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FIRM CHARACTERISTICS AND CRITICAL FACTORS INFLUENCING GREEN BUILDING ADOPTION: INSIGHTS FROM BUILT ENVIRONMENT PROFESSIONALS IN LAGOS, NIGERIA

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ABSTRACT

Green building is increasingly recognised in Nigeria as a strategic approach to achieving sustainable development across environmental, economic, and social dimensions within the construction industry. The integration of Green Building (GB) is fundamental to the realisation of green buildings. However, for GB to be successfully adopted and widely applied across the Nigerian built environment, it is crucial to

INTRODUCTION

The rapid growth of urban areas in developing nations has increased environmental stress, especially from the built environment. Globally, the construction and operation of buildings are responsible for approximately 39% of carbon dioxide (CO_2) emissions and more than 36% of global energy use (Mikhail *et al.*2023). In developing countries like Nigeria, the effects are magnified due to poor planning, rapid population growth, weak enforcement of building regulations, and a shortage of government officials who are building environment professionals. Lagos, Nigeria's commercial capital, is projected to become one of the world's largest megacities by 2100, with a population exceeding 88 million (Auwalu & Bello, M. 2023). This urban explosion presents both a significant threat to sustainability and a crucial opportunity to pivot towards green building practices. Green Building (GB) offer a pathway for Nigeria

understand the underlying factors that influence their uptake, especially from the perspective of key professionals such as architects, engineers, builders and quantity surveyors. This study's main objective is to investigate the relationship between the establishment year of firms and the Distribution of working experience among the built environment professionals (BEPs). A total of 312 valid responses were analysed using SPSS and exploratory factor analysis (EFA) techniques to examine the relationships between various influencing variables and the BEPs' adoption behaviour. The findings reveal that factors such as BEPs' motivation towards green building, the technical capabilities of the available green technologies, the BEPs' knowledge base, and perceived shortcomings or limitations of the technologies significantly influence adoption decisions. Interestingly, organisational support and managerial encouragement were found to have no substantial impact on the willingness of BEPs to adopt GB. These insights offer practical implications for improving GB adoption within firms and promoting sustainable construction practices across Nigeria. The study contributes to the growing body of green building research by introducing a quantitative, theory-driven approach suited to the local context. It also serves as a basis for future research that may extend the scope of analysis to include other built environment professionals and the internal dynamics of Nigerian BEPs' organisations.

Keywords: Critical Factors, Green Building, Built Environment, Theory of Planned Behaviour, Sustainable Development, Lagos.

minimising the negative environmental impact of rapid urbanisation. Green building refers to innovative strategies, materials, and systems that improve the energy efficiency, water conservation, waste management, and overall environmental performance of buildings throughout their lifecycle (United Nations Environment Programme (UNEP), 2022). GBTs can include passive solar designs, green roofs, energy-efficient appliances, low-impact construction materials, photovoltaic solar systems, and intelligent energy monitoring devices. Their integration into building design and construction is pivotal to achieving the goals of the Paris Agreement, the UN Sustainable Development Goals (particularly Goal 11 Sustainable Cities and Communities), and Nigeria's Climate Change Act (2021).

However, the adoption of green buildings in Nigeria has been slow. Despite efforts from stakeholders like the Green Building Council Nigeria (GBCN), private developers, and academic researchers, the market share of green buildings remains negligible. Studies have consistently shown that green buildings are rare in Nigeria due to a combination of institutional, economic, and socio-cultural barriers (Omoniyi & Adeniyi, 2021; Ogunmakinde et al., 2019; Ojelabi *et al*., 2024). Key obstacles include high upfront costs, lack of awareness, inadequate policy enforcement, and limited technical expertise among professionals in the construction sector. Moreover, clients of both public and private often prioritise short-term gains over long-term sustainability, discouraging investment in green design. The lack of adoption is especially concerning given Nigeria's high exposure to climate risks. Heatwaves, floods, droughts, and sea-level rise are increasingly affecting cities like Lagos, Port Harcourt, and Abuja, undermining infrastructure resilience and public health. Building performance plays a crucial role in adapting to these risks. For example, poorly ventilated or non-insulated buildings worsen heat stress, while unsealed structures increase vulnerability to flood damage. As such, the urgency for green transformation in Nigeria's built environment is not just about environmental sustainability; it is about survival, health, and economic stability.

