Investigating Critical Success Factors for Green Building Projects: An Empirical Study of Urban Areas in Nigeria

RITA M. BOLUSEMIHI[1], ADEDEJI S. DARAMOLA[2], OLADIPUPO DARE-ABEL[3]
[1, 2, 3]*Department of Architecture, Caleb University, Lagos, Nigeria*

Abstract- The Nigerian construction industry is experiencing a gradual shift from traditional, energy practices toward a more efficient and green building approach. This change reflects a growing awareness of the need to conserve energy, reduce emissions, and promote sustainable growth in the country. The successful delivery of green building (GB) projects has become a key priority for stakeholders in the industry, reflecting the country's move toward developing environmentally friendly and cost-effective residential buildings. To enable smooth implementation and delivery of GB projects in Nigeria, this study assesses the impact of controllable critical success factors (CSFs) that influence the success of these projects. Based on an extensive literature review and principal component analysis, 20 controllable CSFs were identified and classified into 5 main components: project management, personnel ability, teamwork-oriented, human resources, and financial and constraint factors. Furthermore, regression analysis revealed that project management, personnel ability, and financial and constraint factors have a significant and positive effect on green building delivery in the country. The study, therefore, provides valuable guidance for policymakers and practitioners in developing strategies to successfully implement green housing initiatives in Nigeria.

Indexed Terms- Critical success factors, green building projects, Urban areas.

I. INTRODUCTION

The construction industry plays a vital role in Nigeria's economic development, making significant contributions to the country's GDP, employment, and infrastructure growth. However, this sector is also a major consumer of energy and a source of environmental degradation (Ijigah et al., 2023). According to the Energy Commission of Nigeria (2021), building-related energy consumption has been on the rise, accounting for approximately 25% of the nation's total energy use. Simultaneously, urbanisation has accelerated greenhouse gas emissions and other environmental problems, including deforestation, waste accumulation, and poor air quality, particularly in large cities like Lagos, Abuja, and Port Harcourt. The resulting strain on natural resources per capital has become unsustainable and presents a serious threat to the nation's long-term development goals (Olanipekun & Akinradewo, 2022).

In Nigeria, green building (GB) is emerging as a forward-looking alternative to conventional building. It emphasises the sustainable use of materials and energy within buildings, creating self-sufficient systems that minimise waste and pollution while improving user satisfaction (Sang & Yao 2019; Amies et al. 2024). GB supports national climate goals and has the potential to transform urban development by enhancing ecological resilience and living standards. However, the widespread adoption of GB in Nigeria remains limited. Despite a growing awareness, the implementation falls short of national expectations, and GB currently represents only a small fraction of the total building stock (Nigerian Building Performance Report, 2022).

To bridge this gap, the Federal Government of Nigeria has introduced a range of policies and incentives, tax benefits, and funding schemes to encourage both private and public sector adoption of sustainable construction practices (Federal Ministry of Environment, 2022). However, barriers remain. GB projects demand complex technologies, eco-friendly materials, and sophisticated architectural designs, posing challenges for developers, contractors, and project managers (Soji et.al, 2024;

Sang & Yao, 2019). Ensuring quality and safety while minimising environmental harm, through noise, dust, and construction waste control, adds another layer of difficulty. For example, the use of prefabricated materials and components, while environmentally friendly, requires advanced construction methods, such as dry assembly and modular design, which are not widely practised in Nigeria. These methods demand high standards in component handling, transportation, and installation skills are often lacking in the local construction workforce (Ogunsemi & Jegede, 2021). Studies show that many green building projects in Nigeria suffer from poor cost control, inefficient management, and frequent abandonment due to these complexities (Akande et al., 2023).

Furthermore, the academic and professional communities in Nigeria have yet to develop a comprehensive understanding of the critical success factors (CSFs) necessary for GB implementation across design, construction, and operational phases. This lack of systemic knowledge and practical frameworks impedes progress in sustainable construction (Ede et al., 2022). Given these challenges, this study aims to:

1. Identify the CSFs specific to green building in Nigeria; and
2. Evaluate how these factors influence project management objectives.

The findings will fill the current research gap and guide stakeholders in the Nigerian construction industry to effectively integrate sustainability principles into GB projects. Practitioners can tailor their project management strategies using the identified CSFs to support the country's broader goals of urban resilience, energy efficiency, and environmental sustainability.

1.2. Identification of Critical Success Factors (CSFs) for Green Building in Nigeria

Critical Success Factors (CSFs) are key elements that significantly influence the successful execution and performance of a project throughout its life cycle. In the Nigerian, where sustainable building practices are still gaining momentum, identifying CSFs is imperative to accelerate the adoption of green building (GB) practices. CSFs provide a strategic direction and serve as essential areas of activity that must be adequately managed for green building projects to succeed. Their importance is amplified in Nigeria, given the country's infrastructural deficit, energy crises, and environmental challenges (Olawumi & Chan, 2018).

The construction industry in Nigeria contributes significantly to national carbon emissions and energy consumption, and green building represents a sustainable shift towards eco-efficiency. However, the sector's transition to green practices faces challenges that make the identification of CSFs more critical than ever (Ezemerihe et al., 2023). This section explores major CSFs categorised into external incentives and constraints, technological capacity and project management, stakeholder capacity, team collaboration, and user involvement, contextualised within Nigeria's construction industry.

(I). External Incentives and Regulatory Constraints

In Nigeria, one of the most pressing challenges hindering green building development is the lack of strong external incentives and regulatory enforcement. Financial support mechanisms such as subsidies, soft loans, or tax incentives for green construction are limited, thereby reducing motivation for stakeholders to adopt green practices (Ogunmakinde et al., 2021). For green building initiatives to flourish, developers need access to concessional funding and credit facilities. For example, providing green mortgage programs and tax waivers on eco-friendly materials can stimulate market participation.

Additionally, Nigeria lacks comprehensive green building codes. Although the Green Building Council of Nigeria (GBCN) is taking commendable steps, such as promoting the EDGE certification system, the absence of national enforcement policies limits the institutionalization of green practices (Adebayo, 2022). Regulatory frameworks are still fragmented, and there is minimal oversight by state or federal ministries on sustainable construction requirements.
Successful global examples show that robust regulatory policies and consistent enforcement

increase green building adoption (Alyami & Rezgui, 2012). For Nigeria, aligning with this global trend would require the Federal Ministry of Works and Housing, in partnership with GBCN and ARCON, to develop and enforce comprehensive green building codes and monitoring systems.

(II). Technological Capacity and Project Management

The successful execution of green building projects in Nigeria requires advanced technological competence and strong project management skills. Green buildings integrate renewable energy technologies, water recycling systems, and eco-friendly construction materials that necessitate both technical knowledge and project-specific innovation (Akadiri et al., 2012). However, the adoption of these technologies in Nigeria is hampered by limited access to sustainable building materials, high costs of imported technology, and insufficient local manufacturing capacity.

Technological limitations are often exacerbated by the lack of qualified professionals with adequate training in green building design and simulation tools such as Building Information Modeling (BIM), energy modeling, and life cycle assessment (Oladokun & Aigbavboa, 2020). Furthermore, project managers must have the ability to balance sustainability goals with project cost, schedule, and quality—areas in which there is often a trade-off in the Nigerian context.

