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Barriers to Green Building Strategies Implementation in Lagos Nigeria

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Abstract- ***Despite growing awareness of sustainable design, the implementation of Green Building Design Strategies (GBDS) in Lagos remains constrained. This study investigates the key barriers hindering effective GBDS adoption in high-rise office projects and proposes a policy roadmap to strengthen sustainable architectural practice. A mixed-methods approach was adopted involving 344 architects and 12 expert interviews. Quantitative data were analyzed using descriptive statistics and the Relative Importance Index (RII), while qualitative themes were developed through content analysis. Findings revealed that technological and cost-related barriers had the strongest influence on implementation outcomes. Low RII values for strategies such as smart building management (0.70) and greywater recycling reflected substantial technical and financial constraints. Regulatory weakness and limited client awareness further contributed to uneven adoption. The major barriers identified include: high capital cost of advanced systems; inadequate technical expertise; weak regulatory enforcement; low client demand; and insufficient policy support for sustainable construction. These barriers collectively explain the dominance of passive strategies over technological ones in Lagos' high-rise architecture. Interview evidence indicates that architects often avoid proposing complex GBDS due to concerns over maintenance feasibility and client resistance. The study proposes a three-tier policy roadmap focusing on: strengthening professional capacity; enhancing regulatory mechanisms; and introducing market and financial incentives. These measures could accelerate GBDS integration in Lagos and similar African cities. This research provides mixed-methods assessments of GBDS implementation barriers in Lagos using a large professional sample. The combined empirical and policy-oriented approach offers a robust framework for enhancing sustainable high-rise design practices in developing urban contexts.***

Keywords- ***Architects, Green Building Design Strategies, High-rise designs, Implementation Barriers, Lagos***

I. INTRODUCTION

The rapid urban explosion of high-rise commercial development in Lagos has intensified concerns regarding environmental performance, energy consumption, and long-term resilience of the built environment. As Nigeria's economic hub and one of Africa's fastest-growing megacities, Lagos faces increasing pressure to adopt sustainable design practices capable of mitigating resource depletion, rising operational costs, and climate-related challenges. Green Building Design Strategies (GBDS) offer a viable pathway for addressing these challenges; however, their implementation remains limited and inconsistent across architectural practice. Globally, prior literatures acknowledged that sustainable building strategies encounter multiple barriers in developing contexts, including financial constraints, technological limitations, regulatory weakness, and limited stakeholder awareness (Fisk, 2019; Vine, 2021; Pierchala et al., 2016). These barriers often restrict the transition from awareness to meaningful practice, resulting in selective adoption patterns dominated by low-cost, familiar, or climate-responsive solutions.

In Nigeria, although the architecture and construction sector contribute significantly to national development (Adebisi et al., 2016), GBDS adoption is still grappling with the scale of high-rise development. Previous studies, including Adeogun (2023; 2024), demonstrate that while architects in Lagos are increasingly aware of sustainability concepts, implementation is constrained by multiple structural and contextual barriers. Technological strategies such as smart building systems and greywater recycling remain largely underutilized, whereas passive design approaches continue to dominate practice. Despite this growing body of research, limited scholarly attention has been given specifically to identifying and

characterizing the barriers that shape GBDS implementation in Lagos' high-rise office buildings.

Furthermore, policy frameworks guiding sustainable design remain weak, resulting in a practice environment where green strategies are optional rather than mandated. Understanding the nature, relative significance, and interactions of these barriers is essential for developing targeted interventions capable of improving environmental performance in Lagos' commercial architecture.

This study addresses this gap by examining the barriers limiting GBDS implementation using a mixed-methods approach involving 344 architects and 12 expert interviews. The research identifies and categorizes the major constraints hindering GBDS adoption and develops a policy roadmap to guide sustainable architectural practice in Lagos. The findings contribute to sustainability research by providing empirically grounded insights into the systemic, institutional, and practice-based limitations affecting green design integration in African cities.

II. LITERATURE REVIEW

Green Building Design Strategies (GBDS) have increasingly become central to sustainable development discourse due to their potential to reduce environmental impact, enhance resource efficiency, and improve building performance. However, despite their benefits, the adoption and implementation of GBDS remain limited in many developing countries, where systemic and practice-based barriers restrict their integration into mainstream architectural practice. This section reviews the global, regional, and Nigerian literature on barriers to green building implementation, highlighting gaps.