In 2024, Poorisat *et al*. conducted a study that examined the key factors affecting GB through technological adoption in developing countries, focusing specifically on BEPs. Their research used structural equation modelling to explore the influence of variables such as economic incentives, regulatory support, technological familiarity, and cultural attitudes on GB adoption. Their findings revealed that BEPs' willingness to adopt GB was significantly shaped by a mixture of perceived behavioural control, government policy frameworks, social norms, and personal environmental values. These findings align closely with the Theory of Planned Behaviour (Ajzen, 1991), which posits that intention to perform a behaviour is influenced by attitudes, subjective norms, and perceived behavioural control.

In Nigeria, these variables are also relevant, but their manifestations differ due to the country's unique socio-economic and political realities. For instance, while BEPs in China may be influenced by a highly structured regulatory system and centrally coordinated green building codes, Nigerian professionals operate in a decentralised, often fragmented policy environment. While both contexts face cost-related barriers, Nigeria's foreign exchange instability, high inflation, and infrastructure deficits intensify these economic challenges. Similarly, while cultural perceptions of environmental responsibility influence GB adoption in both countries, Nigeria's multi-ethnic context introduces varying beliefs about land use, aesthetics, and innovation in the construction industry. Adapting Poorisat *et al*.'s research to the Nigerian environment thus requires recontextualising these global findings within local realities. Several studies from Nigeria (e.g., Jung *et al*, 2024). Oduali & Ubani, 2025; Eze *et al*., 2025) suggest that BEPs often lack the autonomy or incentive to propose green alternatives to clients. Moreover, design education in tertiary institutions in Nigeria still lacks in integrating of sustainability and climate-responsive techniques. These structural issues must be accounted for in any model attempting to explain green building adoption in Nigeria.

Beyond economic and institutional issues, awareness remains a core factor. A 2021 survey conducted among architects in Lagos State revealed that over 60% were unfamiliar with Nigeria's own National Building Energy Efficiency Code (NBEEC), and over 75% had never worked on a project that aimed for green certification (Ojelabi *et al*., 2024). This knowledge gap undermines both the demand and supply of green design expertise. While professional organisations like the Nigerian Institute of Architects (NIA) and the Council for the Regulation of Building Contracting and Construction Firms, quantity surveying firms in Nigeria (COBON) have begun offering sustainability-focused training, these initiatives remain underfunded and poorly coordinated. From a policy perspective, there have been promising developments. Nigeria's Nationally Determined Contributions (NDCs) under the Paris Agreement commit to reducing emissions by 20% unconditionally and 47% conditionally by 2030, with green buildings listed as a key strategy. The 2021 Climate Change Act also mandates the creation of a carbon budget and a Climate Change Fund. However, enforcement remains weak. The absence of legally binding GB codes and a national green building rating system (comparable to China's 3-Star or the US's LEED) limits the translation of these commitments into practice.

Meanwhile, innovative projects such as Heritage Place (Lagos), which is the first LEED-certified commercial building in Nigeria, demonstrate the feasibility of GB within the country. Constructed using high-performance glazing, solar shading, and efficient HVAC systems, Heritage Place consumes up to 40% less energy than conventional buildings. Similar successes can be seen in private university campuses and high-end residential developments in Abuja and Lekki, Lagos. These examples, while rare, provide valuable case studies for replicability. In line with global research and local developments, this study aims to explore the key factors influencing the adoption of GB by BEPs in Nigeria, particularly during the design phase. Drawing upon the Theory of Planned Behaviour and the Value-Belief-Norm (VBN) theory (Hamann et al. 2024; Bolusemihi *et al.,* 2025; Wei et.al, 2018), the study proposes a conceptual framework that evaluates designers' awareness, perceived behavioural control, social norms, and environmental values. It also

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integrates practical barriers such as cost, material availability, and institutional support.