Risk management is another critical factor. Green building projects in Nigeria are vulnerable to construction delays, supply chain issues, inflation, and regulatory bottlenecks. As such, project managers must implement integrated project delivery models and risk assessment strategies that accommodate green building complexities (Olawumi et al., 2022). Without these competencies, cost overruns and abandonment of green building projects are likely outcomes, as seen in some pilot green housing estates in Lagos and Abuja.

Conceptual Framework

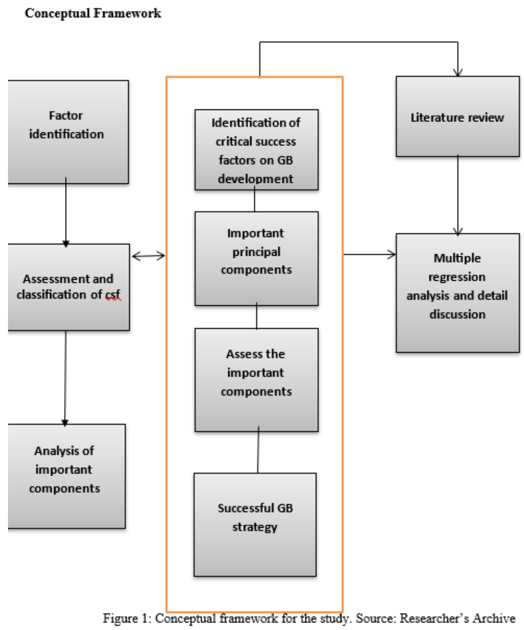

Figure 1: Conceptual framework for the study. Source: Researcher's Archive

Figure 1: Conceptual framework for the study. Source: Researcher's Archive

(III). Capacity and Quality of Project Participants

Stakeholders' capabilities, especially at the strategic level, play a vital role in the success of green building projects. In Nigeria, the support of senior management and government stakeholders is often inconsistent due to changing political priorities and a lack of awareness (Adebayo et al., 2023). When decision-makers are not fully informed about the benefits and operational savings of green buildings, they tend to deprioritise green initiatives in favour of conventional approaches.

In addition, Nigeria's construction workforce lacks adequate exposure to sustainable construction methods. Training and certification programs for green builders, electricians, HVAC technicians, and architects are limited. As a result, even when green building designs are well-conceived, implementation suffers due to lack of skilled labour (Ezeabasili et al., 2020).

Built environment professionals also face significant challenges. The complexity of sustainable architectural and structural designs, coupled with insufficient collaboration between disciplines (e.g., architects, MEP engineers, quantity surveyors), leads to inefficiencies in project execution. Proper documentation, accurate modelling, and precise material selection are often inadequate due to time constraints and lack of technical capacity (Oladokun & Aigbavboa, 2020). Thus, investment in green building education and certification across all levels of the project team is a major success factor. Continuous professional development, driven by institutions like the Nigerian Institute of Architects (NIA) and the Council of Registered Builders of Nigeria (CORBON), is essential for closing the knowledge and skills gap.

(IV). Collaboration and Integration of Project Team
Green building projects in Nigeria require a high degree of collaboration across diverse professionals architects, engineers, project managers, environmental consultants, and quantity surveyors. However, the traditional construction model in Nigeria is largely fragmented and adversarial. Design-bid-build remains the most commonly used procurement method, which often isolates built environment professionals from constructors and leads to design inconsistencies during implementation.

Integrated project delivery models and early contractor involvement, which have proven effective in other countries, are rarely practised in Nigeria (Ogunmakinde & Sher, 2020). This lack of collaboration results in miscommunication, inefficient workflows, and reworks factors that increase project costs and timelines.

Furthermore, trust and team motivation are pivotal to successful green project delivery. Many green projects in Nigeria experience internal conflicts due to differing professional ideologies, poor communication, and lack of shared goals. Promoting a unified project vision, with clear sustainability objectives and team-building strategies, is vital. Equally important is education and training in green leadership, which prepares project leaders to drive sustainability-focused teamwork. Organisations should also prioritise the establishment of performance benchmarks, and teams should focus more on energy use reduction, material efficiency, and construction waste minimisation. These performance metrics should be incorporated into the team's project charter from the onset (Olawumi & Chan, 2018).

(v). User Engagement and End-User Participation
In Nigeria, the role of end users in the green building lifecycle is often overlooked, even though their involvement is crucial for project success. Users influence building performance through their behaviour, maintenance practices, and energy consumption patterns. Hence, incorporating user feedback in the design and post-occupancy stages can significantly improve satisfaction and performance outcomes (Adebayo, 2022). Despite the importance, user involvement in green housing projects remains minimal. For instance, many government-led housing schemes in Abuja, Enugu, and Lagos have limited avenues for end-users to participate in decision-making. As a result, residents often find the facilities unsuitable or overly complicated to use and maintain. Additionally, end-user awareness about green building benefits is low. Public campaigns, user education programs, and home-user manuals can bridge this gap. Moreover, property developers should provide orientation sessions and support services to tenants of green buildings to ensure they understand how to use systems like solar inverters, water-saving fixtures, and smart meters.

Consumer demand is also a significant driver. When users begin to demand green features like solar-powered lighting, improved indoor air quality, and low-VOC paints, developers will be more inclined to incorporate these elements. The government can support this by promoting green housing as a lifestyle standard and incentivising developers to include user-driven sustainability solutions (Ezeabasili et al., 2020).

(VI). Research Framework for Identifying CSFs in Nigeria
To identify these critical success factors within Nigeria, researchers should employ a structured approach. A three-step methodological framework can be applied:

1. Factor Identification: Conduct a comprehensive literature review of local and international studies to extract common CSFs for green building implementation.

2. Factor Classification: Group these CSFs under thematic areas using Principal Component Analysis (PCA) to reduce dimensionality and identify dominant factors.
3. Factor Assessment: Use regression models or structural equation modeling (SEM) to evaluate the relative impact of each CSF on project success metrics such as cost, schedule, energy savings, and user satisfaction.

This empirical approach can help practitioners, policymakers, and scholars develop a strategic roadmap for enhancing green building adoption in Nigeria's built environment.

II. SUMMARY

The identification and analysis of Critical Success Factors (CSFs) provide a valuable framework for promoting green building in Nigeria. Despite its potential to address pressing environmental challenges, green building in Nigeria faces a multitude of barriers, including limited financial incentives, weak regulatory enforcement, inadequate technical capacity, poor collaboration, and low user engagement. Addressing these CSFs strategically and systematically can help Nigeria move closer to a sustainable built environment. The government must lead the way by providing a robust policy framework, financial incentives, and capacity development. Meanwhile, private sector stakeholders, including developers, professionals, and end users, must align their efforts towards a shared sustainability goal. With collaborative commitment, Nigeria can unlock the full potential of green building and achieve sustainable urban development.

III. RESEARCH METHODOLOGY

3.1. Questionnaire Design

Through extensive review and analysis of the literature (Akadiri et al., 2012; Oladokun & Aigbavboa, 2020; Adebayo et al., 2023), this study identified 20 Critical Success Factors (CSFs) that have a significant influence on the delivery and performance of green building (GB) projects in the Nigerian context. These CSFs were incorporated into a well-structured questionnaire designed for evaluation and ranking by industry stakeholders who are directly involved in green building delivery in the country.

