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Architects' Knowledge Distribution and Capacity Gaps in Green Building Strategies in Lagos Nigeria

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Abstract: This study examines the distribution of knowledge and capacity gaps among architects on Green Building Design Strategies (GBDS) in Lagos, with a focus on how varying knowledge levels influence the integration of sustainable design principles in high-rise office projects. A quantitative survey of 344 architects and qualitative interviews with 12 experts were used to assess knowledge levels across major GBDS categories, including passive design, water efficiency, energy efficiency, sustainable materials, and technological systems. Descriptive statistics and Relative Importance Index (RII) were used to quantify knowledge patterns, while thematic analysis was employed to interpret qualitative insights. RII values ranged from 0.74 for sustainable materials and 0.73 for energy efficient lighting and passive cooling to 0.70 for smart building management systems, revealing significant variation in architects' mastery of GBDS. Knowledge was found to be unevenly distributed, with architects demonstrating stronger familiarity with sustainable materials and passive strategies, while technological systems revealed clear capacity gaps. Analysis of firm type and years of experience further showed uneven knowledge profiles across private, corporate, academic, and government sectors. The study highlights the need for targeted capacity building initiatives to bridge identified knowledge gaps, particularly in technological GBDS. Improving professional training, strengthening green building curricula, and integrating sustainability focused Continuing Professional Development programmes can enhance architects' readiness to implement advanced GBDS in Lagos. This research provides in-depth knowledge distribution assessments of Lagos based architects using a large empirical dataset.

Keywords: *Architects; Capacity Gaps; Green Building; GBDS; Knowledge Distribution; Sustainable Architecture; Lagos.*

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I. INTRODUCTION

The need to transition toward sustainable building practices has positioned architects, being the client's prime consultant as the forerunner in advancing environmental performance across the built environment. As Lagos megacity continues to experience rapid urbanization, high-rise buildings increasingly define the city's commercial landscape, intensifying the demand for design approaches that minimize energy use, reduce environmental impact, and improve occupant wellbeing [1]. Green Building Design Strategies offer proven pathways to achieving these outcomes. However, the ability of architects to effectively integrate these strategies depends fundamentally on their knowledge, technical expertise, and professional capacity [2].

In Nigeria, the role of architects in promoting sustainability is increasingly acknowledged, however, empirical evidence suggests that GBDS knowledge remains uneven across professional practice. Although sustainability concepts are gaining more recognition, conventional design and construction approaches remain dominant in many projects, particularly where technical complexity and cost considerations are involved. [3] Previous studies revealed that architects demonstrate strong familiarity with passive strategies such as natural ventilation and shading, but weaker understanding of technologically advanced systems such as smart building management and greywater recycling [4]

High-rise office buildings present unique sustainability challenges due to their dependence on mechanical systems and continuous energy demand. In such contexts, limited

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professional knowledge can result in missed opportunities for environmental performance improvement. Understanding how GBDS knowledge is distributed among architects, and identifying areas of capacity deficiency, is therefore essential for strengthening sustainable architectural practice in Lagos. This study focuses on assessing architects' knowledge distribution and capacity gaps across major GBDS categories in Lagos using empirical evidence drawn from a largescale survey and expert interviews.

II. RESEARCH METHODS

This study adopted a mixed methods research design which allowed for comprehensive assessment of both measurable knowledge levels and contextual to assess architects' knowledge distribution and capacity gaps in Green Building Design Strategies in Lagos. Quantitative data were obtained through a structured questionnaire administered to 344 registered architects, while qualitative insights were gathered through semi-structured interviews with 12 experts drawn from architects practicing in architectural, corporate or real estate firms, academia, and government sector.

The questionnaire captured demographic and professional characteristics, sources of GBDS knowledge, and self-rated knowledge levels across key strategy categories. Knowledge levels were assessed using a five-point Likert scale and analyzed using descriptive statistics and the Relative Importance Index. Qualitative interview data were transcribed and analyzed thematically to support and explain quantitative findings. Ethical consent was obtained from all participants, and data confidentiality was maintained throughout the study.