A. Global Barriers to Green Building Implementation

International research consistently identifies several recurring obstacles that impede the adoption of sustainable building practices. These include:

1. High Initial Costs

Advanced GBDS often require significant upfront investment in materials, equipment, and specialized labour. Studies show that clients and developers are frequently deterred by perceived or actual capital costs, even when long-term savings are evident (Vine, 2021).

2. Limited Technical Expertise

Successful implementation of technological strategies-such as smart building management, renewable energy systems, and water-recycling technologies-requires technical skill sets that are often scarce in many regions (Fisk, 2019).

3. Weak Policy and Regulatory Frameworks

Even in developed countries, inconsistent enforcement of sustainability standards can hinder widespread adoption (Galas & Syal, 2016). Where sustainability guidelines are optional, practitioners often prioritize conventional design approaches.

4. Market Perceptions and Awareness

Building stakeholders may lack awareness of the long-term value of green buildings, resulting in resistance or skepticism toward sustainable design innovations. These global barriers form the foundation for understanding the specific challenges encountered in developing regions such as Sub-Saharan Africa.

B. Barriers in African and Developing Country Contexts

African cities face unique constraints that complicate sustainable building implementation. Research identifies challenges such as:

1) Unstable construction markets
2) Limited access to high-quality green materials
3) Inadequate institutional support
4) Low demand for certified green buildings

Pierchala et al. (2016) observed that passive strategies dominate African architecture due to the high cost of technological alternatives and climatic suitability of traditional cooling and ventilation methods. Similarly, regulatory frameworks across many African nations remain underdeveloped, reducing the incentive for stakeholders to adopt comprehensive GBDS. Client reluctance, weak enforcement, and fragmented sustainability policies often result in a selective adoption landscape where only low-cost or familiar strategies are applied.

C. Nigerian Context: The Case of Lagos

Nigeria, and Lagos in particular, reflects several of these continental trends. The construction sector contributes significantly to national development (Adebisi et al., 2016), yet sustainability integration remains inconsistent. Research reveals a persistent gap between awareness and practice, with architects frequently adopting only those strategies that align with conventional design or client approval. Key Nigerian-specific barriers documented in literature include:

1) Cost sensitivity among clients and developers
2) Insufficient policy mandates for sustainability compliance
3) Irregular supply of green materials and systems
4) Limited expertise in renewable and smart technologies
5) Maintenance concerns in high-rise buildings

Adeogun (2023) observed that while Lagos architects demonstrate adequate awareness of many GBDS, their actual implementation is constrained by economic and technical limitations. Similarly, Adeogun (2024) reported that even occupants of certified buildings remain unfamiliar with advanced sustainability systems, indicating broader market awareness challenges.

D. Synthesis of Obstacles from Prior Literature

Across global, African, and Nigerian contexts, the following five barrier categories consistently emerge:

1) Economic barriers- High capital cost, uncertain payback periods, and limited financing incentives.
2) Technical barriers- Limited expertise, skill shortages, and technology performance concerns.
3) Regulatory barriers- Weak policies, voluntary guidelines, and lack of enforcement mechanisms.
4) Market barriers- Low client awareness and limited demand for sustainable design solutions.
5) Contextual barriers- Climatic considerations, material availability, and infrastructural limitations.

E. Gap in Current Knowledge

Although previous research has documented awareness levels and adoption patterns of sustainable design in Lagos, few studies have comprehensively examined the barriers that shape GBDS implementation in high-rise commercial projects. Even fewer have integrated quantitative and qualitative approaches to develop a policy-oriented roadmap that addresses these obstacles. This study fills that gap by:

1) Identifying and ranking barriers using RII and descriptive analysis
2) Linking barriers to qualitative expert insights
3) Proposing a policy framework grounded in empirical evidence
4) Focusing specifically on Lagos high-rise architecture, a rapidly expanding yet under-regulated construction type.

III. METHODS

A. Research Design

This study employed a mixed-methods research design to identify and analyze the barriers affecting the implementation of Green Building Design Strategies (GBDS) in high-rise office projects in Lagos. The mixed-methods approach enabled the integration of quantitative evidence, derived from a structured questionnaire administered to architects, with qualitative insights gathered through expert interviews. This approach is widely recommended in sustainability research as it allows for nuanced interpretation of contextual, professional, and policy-related constraints (Vine, 2021; Fisk, 2019).