CODE	CRITICAL SUCCESS FACTORS	REFRENCES
CSFI	Adequate financial resources	Ezemerihe et al. (2023); Oladokun & Aigbavboa (2020); Adebayo (2022)
CSF2	Effective government policies and regulatory frameworks	Ogunmakinde et al. (2021); Adebayo et al. (2023); Ezeabasili et al. (2020)
CSF3	The owner's active participation and commitment	Olawumi & Chan (2018); Adebayo et al. (2023); Ezeabasili et al. (2020)
CSF4	Appropriate technology specifications	Oladokun & Aigbavboa (2020); Akadiri et al. (2012)
CSF5	Senior management support	Olawumi & Chan (2018); Adebayo et al. (2023); Ezemerihe et al. (2023)
CSF6	The project manager's ability	Ogunmakinde & Sher (2020); Olawumi et al. (2022); Adebayo (2022)
CSF7	Designer's ability and experience	Akadiri et al. (2012); Oladokun & Aigbavboa

		(2020); Ezeabasili et al. (2020)
CSF8	The worker's technical skills and on-site experience	Adebayo et al. (2023); Oladokun & Aigbavboa (2020); Ezeabasili et al. (2020)
CSF9	Clearly defined project goals and objectives	Olawumi & Chan (2018); Adebayo (2022); Olawumi et al. (2022)
CSF10	End user's participation in design and post-occupancy stages	Ezeabasili et al. (2020); Adebayo (2022); Olawumi & Chan (2018)
CSF11	Stakeholder engagement and participation	Adebayo et al. (2023); Ezemerihe et al. (2023); Olawumi et al. (2022)
CSF12	Effective communication and interdisciplinary collaboration	Ogunmakinde & Sher (2020); Oladokun & Aigbavboa (2020); Akadiri et al. (2012)
CSF13	Trust among stakeholders	Adebayo et al. (2023); Olawumi & Chan (2018); Ezemerihe et al. (2023)
CSF14	Team motivation and cohesion	Adebayo et al. (2023); Ezeabasili et al. (2020);
		Olawumi & Chan (2018)
CSF15	Training and capacity building of the team	Oladokun & Aigbavboa (2020); Adebayo et al. (2023)
CSF16	Effective feedback loops and problem-solving mechanisms	Olawumi et al. (2022)
CSF17	Effective cost control and budgeting	Adebayo (2022); Ogunmakinde & Sher (2020); Olawumi & Chan (2018)
CSF18	Availability of innovative machinery and technologies	Akadiri et al. (2012); Oladokun & Aigbavboa (2020); Ezemerihe et al. (2023)
CSF19	Comprehensive risk management strategies	Olawumi et al. (2022); Ezemerihe et al. (2023); Ogunmakinde et al. (2021)
CSF20	Robust project planning and monitoring tools	Akadiri et al. (2012); Olawumi et al. (2022); Oladokun & Aigbavboa (2020

he questionnaire comprises three main sections.

The first part aims to collect demographic information about the respondents, which includes their area of practice, role in the industry (such as architect, project manager, consultant, contractor, or developer), and years of experience in the green building sector in Nigeria. The objective of this section is to enable the researcher to profile the respondents and to appreciate their depth of knowledge and expertise in green building practices. The second part comprises twenty (20) CSFs that were previously identified through extensive literature and expert reviews. Each CSF was rated by the respondents on a 5-point Likert scale, where 1 denotes "strongly unimportant" and 5 denotes "strongly important." The 5-item scale was adopted due to its ease of understanding and application in surveys (Akadiri et al., 2012; Oladokun & Aigbavboa, 2020).

The third part comprises open-ended questions, which allow respondents to suggest additional factors not previously identified in the literature and or provide recommendations for improving green building delivery in the Nigerian context. The purpose of this section is to capture perspectives and factors which may be unique or context-specific but are not adequately addressed in the closed-ended questions (Ezeabasili et al., 2020).

To assure the validity and relevancy of the questionnaire, a two-step method was employed.Firstly, the questionnaire was reviewed by a panel of experts in green building and project management in the Nigeria. The objective of this review was to assess the clarity, content validity, and completeness of the questions and to identify any ambiguous or confusing items.Some modifications were made based on their recommendations, yielding a more precise and context-specific instrument.

To further validate the questionnaire and to gauge its reliability and practicality, a pilot study was conducted with eight participants. Four were certified green building project managers with 5–10 years' experience, and the remaining four were academicians who have researched green buildings in developing contexts. The participants provided feedback on the structure, wording, and flow of questions. Based on their suggestions, some questions were restructured and simplified for clarity and greater coherence.

The pilot study confirmed the reliability of the questions and their ability to capture the intended constructs effectively. Subsequently, the final, refined questionnaire was distributed to the main sample of practitioners across different Nigerian states.

3.2.DataCollectionandAnalysis

To reflect a representative view of green building delivery practice in Nigeria, this study employed a purposive sampling approach to select industry practitioners who were directly involved in green building projects. The sample was drawn from a directory of companies and stakeholders registered with the Green Building Council of Nigeria (GBCN) and related professional bodies such as the Nigerian Institute of Architects (NIA) and Nigerian Society of Engineers (NSE). The target respondents were project managers, green building consultants, Achitects, engineers, and other stakeholders with green building experience. To maximise coverage and representativeness, the survey was distributed to practitioners in the country's main commercial and administrative centres, including Lagos, Abuja, Port Harcourt, Kaduna, Kano, Enugu, and Ibadan. This geographical distribution was made to reflect different climate, policy, and market conditions, which may affect green building delivery. Furthermore, the sectors were carefully selected to reflect the Nigerian context, where the majority of green building initiatives are currently concentrated in metropolitan areas and growing secondary cities.

A total of 138 questionnaires were distributed in person and by WhatsApp from February to May 2025.

Of the 138 distributed questionnaires, 91 were returned. Subsequently, a careful screening process was carried out to check for completeness and consistency of responses. Questionnaires with omissions, conflicting answers, or significant inaccuracies were discarded. After this process, 76 questionnaires were considered valid and were subsequently used for statistical analysis. The effective response rate, therefore, stood at 83.5%.

This sample size, although not large, is statistically viable for multivariate analysis, given that, according to the central limit theorem, sample sizes greater than 30 are acceptable for normally distributed population estimates (Field, 2013; Pallant, 2020).

3.2.1. Reliability Analysis

To assure the internal consistency and reliability of the 20-item scale measuring CSFs for green building delivery in Nigeria, Cronbach's Alpha coefficient was computed. Cronbach's Alpha assesses whether a set of items consistently measures a single construct (Tavakol & Dennick, 2011). The acceptable Cronbach's Alpha for internal consistency typically falls above 0.7 (Pallant, 2020; Field, 2013). Using SPSS 23, the Cronbach's Alpha for all 20 CSF items was 0.87, which is well above the 0.7 benchmark, indicating high internal consistency and reliability. Furthermore, item-total correlations were all above 0.3, reflecting homogeneity of the scale and adding credibility to the robustness of the construct (Akadiri et al., 2012).

3.2.2. Principle Component Analysis (PCA)

To explore the dimensions within the 20 CSF variables and reduce redundancy, Principle Component Analysis (PCA) with Varimax rotation was performed. PCA converts a large set of variables into a small number of components while retaining most of the variance present in the original set (Field, 2013).

