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Assessment of the Barriers to the Adoption of Sustainable Building Design and Construction in Anambra State, Nigeria

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Abstract: **The global construction industry contributes significantly to environmental degradation, accounting for 39% of carbon emissions and 36% of energy consumption. The sustainable building design and construction (SBDC) offers solutions through improved energy efficiency and reduced environmental impact, its adoption in developing nations like Nigeria remains limited. This study identifies and analyzes the key barriers to SBDC implementation in Anambra State through a survey of 322 construction professionals, including contractors, clients, and consultants. Results indicate that financial and policy-related challenges are the most critical obstacles, with high initial costs (Mean=4.52, SD=0.61), lack of government incentives (Mean=4.38, SD=0.72), and limited material availability (Mean=4.15, SD=0.83) ranking as top barriers. Technical knowledge gaps (Mean=3.94) and low stakeholder awareness (Mean=3.87) were also significant, though with greater variability in responses. Resistance to change (Mean=3.65), weak regulation enforcement (Mean=3.42), and perceived project delays (Mean=3.21) were moderately impactful, while financing limitations (Mean=3.05) and cultural preferences (Mean=2.87) were less critical but contextually relevant. The study recommends immediate policy reforms, including financial incentives like subsidies and tax breaks, alongside stricter enforcement of green building regulations. The study also recommends Capacity-building programs for professionals and public awareness campaigns as essentials to address knowledge gaps, while local production of sustainable materials could improve affordability and accessibility.**

Keywords: **Sustainable construction, green buildings, barriers, Nigeria, policy, financial constraints.**

I. INTRODUCTION

The global construction industry is a significant contributor to environmental degradation, accounting for approximately 39% of global carbon emissions and 36% of energy consumption (Rissman *et al*., 2020). In response, sustainable building design and construction (SBDC) has emerged as a critical strategy to mitigate environmental impacts, enhance energy efficiency, and promote socio-economic resilience (Wang, Ibrahim and Zheng, 2024). Despite its benefits, the adoption of SBDC remains uneven, particularly in developing countries like Nigeria, where rapid urbanization, inadequate regulations, and economic constraints hinder progress (Ameh and Itodo, 2013; Adegun and Olusoga, 2017). Nigeria, as Africa's largest economy and most populous nation, faces acute sustainability challenges in its built environment. With a housing deficit exceeding 28 million units (World Bank, 2021) and reliance on conventional construction methods, the country struggles with resource depletion, energy inefficiency, and waste generation (Olotuah and Bobadoye, 2009). While international frameworks such as the UN Sustainable Development Goals (SDGs) and the Paris Agreement advocate for green building practices, Nigeria's implementation lags due to technical, financial, institutional, and cultural barriers (Egbu, Olomolaiye, & Gameson, 2018).

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According to Udechukwu., Adindu, and Okolie, (2021) SBDC in Nigeria have primarily focused on awareness levels and theoretical benefits with limited empirical assessment of the root barriers obstructing widespread adoption. Furthermore, Aliu and Adebayo, (2020) states that there remains a need for a comprehensive, multi-stakeholder analysis that integrates perspectives from architects, contractors, policymakers, and end-users in addressing the cost implications and policy gaps. This study seeks to fill this gap by systematically evaluating the key barriers to SBDC adoption in Nigeria and proposing actionable recommendations for industry practitioners and regulators.

II. LITERATURE REVIEW

The Concept of Sustainability

Sustainability is defined as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development [WCED], 1987). This concept emerged as a response to growing concerns about environmental degradation, resource depletion, and social inequalities caused by unchecked economic growth. According to Elkington (1997), sustainability rests on three interconnected pillars—environmental protection, economic viability, and social equity, collectively known as the triple bottom line. These dimensions must be balanced to ensure long-term planetary health and human well-being.

Environmental sustainability focuses on preserving ecosystems, reducing pollution, and mitigating climate change. Studies indicate that human activities have significantly altered natural systems, leading to biodiversity loss and global warming (IPCC, 2021). To counteract this, sustainable practices such as renewable energy adoption, waste reduction, and conservation efforts are essential (Rockström et al., 2009). The circular economy model, which emphasizes resource reuse and recycling, has gained traction as a way to minimize environmental impact (Ellen MacArthur Foundation, 2013). Without such measures, research suggests that critical planetary boundaries may be irreversibly crossed (Steffen et al., 2015).