B. Study Population and Sample Size

The target population comprised architects registered with the Architects Registration Council of Nigeria (ARCON) and actively engaged in designing commercial and high-rise buildings in Lagos. A stratified purposive sampling approach was adopted to ensure representation across:

1) architectural consultancy firms
2) government planning and regulatory agencies
3) construction and development companies
4) academic institutions

A total of 344 valid questionnaire responses were collected and complemented by 12 expert interviews with senior architects and sustainability practitioners to provide deeper interpretative insight.

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C. Respondent demographic characteristics

Table 3.1. Demographic Profile of Survey Respondents (N = 344)

Variable	Category	Frequency (%)
Gender	Male	77.74
	Female	22.26
Qualification	B.Sc.	9.01
	M.Sc.	83.14
	PhD	7.85
Years of Practice	0–5	24.42
	6–10	31.10
	11–15	33.72
	16+	10.76

Author's Fieldwork (2025)

The distribution indicates an experienced professional sample, strengthening the relevance of reported barriers.

D. Data Collection Instruments

1. Questionnaire

The questionnaire was organized into four sections:
Section A: Demographic and professional information
Section B: Knowledge of green building strategies
Section C: Perceived barriers to GBDS implementation
Section D: Open-ended comments on policy and practice gaps
Barrier items were measured using a 5-point Likert scale ranging from 1 ("Not a barrier") to 5 ("Very strong barrier"). The questionnaire was validated through expert review and pilot testing.

2. Expert Interviews

Semi-structured interviews were conducted with 12 professionals, including:

1) Senior architects
2) Sustainability consultants
3) Environmental planning officials
4) Interviews explored:
5) Practical challenges encountered during project implementation
6) Client attitudes toward sustainable features
7) Regulatory and market limitations
8) Technical and maintenance challenges in high-rise buildings
9) Qualitative insights were coded and analyzed thematically.

E. Measurement of Barriers

i. Barrier categories were derived from both literature and interview themes:
ii. Categories measured using RII:
iii. Economic Barriers
iv. Technical & Expertise Barriers
v. Regulatory Barriers
vi. Client Awareness and Market Barriers
vii. Contextual & Environmental Barriers

The Relative Importance Index (RII) was used to rank the severity of barriers:
$RII = (\sum w / A \times N)$
Where: (w) = weight assigned to each response, (A) = highest weight (5) (N) = number of respondents (344).
RII values for specific strategies (e.g., Smart BMS RII = 0.70) illustrate barriers related to technological complexity.

F. Data Analysis

1. Quantitative Analysis

Quantitative data were analyzed using:

- *Descriptive statistic*
- RII computation to rank perceived barrier severity
- Cross-tabulation to identify relationships between professional characteristics and barrier perceptions

2. Qualitative Analysis

Interview transcripts were analyzed using thematic coding, producing a structure aligned with barrier categories:

1. Cost-related constraints
2. Technical skill shortages
3. Weak regulatory enforcement
4. Client-driven resistance
5. Contextual limitations (e.g., climate, infrastructure)

These themes were used to interpret and contextualize quantitative findings.

G. Ethical Considerations

All participants provided informed consent prior to participating in the study.

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IV. RESULTS

This section presents the results of the mixed-methods assessment of barriers affecting Green Building Design Strategy (GBDS) implementation in high-rise office projects in Lagos. Quantitative findings (RII rankings and descriptive statistics) are complemented by qualitative insights from expert interviews.

A. Overview of Barrier Categories

The study identified five major categories of barriers:

1. Economic barriers
2. Technical and expertise barriers
3. Regulatory barriers
4. Client-related barriers
5. Contextual/environmental barriers

These categories emerged consistently from both the quantitative analysis and coded interview themes.

1. Economic Barriers

Economic constraints emerged as one of the strongest barrier groups, particularly for technologically intensive GBDS.

Key economy-related constraints include:

1. High upfront cost of renewable energy systems
2. High cost of smart building technologies
3. Additional fees for specialized consultants
4. Uncertainty regarding long-term cost savings

Quantitative results confirm the significance of these barriers. For instance, low adoption of strategies such as Smart Building Management Systems (RII = 0.70) directly correlates with cost-related and expertise-related barriers.

Table 4.1. Economic Barriers to GBDS Implementation

Economic Barrier	Influence Level	Interpretation
Cost of technological systems	High	Major limiting factor
Cost of skilled labour	High	Scarcity increases project cost
Cost of imported materials	Moderate –High	Supply limitations
Uncertain return on investment	Moderate	Drives client resistance

Author's Fieldwork (2025)

One senior architect noted: *"Clients see the initial cost, not the long-term benefit. So advanced systems rarely survive budget reviews."*

2. Technical and Expertise Barriers

Technical capacity is another critical barrier, particularly for high-rise buildings requiring integrated systems.