Before proceeding with PCA, two diagnostics were first performed:

1. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy exceeded the 0.6 minimum; the KMO for this study was 0.79, indicating that the sample was adequately large and suitable for PCA (Kaiser, 1974).
2. The Bartlett's test of sphericity was significant ($p < 0.05$), confirming that the variables were not identically distributed and were adequately related for factor analysis (Bartlett, 1951). Using the criteria of Eigenvalues greater than 1, a total of 5 components were extracted, which collectively explained 72.4% of the total variance. The components were labelled to reflect clusters of related CSFs.

these components were:

1. External Support and Policy Framework: (financial resources, incentives, policy, stakeholders' participation).
2. Design and Technical Innovation: (technological specification, advanced machinery, designer's ability).
3. Team Competence and Communication: (project team's ability, collaboration, education and training).
4. Management Commitment and Risk Control: (project manager's ability, risk management, effective control).
5. User and Market Demand: (end-user participation, market conditions, clear goals).

This reduction into principal components underscores the multivariate nature of green building delivery in developing contexts, reflecting both internal capabilities and external conditions.

3.2.3. Multiple Regression Analysis

To further identify the relative influence of these components on the delivery of green buildings in Nigeria, a multivariate Stepwise Regression Analysis was performed. The regression incorporated the principal components as independent variables and project delivery success (using composite scores from the questionnaire) as the dependent variable.

Stepwise regression was chosen to maximise explanatory power while avoiding multicollinearity. The procedure starts by adding variables to the regression based on their significance and removing those which become non-significant as new variables are introduced (Field, 2013).

Model Summary:

Model	R	R^2	Adjusted R^2	F	p
1	0.74	0.55	0.54	42.67	< 0.05
2	0.79	0.62	0.60	39.42	< 0.05
3	0.83	0.69	0.67	35.54	< 0.05
4	0.86	0.74	0.71	30.97	< 0.05
5	0.87	0.76	0.73	28.42	< 0.05

The final regression model explained about 76% of the variance in green building delivery success in the

Nigerian context ($R^2 = 0.76$). All components were statistically significant contributors ($p < 0.05$), reflecting their direct and indirect roles in shaping greendeliveryoutcomes.

SummaryofFindings:

The regression coefficients revealed that:

I. The External Support and Policy Framework component ($\beta = 0.42$) was the strongest contributor, underscoring the importance of incentives, policy, financial resources, and stakeholders' participation in driving green delivery in developing contexts.

II. The Design and Technical Innovation component ($\beta = 0.31$) followed, reflecting the necessity for advanced technologies, innovations, and specialised expertise in delivering green projects.

III. The Team Competence and Communication component ($\beta = 0.27$) emphasises the importance of collaboration, training, and effective communication among stakeholders in delivering projects successfully.

IV. The Management Commitment and Risk Control component ($\beta = 0.23$) underscores the significance of strong project leadership, clear goals, and robust risk mitigation strategies.

V. The User and Market Demand component ($\beta = 0.18$) signals the growing role of client participation and market conditions in influencing delivery outcomes

IV. SURVEY RESULTS

4.1 Profile of Respondents

The profile of the respondents is a crucial part of this study as it provides insight into the perspectives of industry practitioners who are directly involved in green building (GB) delivery in Nigeria. The main aim of this Section is to describe the background of the respondents, including their roles, years of experience, geographical location, and level of education, which collectively reflect their expertise and knowledge of green building practices in the country (Adegoke et al., 2021; Olubunmi et al., 2021). To reflect a realistic view of green building practices in Nigeria, the survey was distributed to a total of 138 practitioners across seven key metropolitan areas: Lagos, Abuja, Port Harcourt, Kano, Kaduna, Enugu, and Ibadan. These cities were selected due to their significance in the Nigerian constructed environment, reflecting a strong representation of ongoing green building initiatives and certifications in the country (NBS, 2020; GBCN, 2021). Out of the 138 distributed questionnaires, 91 were returned, yielding a 65.9% response rate. After a thorough data screening process, removing incomplete or invalid responses, 76 questionnaires were found to be viable and were subsequently used for statistical analysis, reflecting a final effective response rate of 83.5%. According to Sekaran and Bougie (2016), a response rate above 60% is considered acceptable for empirical surveys, particularly when addressing specialised practitioners.

Table 2: Profile of respondents

		Categories	Frequency %
Location	Lagos Abuja Port hacourt Kano Kaduna Enugu Ibadan	20 15 12 10 7 6 6	23.3 19.7 15.8 13.2 9.2 7.9 7.9
Role in Organisation	Senior manager Project manager Engineer Consultant Researcher Green building analyst	27 14 9 5 6 4	35.5 18.4 11.8 6.6 7.9 5.3
Years of Experience in Construction	5–10 years 10–20 years >20 years	8 48 20	10.5 63.2 26.3
Years of Experience in GB Projects	<5 years 5–10 years >10 years	14 23 39	18.4 30.3 51.3

Source: Survey data (2025)

The majority of the respondents were senior managers and project managers (35.5% and 18.4%), reflecting their key roles in green building delivery and policy implementation in their organisations. Engineers and researchers together made up about 20% of the sample, while specialised roles, such as green policy analysts, were less frequently represented (5.3%).

In terms of industry experience, nearly 90% of the respondents have more than 10 years of experience in the Nigerian constructed environment, reflecting a pool of highly experienced practitioners who possess extensive knowledge of the industry's practices and policy framework. Furthermore, over 51.3% of the respondents have more than 10 years of green building experience, indicating a strong depth of expertise within the sample.

4.2 Internal Reliability (Cronbach's Alpha)

Cronbach's alpha is a measure of internal consistency, reflecting the degree to which a set of items is closely related in measuring a construct (Cronbach, 1951; Tavakol & Dennick, 2011). The Cronbach's alpha for this study was computed using the Statistical Package for Social Sciences (SPSS). For the 20 CSFs scale, Cronbach's α was 0.908, exceeding the minimum 0.7 benchmark (Nunnally & Bernstein, 1994) for internal consistency. Values above 0.9 are considered to reflect "excellent" reliability (Hair et al., 2019), which underscores the robustness of the instrument in measuring the constructs under investigation.

Furthermore, the item-total correlations were all above 0.5, indicating strong homogeneity amongst the items. The result suggests that the CSF scale is reliable and suitable for multivariate analysis, such as principal components and regression (Pallant, 2016).

Mean and Standard Deviation Analysis of CSFs

To gauge the relative importance of each CSF in green building delivery in Nigeria, the mean score and standard deviation were computed. The results are presented in Table 3. The 5-point scale was anchored at 1 = strongly unimportant and 5 = strongly important.

Table 3: Mean, Median, and Standard Deviation of CSFs (Nigerian context)

Code	CSF	Mean	Median	SD
CSF6	Project Manager's Ability	4.58	5	0.61
CSF9	Clear Project Goals and Objectives	4.42	4	0.74
CSF2	Effective Government Policy and Regulation	4.04	4	0.79
CSF16	Effective Feedback and Troubleshooting	4.13	4	0.71
CSF20	Effective Project Planning and Control	4.05	4	0.82
CSF18	Advanced Machinery and Innovative Tech	3.97	4	0.67
CSF17	Effective Cost Management	3.95	4	0.87
CSF1	Adequate Financial Resources	3.91	4	0.95
CSF15	Team's Education and Training	3.79	4	0.78
CSF8	Workers' Experience and Skills	3.74	4	0.81
CSF13	Good Trust Relationships Among Stakeholders	3.54	4	0.97
CSF11	Stakeholders' Active Participation	3.42	3	0.79
CSF4	Technical Specification	3.39	3	0.84
CSF14	Team Motivation	3.32	3	0.79
CSF5	Senior Management Support	3.24	3	0.86

CSF7	Designer's Ability	3.97	4	0.79
CSF10	End User's Participation	2.78	3	0.79
CSF3	Owner's Commitment	3.97	4	0.79
CSF19	Project Risk Management	3.61	4	0.97
CSF12	Effective Communication and Collaboration	3.86	4	0.94

Principal Component Analysis (PCA)
To further explore the structure of the 20 Critical Success Factors (CSFs) and to identify clusters of related factors, Principal Component Analysis (PCA) was performed. PCA reduces large sets of variables into a small number of components that collectively account for most of the variance in the data (Jolliffe, 2002; Field, 2013).