III. RESULTS

A. Demographic and Professional Characteristics of Respondents

The Table 1 below show that the architectural profession in Lagos is dominated by male practitioners, with 77.74% male and 22.26% female respondents. Most architects fall within the 41–50 age group and hold postgraduate qualifications, with 83.14% possessing a Master's degree. In terms of experience, 33.72% of respondents have between 11–15 years of professional practice, while 24.42% have less than five years of experience.

Table 1: Gender, Age, Education and Experience Distributions of Respondents

Gender	**Count**	**Percent**
Male	264	77.74%
Female	80	22.26%
Age Group	Count	Percent
21–30	69	20.06%
31–40	114	33.14%
41–50	131	38.08%
51–60	30	8.72%
Education Level	Count	Percent
B.Sc.	31	9.01%
M.Sc.	286	83.14%
PhD	27	7.85%
Years of Experience	Count	Percent
0–5	84	24.42%
6–10	107	31.10%
11–15	116	33.72%
16 and above	37	10.76%
Grand Total	344	100.00%

Source: Author's fieldwork (2025)

These results indicate a predominantly male profession with a strong concentration of mid-career architects and a high proportion of respondents holding postgraduate qualifications. This shows that the respondent has a stronger educational back and professional experience.

B. Professional Affiliation and Firm Characteristics

Most respondents work in private architectural firms (64.83%), followed by corporate real estate firms (20.35%), academia (8.72%), and government agencies (6.10%). A significant proportion of respondents hold multiple professional registrations, including membership in ARCON, NIA, and GBCN.

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Table 2: Membership, Firm, Professionalism and Number of Staff Distribution of Respondents

Status	Count	Percent
Full Member	257	74.71%
Provisional 2	50	14.53%
Provisional 1	37	10.76%
Firm Type	Count	Percent
Private	223	64.83%
Corporate (Real Estate)	70	20.35%
Academia	30	8.72%
Government	21	6.10%
Staff Size	Count	Percent
1–10	201	58.43%
11–50	142	41.28%
50+	1	0.29%
Total	344	100.00%

Source: Author's fieldwork (2025)

Firm size data show that most practices operate as small or medium sized firms. These characteristics influence exposure to GBDS knowledge and access to professional development opportunities.

C. Sources of Knowledge of Green Building Design Strategies

Table 3 show that the respondents identified workshops, online courses, on-the-job training, and tertiary education as major sources of GBDS knowledge. Workshops emerged as the most frequently cited source, indicating the importance of professional development programmes in building sustainability competence.

Table 3: Sources of GBDS Knowledge

Source of Knowledge	Count	Percent
Workshops	240	69.77%
Online Courses	222	64.53%
On-the-job Training	215	62.50%
Tertiary Education	211	61.34%
Online Research	11	3.19%

Source: Author's fieldwork (2025)

The results indicated that the workshops and professional training programmes emerged as the most prominent sources of knowledge, exceeding reliance on formal university education alone.

D. Knowledge Levels of Green Building Design Strategies

Relative Importance Index analysis reveals variation in architects' knowledge across GBDS categories. Sustainable materials recorded the highest knowledge level (RII = 0.74), followed by energy efficient lighting and passive cooling and ventilation (RII = 0.73). Smart building management systems recorded the lowest knowledge level (RII = 0.70), indicating a major capacity gap in technological strategies. The results indicate stronger knowledge of passive and material-based strategies and lower knowledge of technologically intensive systems.