Economic sustainability ensures that development is both profitable and enduring. The World Bank (2021) notes that transitioning to green economies can generate jobs while reducing ecological harm. Investments in clean energy, sustainable agriculture, and eco-friendly infrastructure are key drivers of this shift (IEA, 2020). However, critics argue that short-term profit motives often overshadow long-term sustainability goals (Stiglitz, 2019). To address this, frameworks like Environmental, Social, and Governance (ESG) criteria have been introduced to align business practices with sustainability principles (GRI, 2021).

Social sustainability promotes inclusive growth, ensuring that marginalized communities benefit from development. The United Nations (2015) highlights that poverty, inequality, and lack of access to basic services undermine sustainable progress. Affordable housing, fair wages, and participatory governance are critical components (UN-Habitat, 2020). Arnstein's (1969) ladder of citizen participation underscores the importance of community involvement in sustainability initiatives. Without equitable policies, social disparities can exacerbate environmental and economic crises (Raworth, 2017). In practice, sustainability requires collaboration across governments, businesses, and individuals. The United Nations Sustainable Development Goals (SDGs) provide a global blueprint for action (United Nations, 2015). While challenges remain, evidence suggests that systemic change is achievable through innovation, regulation, and collective effort (Mazzucato, 2021). Ultimately, sustainability is not just an environmental issue but a fundamental rethinking of how societies operate to ensure a viable future for all.

Sustainable Building Design and Construction

Sustainable building design and construction (SBDC) refers to the practice of creating structures that minimize environmental impact while maximizing resource efficiency, occupant health, and long-term economic viability. According to Kibert (2016), SBDC integrates principles such as energy efficiency, water conservation, and the use of eco-friendly materials to reduce the carbon footprint of buildings. The United Nations Environment Programme (UNEP, 2020) reports that the construction sector accounts for nearly 40% of global carbon emissions, making sustainable practices essential for mitigating climate change. Key strategies include passive solar design, green roofs, and rainwater harvesting systems, which enhance a building's sustainability performance (Smith, 2018).

A critical aspect of SBDC is the adoption of green building certification systems, such as LEED (Leadership in Energy and Environmental Design) and BREEAM (Building Research Establishment Environmental Assessment Method). These frameworks provide standardized metrics for evaluating sustainability in construction (Doan *et al.*, 2017). Research indicates that certified green buildings consume 25-30% less energy and generate significantly lower waste compared to conventional structures (WGBC, 2021). However, barriers such as high upfront costs, lack of skilled labor, and limited policy enforcement often hinder widespread adoption, particularly in developing nations (Ameh and Itodo, 2013).

Beyond environmental benefits, sustainable construction also enhances social and economic outcomes. Studies show that green buildings improve indoor air quality and occupant productivity, reducing healthcare costs and absenteeism (MacNaughton *et al*., 2018). Economically, while initial investments may be higher, life-cycle cost analyses reveal long-term savings through reduced energy and maintenance expenses (Kats, 2010). Governments and industry stakeholders play a pivotal role in promoting SBDC through incentives, stricter regulations, and public awareness campaigns (UNEP, 2021). As urbanization accelerates globally, sustainable building practices will be crucial for creating resilient, low-carbon cities that meet the needs of present and future generations

III. METHODOLOGY

This study utilized a survey design approach, employing questionnaire to gather data from building construction professionals actively involved in ongoing projects within Anambra State. The target population included contractors, clients, and officials from building development control units within the states' Physical Planning Boards, all of whom were fully registered professionals. A preliminary survey revealed a total population of 1,653 key stakeholders comprising 333 clients, 894 contractors, and 426 consultants engaged in public projects. Using purposive sampling, a sample size of 322 participants was selected, which included 131 contractors, 40 clients, and 151 consultants proportionally distributed across the states.

The copies of the questionnaire were sent to the heads of departments, site managers, and other key stakeholders to gather detailed insights into their experiences and perspectives. A structured questionnaire with open-ended questions ensured consistency, while allowing for a conversational style that facilitated deeper exploration of relevant topics. This approach enabled the researchers to clarify responses and obtain rich, context-specific data aligned with the study's objectives.

The mean score of the barriers were ranked according to their significant levels below:

4.51 – 5.00 = Extremely Significant Barrier

3.51 – 4.50 = Very Significant Barrier

2.51 – 3.50 = Moderately Significant Barrier

1.51 – 2.50 = Less Significant Barrier

1.00 – 1.50 = Not Significant

IV. RESULTS AND DISCUSSIONS

Table 1: The barriers to the adoption of sustainable building design and construction in Nigeria.