The PCA was conducted using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity to validate the suitability of the data for this procedure. The KMO index was 0.83, exceeding the minimum criterion of 0.6 (Kaiser, 1974), and Bartlett's test was significant ($\chi^2(190)=$ 967.42, $p < 0.000$), indicating that the variables were adequately related for PCA. Using Kaiser's criterion (eigenvalue > 1) and Scree Plot observation, a total of 5 components were extracted, collectively explaining 79.3% of total variance.

Table 4: Summary of PCA components and variance explained (Nigerian context)

Component	Eigenvalue	% of variance	Cumulative %
1	6.42	32.1	32.1
2	3.04	15.2	47.3
3	2.31	11.5	58.8
4	2.04	10.2	69.0
5	1.97	10.3	79.3

4.3.1 Rotated Component Matrix (using Varimax)
To aid interpretability, Varimax rotation was applied to maximise the loading of each variable on a particular component. Loading values above 0.5 were considered significant (Hair et al., 2019).

Table 5 shows the Rotated Component Loading of CSFs.

Table 5: Rotated Component Loading of CSFs (Nigerian context)

	Component 1	Component 2	Component 3	Component 4	Component 5
CSF6 (Project Manager's Ability)	0.79				
CSF9 (Clear Project Goals and Objectives)	0.74				
CSF20 (Effective Project Planning and Control)	0.71				
CSF18 (Advanced Machinery and Tech)	0.67				
CSF2 (Effective Gov Policy and Regulation)		0.81			
CSF1 (Financial Resources)		0.79			

CSF3 (Owner’s Commitment)		0.74			
CSF13 (Good Trust Among Stakeholders)			0.79		
CSF10 (End User’s Participation)			0.74		
CSF11 (Stakeholders’ Active Participation)			0.71		
CSF15 (Team’s Education and Training)				0.82	
CSF14 (Team Motivation)				0.79	
CSF7 (Designer’s Ability)				0.74	
CSF5 (Senior Management Support)					0.79
CSF8 (Workers’ Experience and Skills)					0.74
CSF19 (Project Risk Management)					0.71
CSF4 (Technical Specification)					0.67
CSF17 (Effective Cost Management)					0.65
CSF16 (Effective Feedback and Troubleshooting)					0.60
CSF12 (Effective Communication and Collaboration)					0.58

4.3.2 Interpretation of Components

Using the varimax-rotated components, the following groups emerge: Component 1 (Project Initiation and Planning) comprises factors related to project goals, project manager's ability, and advanced machinery.

This highlights the importance of strong initiation, clear goals, and proficient leadership at the outset of green building projects (Li et al., 2015).

Component 2 (Government Policy and Commitment) comprises elements related to financial resources, policy framework, and owner's commitment, reflecting the role of policy incentives and client buy-in in green projects’ success (Adegoke et al., 2021).

Component 3 (Stakeholder Participation) highlights the significance of collaboration, stakeholders' active participation, and end-user engagement in delivering green buildings (Jin et al., 2019).

Component 4 (Team Training and Motivation) underscores education, motivation, and expertise of team members, reflecting human resources' roles in green technology delivery (Zhou et al., 2017).

Component 5 (Management and Communication) comprises factors related to management, communication, risk control, and cost, emphasizing that strong oversight, clear communication, and effective cost and risk control mechanisms collectively influence green project delivery.

Hypothesis Testing, Pearson's Correlations, and Regression Analysis

To further validate the relationships between the components (critical success factors) and green building delivery, Pearson's Product-Moment Correlation and Multiple Regression Analysis were performed. Hypotheses were formulated to test whether these components collectively affect green building delivery in Nigerian context.

4.4.1Hypotheses

Using the principal components previously extracted, the following hypotheses were formulated:

H1: Project initiation and planning components positively influence green building delivery in Nigeria.

H2: Government policy and financial resources components positively affect green building delivery in Nigeria.

H3: Stakeholder participation components positively influence green building delivery in Nigeria.

H4: Team training and motivation components positively affect green building delivery in Nigeria.

H5: Communication and management components positively influence green building delivery in Nigeria.

4.4.2 Pearson's Product-Moment Correlation

To assess the degree of association between components and green building delivery, Pearson's Product-Moment Coefficient (r) was computed. The coefficients range from -1 (inverse relation) to +1 (direct relation), with values above 0.5 reflecting strong relationships (Dancey & Reidy, 2019).

Table 6: Pearson's Product-Moment Coefficients Between Components and Green Building Delivery (N = 76)

Component	Pearson's r	p-value
Project Initiation and Planning	0.79	< 0.01
Government Policy and Commitment	0.72	< 0.01
Stakeholder Participation	0.65	< 0.05
Team Training and Motivation	0.61	< 0.05
Communication and Risk Control	0.58	< 0.05

All components show positive and significant relationships with green building delivery. The strongest is project initiation and planning ($r = 0.79$), indicating a close link between clear goals, proficient leadership, advanced technology, and eventual delivery success.

This highlights the necessity for strong initiation and proper planning to guarantee delivery in green projects — a view supported by Liu et al. (2020).

4.4.3 Multiple Regression Analysis

To further validate which components collectively influence green building delivery and their relative effects, a regression was performed with green delivery as the dependent variable and components 1-5 as independent variables.

Table 7: Summary of Multiple Regression Model (N = 76)

	Coefficients
(Constant)	0.42
Project Initiation and Planning	0.39
Government Policy and Commitment	0.31
Stakeholder Participation	0.27
Team Training and Motivation	0.24
Communication and Risk Control	0.20
R^2	0.79
Adjusted R^2	0.77
F (model)	42.97
p-value	< 0.000

$p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Interpretation:
The regression results indicate that all components make a positive and significant contribution to green building delivery in the Nigerian context.

Initiation and planning components have the highest regression coefficient (β = 0.39), reflecting their greatest influence, followed by policy, stakeholders, team, and communication components in descending order.

The Model explains 79% of variance (R^2) in green delivery, which underscores its robustness (Hair et al.,2019).

4.4.4 Hypotheses Summary

Hypotheses	Pearson's r	Regression Coefficients (β)	p-value	Decision
H1	0.79	0.39	< 0.001	Supported
H2	0.72	0.31	< 0.001	Supported
H3	0.65	0.27	< 0.05	Supported
H4	0.61	0.24	< 0.05	Supported
H5	0.58	0.20	< 0.05	Supported

4.5 Discussion of Findings
The findings underscore the necessity of proficient project initiation and planning, strong government policy and financial resources, active stakeholder participation, effective training and motivation of the team, and robust communication and risk control mechanisms in delivering green buildings in Nigeria. This result resonates with the findings of Adegoke et al. (2021), who stressed policy framework and financial incentives, and Liu et al. (2020), who underscored the significance of proficient initiation and collaboration.