Table 4: Relative Importance Index of Green Building Design Strategies Based on Architects' Knowledge

GBDS Strategy	Expert	High Knowledge	Moderate Knowledge	Low Knowledge	No Knowledge	RII
Sustainable Materials	34	204	19	79	8	0.74
Energy Efficient Lighting	18	212	29	85	–	0.73
Passive Cooling and Ventilation	24	206	26	84	4	0.73
Solar Power Integration	24	183	21	112	4	0.72
Rain Water Harvesting	24	198	28	86	8	0.72
Smart Building Management Systems	18	172	28	98	28	0.70

Source: Author's fieldwork (2025)

E. Knowledge of Technological Systems by Firm Type

Table 5 show analysis by firm type shows that private and corporate real estate firms demonstrate higher knowledge levels of smart building management systems compared to academic institutions and government sectors. Government and academic sectors recorded higher proportions of low and no knowledge responses, highlighting institutional capacity gaps. Knowledge of smart building systems is highest in private sector practice and lowest in academic and government sector.

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Table 5: Knowledge Rating of Respondents on Smart Building Management Systems

Firm Type	Expert	High Knowledge	Moderate Knowledge	Low Knowledge	No Knowledge	Grand Total
Private	4.93%	60.99%	21.08%	13.00%	0.00%	100.00%
Corporate (Real Estate)	10.00%	58.57%	20.00%	11.43%	0.00%	100.00%
Academia	20.00%	16.67%	33.33%	16.67%	13.33%	100.00%
Government	0.00%	33.33%	19.05%	28.57%	19.05%	100.00%

Source: Author's fieldwork (2025)

F. Knowledge Levels by Years of Professional Experience

Knowledge levels vary across years of experience, with early career architects showing strong academic based knowledge and senior practitioners demonstrating practice-based familiarity. Midcareer architects exhibit more uneven knowledge profiles across GBDS categories.

Table 6: Overall Knowledge of GBDS by Years of Experience

Experience (Years)	Fair	Good	Average	Excellent	Total
0–5	0.00%	38.10%	11.90%	50.00%	100%
6–10	17.76%	32.70%	28.04%	21.50%	100%
11–15	8.62%	26.72%	33.62%	31.04%	100%
16& above	0.00%	70.27%	13.51%	16.22%	100%

Source: Author's fieldwork (2025)

Knowledge levels vary across experience groups, reflecting differences between academic exposure and practice-based learning.

G. Preferred Knowledge Development Pathways

Respondents overwhelmingly identified professional certifications and workshops as the most effective means of improving green building knowledge. As shown in Table 7, 94.48% of respondents selected professional certifications, while 88.37% selected workshops.

Table 7: Recommended Most Beneficial GBDS Knowledge

Knowledge Source	Count	Percent
Professional Certifications	325	94.48%
Workshops	304	88.37%
Online Courses	265	77.03%
University Degree	250	72.67%

Source: Author's fieldwork (2025)'

H. Qualitative Insights on Professional Knowledge Gaps

Interview findings revealed four dominant themes:

➢ *Theme 1: Training Limitations*

Experts noted insufficient exposure to GBDS during academic training or early career practice.

"We were taught passive design well, but not the new technologies. You only learn them if a project demands it."

➢ *Theme 2: Market Exposure and Experience*

Architects often rely on strategies they have successfully implemented before. This reinforces traditional practice patterns.

➢ *Theme 3: Limited Access to Professional Development*

Many practitioners noted that sustainability-focused CPD programmes are optional, infrequent, or unaffordable.

➢ *Theme 4: Client Influence on Knowledge Application*

Architects avoid investing time in learning systems that clients are unlikely to approve.

"There is little motivation to master what clients will not pay for."

I. Ranking of Capacity Gaps

Based on RII values and thematic analysis, the study identifies the following ranking of knowledge gaps:

➢ *Technological GBDS (largest gap)*
- Smart BMS
- Automated lighting/shading
- Greywater recycling
- Solar PV integration (technical aspects)

➢ *Water-Efficiency Systems (moderate gap)*
- Greywater systems
- Advanced water reuse technologies

➢ *Energy-Efficiency Technologies (moderate–low gap)*
- Technical calculation methods
- Simulation tools

➢ *Materials and Passive Strategies (smallest gap)*
- Well-understood, widely taught, and commonly applied

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J. Relationship Between Experience Level and Knowledge

The data show a notable pattern:

- Early-career architects (0–5 years) displayed higher enthusiasm but lower technical knowledge, especially for technological GBDS.
- Mid-career architects (6–15 years) had the highest confidence and practical knowledge.
- Senior architects (16+ years) demonstrated strong knowledge of passive strategies but lower familiarity with digital/technical systems.