Main technical barriers include:

1. Limited availability of technicians trained in smart building systems
2. Insufficient expertise in greywater recycling design and maintenance
3. Concerns about system reliability and component lifespan
4. Limited local supply chain for advanced building technologies

Table 4.2. Technical Barriers to GBDS Implementation

Technical Barrier	Severity	Interpretation
Lack of skilled labour	High	Strong constraint across all tech-GBDS
Maintenance challenges	High	Inhibits client approval
Limited technological infrastructure	Moderate	Affects feasibility
Poor availability of system components	Moderate	Due to supply-chain gaps

Author's Fieldwork (2025)

These barriers directly explain low adoption levels of advanced GBDS identified, such as:

- Greywater recycling (very low adoption)
- Smart BMS (RII = 0.70)
- Solar PV systems (low adoption)

3. Regulatory and Institutional Barriers

Regulatory weakness was consistently identified as a moderate-to-low barrier category. While environmental guidelines exist, sustainability requirements are neither mandatory nor strongly enforced.

Table 4.3. *Regulatory Barriers*

Barrier	Severity	Interpretation
Lack of mandatory GB codes	High	Leaves adoption optional
Weak enforcement of existing guidelines	High	Reduces compliance motivation
Lack of formal incentives	Moderate	Discourages investment
Fragmented institutional framework	Moderate	Poor coordination across agencies

Author's Fieldwork (2025)

Respondents repeatedly stated that sustainable strategies are "encouraged but not required," limiting their uptake beyond voluntary practice.

4. Client Awareness and Market Barriers

Client-related factors exhibited a moderate level of influence. Many clients remain unfamiliar with the benefits of GBDS, leading to reluctance to approve strategies perceived as expensive or complex.

1. Reasons for limited client-driven demand include:
2. Low awareness of sustainability benefits
3. Prioritization of aesthetic or economic returns
4. Concern about system complexity
5. Preference for conventional construction solutions

Table 4.4. *Client and Market Barriers*

Barrier	Severity	Interpretation
Low client awareness	Moderate–High	Influences rejection of GBDS proposals
Preference for conventional design	Moderate	Limits innovation
Fear of maintenance risk	High	Affects adoption of advanced systems
Limited valuation of sustainability	Moderate	GBDS not seen as added asset value

Author's Fieldwork (2025)

This aligns with Adeogun (2023b), which found occupants of certified buildings still lacked strong understanding of advanced green features

5. Contextual and Environmental Barriers

These barriers relate to climatic, infrastructural, or market conditions unique to Lagos' built environment. Major contextual barriers include:

1. High humidity affecting performance of some renewable technologies
2. Space constraints in dense high-rise urban environments
3. Poor integration of green concepts in conventional supply chains
4. Unreliable municipal water and power supply influencing feasibility of some systems

Table 4.5. Contextual Barriers

Barrier	Severity	Notes
Climatic limitations for some technologies	Moderate	Especially humidity-related
Urban density constraints	Moderate	Limits spatial GBDS integration
Inconsistent utility infrastructure	Moderate–High	Reduces reliability
Limited local material availability	Moderate	Impacts cost and feasibility

Author's Fieldwork (2025)

D. Integrated Barrier Severity Ranking

Based on combined quantitative and qualitative evidence, the overall ranking of barrier categories is:

1. Economic Barriers -Highest Severity
2. Technical/Expertise Barriers -High Severity
3. Client Awareness Barriers -Moderate to High
4. Regulatory Barriers -Moderate
5. Contextual/Environmental Barriers -Moderate

This hierarchy provides a basis for the policy roadmap developed in the next section.

V. DISCUSSION

The findings of this study demonstrate that the implementation of Green Building Design Strategies (GBDS) in Lagos' high-rise office sector is constrained by a complex interaction of economic, technical, regulatory, market, and contextual barriers. These barriers collectively shape the limited and uneven integration of sustainable practices within architectural workflows.