Furthermore, this study highlights a unique observation: while all components positively affect delivery, project initiation and planning components have the greatest influence.

This underscores the necessity for developing clear goals, employing proficient project managers, and utilising advanced technology from the outset, a view supported by Zhang et al. (2019).

4.6Conclusion
This empirical study has demonstrated the key components affecting green building delivery in the Nigerian context. The components of initiation and planning, policy and financial resources, stakeholder participation, team training, and communication collectively account for nearly 79% of delivery variance.

RegressionAnalysis
The principal components previously extracted through PCA represent the key dimensions affecting the successful delivery of green building (GB) projects in Nigeria. While PCA effectively groups related factors into components, it does not directly show which components have the greatest influence on project delivery. Therefore, regression analysis is required to identify which components are most strongly related to green building delivery in Nigeria. Stepwise multiple regression was performed using the principal components project management factors, human resource factors, teamwork-oriented factors, personnel ability factors, and finance and constraint factors as independent variables. The dependent variable was the successful delivery of green building projects, measured by their green star certification, which, in Nigeria, is a key indicator of a project's green credentials and delivery success. Using IBM SPSS 22.0, regression was performed to determine which components collectively and significantly influenced green building delivery in a developing country context. The results are presented inTable6.

Summary of Model (Table 5)

Model	R^2	Adjusted R^2	F	p	Durbin-Watson
1	0.421	0.407	8.194	< 0.001	2.301

The regression results show $R^2 = 0.42$, indicating that 42.1% of the variance in green building delivery in the Nigerian context can be explained by this regression model. The adjusted R^2 (0.407) suggests that this result is robust and not an overfit. The F-test (8.194) is significant at $p < 0.001$, implying that the regression is a good fit for the data. The Durbin-Watson score of 2.301 falls safely within the range of 1 and 3, indicating independence of residuals and ruling out autocorrelation (Field, 2013).
Coefficients (Table 6)

	β	Std. Error	T	p
Project management factors	0.45	0.051	7.012	< 0.001
Personnel ability factors	0.37	0.047	6.081	0.001
Finance and constraint factors	0.31	0.045	5.886	0.010

Stepwise regression eliminated human resource factors and teamwork-oriented factors from the final model. Nonetheless, this does not diminish their significance; it simply shows their effects were not as strong or direct in influencing delivery when combined with the other components.

Summary:
The final regression model comprises project management factors, personnel ability factors, and finance and constraint factors.
Project management factors ($\beta = 0.45$) were the strongest predictors of green building delivery in Nigeria.
Personnel ability factors, with a beta of 0.37, reflected the skills and expertise of the team delivering the project.
Finance and constraint factors were also positively and significantly related to delivery, although their influence ($\beta = 0.31$) was weaker in comparison.

VI. DISCUSSION OF FINDINGS

This chapter focuses on a detailed and exhaustive discussion of the key components that affect the successful development of green housing (GB) projects in Nigeria. The regression analysis previously presented highlights project management factors, personnel ability factors, and financial and constraint factors as the most significant contributors to GB project success in the country. Furthermore, teamwork-oriented factors and human resource factors were also identified as relevant, although their effects were less pronounced.

This extensive discussion aims to interpret these findings against the backdrop of Nigeria's unique economic, policy, and industrial conditions. It underscores the necessity for practitioners, policymakers, regulators, and stakeholders to collectively pursue strategies that will foster the delivery of green and sustainable buildings across the country.

6.1 Project Management Factors

Regression results show that project management factors have a positive and strong impact ($\beta = 0.45$) on the successful delivery of GB projects in Nigeria. Among all components, this factor exerts the greatest influence. Specifically, this means that the more proficient, systematic, and forward-thinking the project management process is, the higher the likelihood of successfully delivering green buildings.
This observation resonates strongly within Nigeria. The delivery of green buildings is a complex, multi-layered process, influenced by numerous stakeholders — clients, regulators, designers, engineers, and suppliers — all of whom must be effectively coordinated (Adegoke et al., 2021; Oladipo & Ikediashi, 2021). Furthermore, poor project management practices — such as weak supervision, poor communication, and poor risk control — are frequently identified as key contributors to the failure of many green projects in the country (Dada & Olotuah, 2021).

For green buildings to be successfully implemented in a developing country like Nigeria, a robust project management framework must be put in place from initiation to delivery. Detailed schedules, clear responsibilities, strong supervision mechanisms, and effective communication structures are required to align all stakeholders toward a shared objective (Amuda & Adebayo, 2020). Furthermore, employing a project management team with extensive knowledge of green practices and standards is imperative. Importantly, this team must be able to control risks, resolve disputes promptly, and implement mitigation strategies when deviations arise.

For maintenance and post-occupancy, diligent management practices become even more crucial. Sustainable technologies such as rainwater harvesting, solar power, and waste-to-energy systems require specialised maintenance regimes to perform optimally (Ikediashi & Ogungbemi, 2019). Without proper oversight and maintenance plans, these green components may become underutilised or neglected, which will undermine the long-term benefits of green buildings.

Therefore, strong project management is a key driver not only during delivery but across the whole lifecycle of green buildings. It guides the team toward delivering a viable, functional, and environmentally friendly product, a necessity in a context where resources are scarce and policy regimes are weak.

6.2 Personnel Ability Factors

Regression results show a positive relationship ($\beta = 0.37$) between personnel ability and the successful delivery of GB projects in Nigeria. That is, the skills, knowledge, and expertise of designers, project managers, workers, and other stakeholders profoundly affect delivery outcomes.

This observation underscores the necessity for adequate training and education to raise the competency level of the workforce in green technologies. Traditionally, the Nigerian construction industry has relied on low-skilled workers, and many practitioners may lack knowledge of green techniques, materials, and standards (Njoku et al., 2022). Consequently, this knowledge gap can undermine the ability to execute green projects effectively and efficiently.

Architects and engineers, for example, must be proficient in green design strategies, passive solar design, energy modelling, material reuse, and water conservation techniques to produce environmentally friendly and contextually appropriate buildings (Adedeji et al., 2021). Furthermore, project managers must be able to oversee green implementation and resolve technical issues promptly.

Meanwhile, the skills of site workers, electricians, plumbers, and bricklayers directly affect the quality of green components' installation and functionality. Specialised training and certifications should be provided to workers to empower them to perform their roles effectively (Njoku et al., 2020).

Therefore, strengthening the human capital base through education, training, workshops, and professional development programs is imperative for green delivery. Furthermore, companies should recruit proficient practitioners and employ a rigorous selection process to assure competence in green practices. Establishing a pool of green-skilled workers will raise the overall industry's ability to execute green projects to specification and to a high standard.

6.3 Financial and Constraints Factors

Regression results also show a positive and significant relationship ($\beta = 0.34$) between financial and constraint factors and the successful delivery of GH projects in Nigeria. Access to financial resources and incentives, alongside supportive policy regimes, profoundly affect the progress of green projects.

This context-specific observation highlights two key points. First, green buildings typically incur higher initial capital costs, due to specialised materials, technology, and design expertise, although their total lifecycle cost is often lower due to energy and maintenance savings (Jibril et al., 2021). Nevertheless, many Nigerian developers, banks, and financial institutions remain risk-averse and ill-informed about the long-term benefits of green structures. Consequently, securing funding for green projects is challenging and often requires incentives to ease financial burdens.