This distribution reflects continuous exposure to training, technological change, and Lagos' evolving architecture and construction industry.

IV. DISCUSSONS

This study set out to examine how knowledge of Green Building Design Strategies (GBDS) is distributed among architects in Lagos and to identify areas where capacity gaps remain evident. The findings reveal a clear pattern of uneven knowledge across GBDS categories, professional settings, and experience levels, confirming that awareness of sustainability principles does not translate uniformly into technical competence across all strategy types. The results show that architects demonstrate stronger knowledge of passive and material-based strategies, particularly sustainable materials (RII = 0.74), energy efficient lighting (RII = 0.73), and passive cooling and ventilation (RII = 0.73). These strategies have long been embedded within architectural education and practice in Nigeria and align closely with the country's climatic conditions. As such, they remain more familiar and easier to apply without requiring advanced technological systems. This finding supports earlier observations that architects in developing contexts tend to priorities strategies that are cost-effective, context responsive, and less dependent on specialized infrastructure [3][4][6]

In contrast, technological strategies recorded the lowest knowledge levels, with smart building management systems scoring the lowest RII value (0.70). The high proportion of low and no knowledge responses associated with these systems indicates a significant capacity gap in technologically intensive GBDS. This gap reflects limited exposure to advanced systems during professional training, as well as weak market demand and limited institutional support for such technologies. Similar patterns have been observed in previous sustainability studies, where knowledge of complex systems remains low in contexts characterized by cost sensitivity and limited technical training opportunities [1][2].

Differences in knowledge levels across firm types further highlight institutional disparities within the profession. Architects working in private and corporate real estate firms demonstrate higher levels of knowledge of smart building management systems compared to those in government and academic institutions. This variation suggests that exposure to market driven projects and client expectations plays a significant role in shaping professional competence. Academic and the government, which are expected to provide leadership in policy formulation and professional education, recorded higher proportions of low and no knowledge responses, indicating a critical institutional weakness that may hinder broader sustainability transitions.

The analysis of knowledge levels by years of experience reveals a nonlinear relationship between experience and GBDS knowledge. Early career architects show relatively strong academically driven knowledge, likely reflecting recent exposure to sustainability concepts during formal education. Senior practitioners demonstrate familiarity rooted in long-term practice experience, particularly with passive strategies. However, mid-career architects exhibit more uneven knowledge profiles, possibly due to the pressures of project delivery, budget constraints, and limited opportunities for structured retraining. This finding reinforces the argument of [6] that professional experience alone does not guarantee competence in emerging sustainability strategies and that continuous professional development remains essential.

The dominance of workshops, professional certifications, and on-the-job training as preferred knowledge sources further underscores the limitations of relying solely on university education to build sustainability capacity. While formal education provides a foundation, respondents clearly recognize that applied training and professional certification pathways are more effective in strengthening GBDS competence. This highlights the importance of structured Continuing Professional Development programmes tailored to advanced green building technologies.[6]

Knowledge levels cannot be viewed in isolation from the practice environment. Interviewees repeatedly emphasized that:

- Architects focus on strategies they know clients will accept
- Technical competence is shaped by project opportunities
- Learning is often driven by market exposure rather than formal training

These findings reflect the design management challenge highlighted by [4][5]: architectural decisions in Lagos are often shaped by economic and contextual constraints rather than technical capacity alone. As a result of this:

- Passive strategies remain dominant because they align with traditional design culture
- Technological strategies lag because they require expertise that is not widely supported by the market
- This has long-term implications for the sustainability of high-rise architecture in Lagos.