S/N	Barrier	N	Mean (1-5)	±SD	Rank	Interpretation
1	High initial construction costs	322	4.52	0.61	1	Extremely Significant
2	Lack of government incentives/policies	322	4.38	0.72	2	Very Significant
3	Limited availability of sustainable materials	322	4.15	0.83	3	Very Significant
4	Lack of technical expertise/knowledge	322	3.94	0.91	4	Significant
5	Low awareness among stakeholders	322	3.87	0.89	5	Significant
6	Resistance to change from traditional methods	322	3.65	1.02	6	Moderately Significant
7	Poor enforcement of building codes/regulations	322	3.42	1.11	7	Moderately Significant
8	Perceived longer project timelines	322	3.21	1.24	8	Moderately Significant
9	Limited financing options for green projects	322	3.05	1.32	9	Less Significant
10	Cultural preferences for conventional designs	322	2.87	1.45	10	Least Significant

Source: Researcher's Field survey (2024)

Table 1 presents a comprehensive analysis of the perceived barriers to adopting sustainable building design and construction in Nigeria, based on survey responses from 322 construction professionals and key stakeholders. The data reveals clear patterns in both the significance of various barriers and the degree of consensus among respondents about these challenges.

The results show that financial and policy-related barriers dominate as the most critical obstacles, with high initial construction costs (Mean=4.52, SD=0.61) ranking as the most significant barrier. The remarkably low standard deviation for this item indicates strong consensus among respondents about its importance. Similarly, lack of government incentives/policies (Mean=4.38, SD=0.72) and limited availability of sustainable materials (Mean=4.15, SD=0.83) were identified as very significant barriers, with relatively low standard deviations suggesting widespread agreement on these challenges. These findings align with existing literature that identifies cost and policy gaps as primary constraints in developing nations' sustainable construction efforts.

Technical and knowledge-related barriers form the next tier of significant obstacles, with lack of technical expertise (Mean=3.94) and low awareness among stakeholders (Mean=3.87) ranking fourth and fifth respectively. While still significant, these barriers show slightly higher standard deviations (0.91 and 0.89), indicating somewhat more varied perceptions among respondents. The middle range of barriers includes resistance to change (Mean=3.65), poor code enforcement (Mean=3.42), and perceived longer timelines (Mean=3.21), all classified as moderately significant. These items show progressively higher standard deviations (1.02 to 1.24), reflecting increasing variability in how respondents assess their importance.

The least significant barriers - limited financing options (Mean=3.05) and cultural preferences (Mean=2.87) - show the highest standard deviations (1.32 and 1.45 respectively), suggesting these are either context-dependent or not universally recognized as major obstacles. The pattern of decreasing means accompanied by increasing standard deviations from the top to bottom of the table implies that while professionals strongly agree about the primacy of financial and regulatory barriers, there is less consensus about the relative importance of other challenges.

These findings have important implications for policy and practice. The strong consensus around high costs and policy gaps suggests there should be immediate priorities for intervention, potentially through financial incentives, subsidies, or regulatory reforms. The moderate but more variable ratings of other barriers indicate that solutions may need to be tailored to specific contexts or stakeholder groups. The data provides valuable evidence to guide strategic decision-making in Nigeria's transition to sustainable construction practices

V. CONCLUSION AND RECOMMENDATIONS

The construction industry plays a major role in global environmental challenges, accounting for nearly 40% of carbon emissions and energy use worldwide. Sustainable building practices have emerged as a crucial solution to reduce this impact while creating more efficient and resilient structures. However, developing countries like Nigeria continue to face significant challenges in adopting these methods, despite their potential benefits.

This study examined the key barriers to sustainable construction in Anambra State, Nigeria through a survey of 322 building professionals, including contractors, clients, and consultants. The results clearly identified financial and policy issues as the most critical obstacles. High initial costs ranked as the top challenge, followed closely by lack of government incentives and limited availability of sustainable materials. These findings were consistent across respondents, showing strong agreement about their importance.

Technical knowledge gaps and low awareness among stakeholders emerged as secondary but still significant barriers. Other challenges like resistance to change, weak enforcement of regulations, and perceived longer project timelines were seen as moderately important, with more variation in how different groups viewed them. Cultural preferences and financing options were considered less critical overall, though they may require attention in specific situations.

To accelerate sustainable building adoption in Anambra State, immediate priorities should include implementing financial incentives like subsidies and tax breaks while strengthening green construction policies through stricter regulations and enforcement. Concurrently, targeted training programs for professionals and public awareness campaigns should address knowledge gaps while promoting local production of sustainable materials to improve affordability and accessibility

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