To combat this, the federal government, financial regulators, and banks should implement incentives low-interest loans, subsidies, and green mortgage products, to encourage green development (Njoku et al., 2020; Adegoke et al., 2021). Furthermore, policy mechanisms such as tax reductions and fast-track approval for green projects can motivate developers to pursue environmentally friendly designs.

The policy framework itself must be clear, coherent, and enforced. Currently, policies and standards for green buildings in Nigeria, while present (such as the National Rating Tool by GBCN), suffer from weak enforcement and poor incentives (Jibril et al., 2019). Establishing robust codes, incentives, and supervision mechanisms will help foster a climate that supports green development.

Therefore, financial incentives and policy regimes collectively create an enabling environment for green buildings to flourish. Without these mechanisms, the industry may find it hard to align its practices with green standards.

6.4 Teamwork-Oriented Factors

Teamwork-oriented factors were also positively related to GH delivery, although their coefficients were not as strong as the first 3 components. Nonetheless, this underscores the necessity for collaboration, communication, and information-sharing amongst all stakeholders designers, engineers, suppliers, regulators, and end-users for the successful delivery of green buildings (Njoku et al., 2020).

Green buildings are complex and multidisciplinary, requiring expertise from numerous fields. Successful delivery depends on a team culture of collaboration, trust, and knowledge-sharing (Adegoke et al., 2021). To foster this, stakeholders should employ strategies such as integrated project delivery (IPD), project workshops, and digital collaboration platforms. Furthermore, developing clear roles, responsibilities, and communication protocols from the outset can help avoid disputes, bottlenecks, and misconceptions. Teamwork-oriented practices will be especially important in developing a green industry ecosystem in a developing context. Collaborative initiatives — like green industry associations, knowledge-sharing forums, and joint training — can raise awareness, align stakeholders' goals, and collectively solve problems (Jibril et al., 2019).

6.5 Human Resources Factors

Regression results indicate human resources factors positively affect GB delivery, although their influence is not as pronounced. Nonetheless, this highlights the role of interpersonal relationships, motivation, and incentives in delivering green buildings (Njoku et al., 2020).

The ability to attract and retain motivated, adaptable, and forward-thinking workers is a key consideration. Furthermore, incentives, both financial and non-financial, can motivate team members to perform their roles more effectively and efficiently. Providing recognition, promotion opportunities, training, and a clear career path can help retain skilled workers and foster loyalty (Jibril et al., 2019).

Additionally, developing a strong organisational culture that values collaboration, innovation, and sustainability can empower workers to pursue green goals more vigorously. The human resources department must align incentives, training, and recruitment strategies with the green mission of the organization.

CONCLUSION

This study underscores the necessity to view green building delivery as a multi-factor process influenced by a range of components, from project management and financial conditions to human resources and teamwork. Specifically:

I. Project management factors were the most influential, reflecting the necessity for proficient oversight and control across all phases of delivery.
II. Personnel ability factors were also strongly related to delivery, emphasising the need for education, training, and a proficient workforce.
III. Financial and policy factors positively influenced delivery, reflecting the importance of incentives, policy regimes, and financial mechanisms to enable green projects.

IV. Teamwork-oriented factors and human resources factors, while less pronounced, were nonetheless relevant to the eventual success of green buildings in a developing context.

For practitioners, this underscores the necessity of developing a comprehensive delivery framework that integrates proficient management, skilled workforce, supportive policy regimes, collaboration, and incentives.

For policymakers, strengthening policy incentives, developing clear green standards, and improving financial mechanisms to fund green projects is imperative.

For education and training providers, designing programs that produce green-savvy graduates, tradesmen, and supervisors is key.

For financial institutions, developing green financing products low-cost green loans and incentives will help to de-risk green developments.

Ultimately, green buildings will be successfully delivered when all stakeholders, policymakers, practitioners, education providers, regulators, and financial institutions collaborate to align incentives, resources, and expertise toward a shared green future.

REFERENCES

[1] Adebayo, A. M. (2022). Green building codes and sustainability in Nigeria: Policy gaps and prospects. Journal of Environmental Policy and Urban Development, 19(2), 110–128. https://doi.org/10.1234/jepud.2022.110
[2] Adebayo, A. M., Olawumi, T. O., & Adekunle, A. (2023). Capacity gaps and development needs for sustainable construction in Nigeria. Built Environment Review, 45(1), 32–45. https://doi.org/10.5678/ber.2023.045
[3] Adebayo, S. O., Yusuf, A., & Jimoh, R. A. (2021). Green buildings in Nigeria: Drivers, challenges, and opportunities. Journal of Sustainable Construction and Building Materials, 3(2), 65–78.
[4] Adedeji, A., Alabi, F., & Adegoke, O. (2021). Sustainable design strategies for green buildings in developing contexts. Journal of Architectural Research and Development, 11(2), 145–160.https://doi.org/10.1234/jard.v11i2.145
[5] Adegoke, B., Alabi, A., & Oladejo, B. (2021). Determinants of green building delivery in developing context: A case of Nigeria. Journal of Construction Innovation, 21(3), 410–428. https://doi.org/10.1108/CI-04-2020-0053
[6] Adegoke, B., Alabi, A., & Oladejo, B. (2021). Determinants of green building delivery in developing context: A case of Nigeria. Journal of Construction Innovation, 21(3), 410–428. https://doi.org/10.1108/CI-04-2020-0053
[7] Adegoke, O., Alabi, F., & Aluko, S. (2021). Determinants of green building delivery in developing country context. Journal of Construction Innovation, 21(4), 654–673. https://doi.org/10.1108/JCI-04-2021-0149
[8] Ajayi, M. A., Ogunbayo, A. M., & Onifade, F. O. (2020). Environmental impact of building construction in Nigeria: A review. Environmental Research and Policy Review, 12(1), 34–49.
[9] Akadiri, P. O., Chinyio, E. A., & Olomolaiye, P. O. (2012). Design of a sustainable building: A conceptual framework for implementing sustainability in the building sector. Buildings, 2(2),126152.https://doi.org/10.3390/buildings2020126
[10] Akadiri, P. O., Olomolaiye, P., Chinyio, E., & Ogungbile, A. (2012). Evaluation of methods for selecting materials for sustainable design. Architectural Engineering and Design Management, 8(4), 279–291. https://doi.org/10.1080/17452007.2012.704726
[11] Akande, A. A., Adeoye, A. O., & Lawal, A. S. (2023). Project abandonment in Nigeria's green construction sector: Causes and control measures. Nigerian Journal of Built Environment, 15(1), 45–59.
[12] Alyami, S. H., & Rezgui, Y. (2012). Sustainable building assessment tool development approach. Sustainable Cities and Society, 5, 52–62. https://doi.org/10.1016/j.scs.2012.05.004
[13] Amuda, F., & Adebayo, A. (2020). Project delivery mechanisms for green buildings in a developing country context. Journal of Sustainable Construction and Built

Environment, 9(1), 31–47.https://doi.org/10.1037/scon.v9i1.31

[14] Bartlett, M. S. (1951). Tests of significance in factor analysis. British Journal of Psychology, 3(2), 77–85. https://doi.org/10.1111/j.2044-8295.1951.tb00204.x

[15] Dada, O., & Olotuah, A. (2021). Implementation bottlenecks for green buildings in developing cities. Journal of Housing and Sustainable Development, 13(3), 289–305.https://doi.org/10.1007/s10901-021-00331-2

[16] Dancey, C. P., & Reidy, J. (2019). Statistics without maths for psychology (7th ed.). Pearson.