Overall, the findings demonstrate that knowledge distribution among architects in Lagos is shaped by a combination of educational background, institutional context, market exposure, and professional development opportunities. Without targeted interventions to address technological capacity gaps, architects may continue to rely

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primarily on passive strategies, limiting the potential environmental performance of high-rise office buildings.

V. CONCLUSION

This study examined the distribution of knowledge and capacity gaps among architects in relation to Green Building Design Strategies in Lagos, drawing on data from a survey of 344 architects and qualitative insights from expert interviews. The findings confirm that knowledge of GBDS is unevenly distributed across strategy categories, firm types, and levels of professional experience. Architects demonstrate stronger knowledge of passive strategies and sustainable materials, which are well established within local practice and education. In contrast, technological strategies, particularly smart building management systems, reveal clear capacity gaps. These gaps are most pronounced within academic institutions and government sector architects with limited exposure to market driven sustainability projects. The results also show that professional experience does not automatically translate into higher GBDS knowledge, reinforcing the need for continuous learning and targeted professional development.

From a professional practice perspective, the findings highlight the need for stronger emphasis on advanced GBDS training within architectural practice. Professional bodies such as ARCON, NIA, and GBCN have a critical role to play in expanding access to sustainability focused continuing professional development programmes, professional certifications, and hands-on training opportunities.

From an educational perspective, the results suggest the need to strengthen green building curricula at both undergraduate and postgraduate levels, with greater emphasis on technological systems, performance-based design, and practical application. Academic institutions must also improve their own institutional capacity to model best practices in sustainable building design.

From a policy perspective, addressing knowledge gaps in GBDS requires coordinated action involving regulatory agencies, professional bodies, and industry stakeholders. Strengthening institutional support for green building technologies, improving access to training, and creating incentives for advanced GBDS integration can enhance architects' readiness to deliver high performance, sustainable high-rise buildings in Lagos.

In conclusion, this study provides comprehensive assessments of GBDS knowledge distribution among architects in Lagos. By identifying specific capacity gaps and professional development needs, it offers practical insights for advancing sustainable architectural practice and supporting the long-term environmental performance of high-rise office buildings in rapidly urbanizing cities.

VI. RECOMMENDATIONS

Based on the study findings, the following recommendations are proposed for improving architects' knowledge and capacity in GBDS:

A. Strengthen Sustainability Education in Architectural Curricula:

Universities should integrate advanced GBDS concepts-particularly technological systems-into core design, building services, and environmental courses. Collaboration between academia and professional bodies (NIA, ARCON) should ensure curriculum alignment with emerging sustainability standards.

B. Expand Continuing Professional Development (CPD) Opportunities:

Mandatory CPD modules on green technologies, energy modelling, and water efficiency systems should be instituted for licensed architects. Professional associations should partner with international sustainability organizations to deliver updated training programmes.

C. *Promote Knowledge Sharing Within Design Firms:*

Architectural firms should adopt internal knowledge management practices, including mentorship systems, practice-based learning sessions, and project debriefs focused on sustainability integration. Midcareer practitioners, identified as the most competent group, should play a leading role in internal capacity development.

D. Improve Access to Professional Tools and Resources:

Government and professional bodies should support access to building simulation tools, material performance databases, and training software for architects. Subsidized licensing for sustainability software could significantly enhance architects' technical capability.

E. Strengthen Client Awareness Through Strategic Communication:

Architects should actively communicate the long-term cost benefits and performance advantages of advanced GBDS. Publishing performance case studies and demonstrating lifecycle savings can help shift client perceptions.

F. Develop Incentive Based Policies to Encourage Skill Development:

Policymakers should introduce incentives for firms investing in sustainability training, such as tax credits or project-based recognition schemes. These measures would encourage firms to prioritize green competence development.

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