, A. O., Semiu, M. A., & Mudashiru, S. A. (2024). Critical barriers to effective communication in the construction industry: evidence from Nigeria. *International Journal of Construction Management*, 1–19. https://doi.org/10.1080/15623599.2024.2362018

Olawumi, T. O., & Chan, D. W. (2018). A scientometric review of global research on sustainability and sustainable development. *Journal of Cleaner Production, 183*, 231-250.

Omopariola, E. D., Olanrewaju, O. I., Albert, I., Oke, A. E., & Ibiyemi, S. B. (2024). Sustainable construction in the Nigerian construction industry: unsustainable practices, barriers and strategies. *Journal of*

Engineering, Design and Technology, 22(4), 1158-1184.

Onyekwere, C. (2023). *Perception of key actors on the drivers and barriers to construction and demolition waste (CDW) management in Nigeria: A roadmap for the recognition of the informal sector* (Doctoral dissertation, Cardiff University).

Oyewobi, L. O., Ganiyu, B. O., Oke, A. A., Ola-Awo, A. W., & Shittu, A. A. (2011). Determinants of unethical performance in Nigerian construction industry. *Journal of Sustainable Development, 4*(4), 175.

Oyewobi, L., Adedayo, O. F., Olorunyomi, S. O., & Jimoh, R. A. (2023). Influence of social media adoption on the performance of construction small and medium-sized enterprises (SMEs) in Abuja–Nigeria. *Engineering, Construction and Architectural Management, 30*(9), 4229-4252.

Rostami, A., Sommerville, J., Wong, I. L., & Lee, C. (2015). Risk management implementation in small and medium enterprises in the UK construction industry. *Engineering, Construction and Architectural Management, 22*(1), 91-107.

Sallem, N. M., Nasir, N. E. M., Nori, W. M. N. W. M., & Kassim, C. K. H. C. K. (2017). Small and medium enterprises: Critical problems and possible solutions. *International Business Management, 11*(1), 47-52.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7th ed.). Pearson Education Limited.

Shurrab, J., Hussain, M., & Khan, M. (2019). Green and sustainable practices in the construction industry: A confirmatory factor analysis approach. *Engineering, Construction and Architectural Management, 26*(6), 1063-1086.

Tokbolat, S., Karaca, F., Durdyev, S., & Calay, R. K. (2020). Construction professionals' perspectives on drivers and barriers of sustainable construction. *Environment, Development and Sustainability, 22*, 4361-4378.

UNEP. (2019). *Global status report for buildings and construction: Towards a zero-emission, efficient and resilient buildings and construction sector.* United Nations Environment Programme.

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