A. Economic and Technical Barriers as the Most Critical Constraints

Economic and technical challenges emerged as the strongest barriers, consistent with global findings that high upfront costs, specialized labour requirements, and technology reliance significantly influence the adoption of sustainable building systems (Vine, 2021; Fisk, 2019). The low RII score associated with Smart Building Management Systems (0.701) reflects both capital and skill constraints. These findings align with earlier observations in African contexts where high implementation costs and insufficient technical expertise limit the use of advanced GBDS (Pierchala et al., 2016).

B. Role of Weak Regulatory Enforcement and Limited Policy Incentives

The absence of mandatory sustainability regulations was identified as a moderate yet influential barrier. While Lagos has urban development guidelines, enforcement is inconsistent, leaving GBDS adoption largely voluntary. This mirrors findings from other developing countries where regulatory institutions lack the capacity or authority to drive sustainable building compliance (Galas & Syal, 2016). The lack of incentives-such as tax rebates, certification credits, or loan support-further reduces the motivation for stakeholders to invest in sustainable solutions.

C. Influence of Market Perceptions and Client Attitudes

The study shows that client awareness significantly influences the approval and implementation of sustainable design proposals. As noted by Adeogun (2023b), even occupants of certified buildings often lack a full understanding of the benefits of green features. This low awareness translates into client hesitation, reluctance to approve unfamiliar technologies, and a general preference for conventional approaches. The perception of green systems as "cost-increasing" rather than "value-enhancing" remains a critical barrier in the Lagos real estate market.

D. Contextual Realities of Lagos' Built Environment

Contextual limitations such as high humidity, variable infrastructure reliability, supply-chain gaps, and urban density constraints affect the feasibility of specific GBDS. These findings confirm earlier work by Adeogun (2023a), which showed that climatic and infrastructural challenges often shape the extent to which architects can integrate sustainable technologies.

E. Implications for Sustainable High-Rise Development

Collectively, these findings suggest that while awareness of sustainability principles is increasing among Lagos architects, implementation is restricted by structural barriers requiring coordinated intervention. Without economic incentives, technical capacity-building, and regulatory reinforcement, the transition to fully sustainable high-rise development will remain slow and uneven.

F. Policy Roadmap for Strengthening GBDS Implementation in Lagos

Based on the identified barriers, this study proposes a three-tier policy roadmap designed to support the effective adoption of GBDS in Lagos' high-rise buildings. This roadmap integrates empirical findings with international best practices and contextual realities.

Tier 1: Strengthen Professional Capacity and Technical Expertise

Recommended Actions:

1. Mandatory Continuing Professional Development (CPD) on green technologies for architects and engineers.

2. Accredited training partnerships with universities, industry bodies, and international sustainability institutions.
3. Specialized certification programmes on smart systems, renewable technologies, and water recycling systems.

Expected Impact:
Improved technical competence will reduce design errors, strengthen confidence in recommending complex systems, and increase feasibility of high-performance GBDS.

Tier 2: Enhance Regulatory and Institutional Frameworks
Recommended Actions:
1. Introduce mandatory minimum sustainability requirements for high-rise buildings.
2. Integrate GBDS into ARCON, NIA, LASBCA, and physical planning review procedures.
3. Develop Lagos Green Building Code, aligned with climate-responsive and technological requirements.
4. Strengthen enforcement mechanisms through routine audits and compliance checks.

Expected Impact:
Regulatory enforcement will shift GBDS integration from voluntary to essential, creating a standard practice culture across the building sector.

Tier 3: Introduce Market and Financial Incentives
Recommended Actions:
1. Tax rebates or development charge reductions for buildings integrating certified GBDS.
2. Green financing schemes through banks and mortgage institutions, with reduced interest rates.
3. Public-private partnerships (PPPs) to support renewable energy and water recycling technologies.

Expected Impact:
Incentives will reduce economic burden, increase client willingness, and encourage the adoption of advanced strategies previously considered too costly.

VI. CONCLUSION

This study provides one of the most comprehensive examinations of barriers limiting the adoption of Green Building Design Strategies in Lagos' high-rise office sector. The findings demonstrate that economic and technical barriers exert the strongest influence on implementation, while regulatory weaknesses and limited client awareness further constrain sustainable decision-making. Contextual factors, including climatic and infrastructural limitations, shape the feasibility of certain technologies and reinforce architects' reliance on passive strategies. The proposed policy roadmap highlights practical pathways for addressing these barriers through professional development, regulatory reform, and financial incentives. Strengthening these areas will significantly improve the uptake of GBDS in Lagos and contribute to the development of a more sustainable and resilient high-rise-built environment across African cities.

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