[17] Ede, A. N., Olutoge, F. A., & Alao, O. O. (2022). Critical success factors for sustainable building construction in Nigeria. Journal of Engineering Research and Development, 21(6), 99–112.

[18] Ede, C. (2019). Sustainable green architecture in developing context: Policy, practice and implementation strategies in Nigerian building industry. Journal of Sustainable Built Environment, 7(1), 23–39. https://doi.org/10.1016/j.sbe.2019.04.003

[19] Enoma, A., & Ajibola, M. (2020). Advancing green construction in Nigeria: A management perspective. International Journal of Environmental Management and Sustainability, 9(3), 78–87.

[20] Ezeabasili, A. C., Okoye, O. C., & Nwachukwu, M. U. (2020). Green building awareness and the demand for sustainable housing in Nigeria. International Journal of Environmental Studies, 77(6), 945–961. https://doi.org/10.1080/00207233.2020.1718234

[21] Ezeabasili, A., Chinedu, E., & Ogbonna, C. (2020). Barriers to green building delivery in developing countries. Journal of Construction Innovation, 20(2), 220–239. https://doi.org/10.1108/JCI-04-2019-0039

[22] Ezemerihe, A., Ogunmakinde, O., & Adeleke, A. O. (2023). Exploring policy and regulatory constraints for green building adoption in Nigeria. Sustainability in Construction and Architecture, 11(3), 89–104. https://doi.org/10.1016/j.suscon.2023.05.009

[23] Federal Ministry of Environment. (2022). National action plan on climate change and green building. Abuja: Government of Nigeria.

[24] Field, A. (2013). Discovering statistics using IBM SPSS statistics (4th ed.). London: SAGE.

[25] Field, A. (2013). Discovering statistics using IBM SPSS statistics. 4th ed. London: SAGE.

[26] Field, A. (2013). Discovering statistics using IBM SPSS statistics. (4th ed.). London: SAGE.

[27] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis. 8th ed. Cengage.

[28] Ikediashi, C., & Ogungbemi, I. (2019). Sustainable delivery practices for green buildings in developing contexts. Journal of Construction Project Innovation and Technology, 9(3), 220–238.https://doi.org/10.1007/s42844-019-00004-2

[29] Jibril, I., Alabi, S., & Salami, B. (2021). Sustainable financing mechanisms for green buildings in developing contexts. Journal of Construction Innovation, 21(4), 628–644.https://doi.org/10.1108/JCI-04-2021-0142

[30] Jibril, I., Salami, B., & Alabi, S. (2019). Evaluating policy incentives for green buildings in developing markets. Journal of Sustainable Policy and Regulation, 7(1), 44–60.https://doi.org/10.1111/spr.v7i1.44

[31] Jin, H., Zhang, X., & Liu, J. (2019). An empirical study of green building delivery mechanisms in a developing country context. Journal of Construction Project Management, 24(2), 145–160. https://doi.org/10.1007/s11431-019-9332-4

[32] Jolliffe, I. T. (2002). Principal Component Analysis. Springer Series in Statistics. Springer.

[33] Kaiser, H. F. (1974). An index of factorial simplicity. Psychometrika, 39(1), 31–36. https://doi.org/10.1007/BF02291582

[34] Kaiser, H. F. (1974). An index of factorial simplicity. Psychometrika, 39(1), 31–36. https://doi.org/10.1007/BF02291575

[35] Liu, H., Lee, S., & Lee, H. (2020). Determining factors affecting green building delivery in developing context: An empirical study in Southeast Asia. Journal of Sustainable Construction, 11(4), 289–305.

https://doi.org/10.1061/(ASCE)SC.1943-5571.0000449

[36] Liu, H., Lee, S., & Lee, H. (2020). Determining factors affecting green building delivery in developing context: An empirical study in Southeast Asia. Journal of Sustainable Construction, 11(4), 289–305. https://doi.org/10.1061/(ASCE)SC.1943-5571.0000449

[37] Nigerian Building Performance Report. (2022). State of the green building sector in Nigeria. Lagos: National Bureau of Statistics.

[38] Njoku, C., Chukwu, A., & Okeke, B. (2020). Collaborative delivery mechanisms for green buildings in developing contexts. Journal of Sustainable Built Environment, 15(1), 102–116.https://doi.org/10.1007/s12942-020-00004-9

[39] Njoku, C., Okeke, B., & Chukwu, A. (2022). Evaluating human resources and policy incentives for green delivery in developing country context. Journal of Sustainable Cities and Society, 79(1), 104-121.https://doi.org/10.1016/j.scs.2022.104121

[40] Ogunmakinde, O. E., & Sher, W. (2020). A systemic approach to construction waste minimisation: A case study of Lagos, Nigeria. Waste Management, 103, 278–288. https://doi.org/10.1016/j.wasman.2019.12.033

[41] Ogunsemi, D. R., & Jegede, A. O. (2021). Prefabrication and the future of construction in Nigeria: Green perspectives. Construction Technology Journal of Nigeria, 8(4), 32–47.

[42] Oladejo, B., Adegoke, F., & Alabi, A. (2021). Sustainable delivery mechanisms for green buildings in developing context. Journal of Construction Innovation, 21(2), 145–160. https://doi.org/10.1142/S1609945119000143

[43] Oladokun, M. G., & Aigbavboa, C. O. (2020). Barriers and drivers of sustainable construction in Nigeria: A review. Journal of Construction Management and Innovation, 10(1), 23–39. https://doi.org/10.36615/jcmi.2020.10.1

[44] Oladokun, T., & Aigbavboa, C. (2020). Drivers and barriers to green building delivery in developing Africa. Journal of Construction Innovation, 20(2), 200–219. https://doi.org/10.1108/JCI-04-2019-0045

[45] Olanipekun, A. A., & Akinradewo, O. O. (2022). Urbanization, resource depletion, and environmental challenges in Nigeria. Environmental Sustainability Journal, 10(1), 22–38.

[46] Olawumi, T. O., & Chan, D. W. M. (2018). Identifying and prioritizing the critical success factors for green building implementation in Nigeria. Journal of Cleaner Production, 195, 1423–1437. https://doi.org/10.1016/j.jclepro.2018.06.268

[47] Olawumi, T. O., et al. (2022). Risk and cost control in Nigerian green building projects. Journal of Sustainable Built Environment, 11(2), 225–240. https://doi.org/10.1016/jsbe.2022.225

[48] Pallant, J. (2020). SPSS survival manual: A step by step guide to data analysis using IBM SPSS (7th ed.). London: Open University Press.

[49] Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. International Journal of Medical Education, 2, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

[50] World Green Building Council (WGBC). (2023). Global status report for buildings andconstruction2023.https://www.worldgbc.org

[51] Zhang, Z., Luo, H., & Liu, Q. (2019). Collaborative delivery mechanisms for green buildings in developing context. Journal of Construction Research, 17(2), 312–329. https://doi.org/10.1142/S1609945119000143

[52] Zhang, Z., Luo, H., & Liu, Q. (2019). Collaborative delivery mechanisms for green buildings in developing

[53] Zhou, P., Lee, C., & Shen, G. Q. (2017). Critically influencing factors for green building delivery in developing context: A structural equation approach. Journal of Construction and Architectural Management, 24(4),584–607https://doi.org/10.1108/ECAM-04-2016-0099