Problem Statement

Despite the growing global emphasis on sustainable development, the adoption and implementation of green building (GB) in Nigeria remain significantly low. This is particularly concerning given Nigeria's rapid urbanisation, environmental degradation, and increased energy demand in urban areas (Omoniyi & Adeniyi, 2021). While green building offers a viable alternative by minimising energy use, reducing carbon emissions, and improving resource efficiency (Darko & Chan, 2016), its uptake by built environment professionals in Nigeria has not met expectations.

Multiple studies have identified key barriers, including inadequate awareness, lack of technical know-how, limited access to green materials, and the perceived high cost of green building (Oladokun & Adebayo, 2017; Agyekum *et al.*, 2018). Moreover, institutional frameworks to support green construction are underdeveloped, and existing policies are either non-enforceable or poorly implemented (Adebayo & Ajayi, 2021). The Nigerian construction industry, characterised by a fragmented structure and dominated by small and medium-sized enterprises, lacks the collaborative environment required for the effective integration of green practices (Oluwatobi *et al.*, 2021).

In contrast to developed countries where green building adoption is incentivized through government support and robust regulations (Hwang & Tan, 2012), Nigeria still lacks a national green building code or standardized rating systems that are enforceable. This regulatory void, coupled with low demand from clients and end-users who are often unaware of the long-term benefits of green buildings, further hinders widespread implementation (Amusan, Adekunle, & Owolabi, 2022).

Hence, there is a pressing need to empirically investigate the critical success factors (CSFs) affecting the adoption and implementation of green building technologies in Nigeria. This study aims to fill this gap by identifying these factors through the perspectives of built environment professionals in Lagos, providing recommendations for policymakers, educators, and industry stakeholders.

LITERATURE REVIEW

In recent decades, the global construction industry has undergone a paradigm shift towards sustainability, driven by escalating concerns about climate change, environmental degradation, and the depletion of natural resources. Green Building (GB) have emerged as a critical framework for mitigating the environmental impacts of construction activities while promoting energy efficiency, indoor air quality, and resource conservation (Darko & Chan, 2018; Zhao *et al*., 2022). The adoption of GB is not merely a technical preference but a vital strategy aligned with global sustainability goals, including the United Nations Sustainable Development Goals (SDGs), particularly SDG 11 on sustainable cities and communities (UNDP, 2023).

The rationale behind GB is grounded in principles of eco-efficiency, lifecycle cost reduction, occupant health, and long-term resilience of buildings (Azhar *et al*., 2011). As green buildings shift from being a niche concern to a mainstream construction goal, the diffusion of GB becomes essential. The BEPs play a pivotal role in this transition, as their decisions during the planning and design stages significantly influence material use, energy systems, and structural efficiency (Zuo & Zhao, 2014). Despite increased awareness, the uptake of GB remains uneven, especially in developing countries like Nigeria. Factors such as lack of awareness, limited technical skills, insufficient management support, fragmented project teams, and the perception of increased costs have been identified as key barriers (Olanrewaju et al., 2021; Bolusemihi *et al*., 2025). Understanding the critical factors and barriers to GB adoption among BEPs is therefore critical. This literature review synthesises key theoretical, empirical, and conceptual contributions to this subject, focusing on themes such as knowledge structure, GB capability, management support, motivation, and technical limitations.

Conceptualising Green Building Through Technology (GBT)

The term GBT encompasses a broad array of processes, materials, and techniques designed to reduce environmental impact and improve building performance. Initially derived from the broader concept of Environmentally Sound Technologies (Braun & Wield, 1994), GBT have evolved to include technologies that facilitate energy savings, water conservation, material efficiency, indoor air quality improvement, and enhanced occupant comfort (Ahmad *et al*., 2020). According to the World Green Building Council (WGBC, 2022), a GB is one that, in its design, construction, or operation, reduces or eliminates negative impacts and can create positive impacts on our climate and natural environment. Technologies that support this objective span multiple domains: smart lighting systems, solar photovoltaic panels, rainwater harvesting units, HVAC systems with variable speed drives, and Building Information Modelling (BIM) for sustainable design planning (Kibert, 2016).

However, the definition of GBT lacks universal consensus. Cook (2008) described green technologies broadly as products or services that minimise resource

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consumption and pollution while creating economic value. Similarly, Haden and Oyler (2011) emphasised that GBT should be framed as part of an ongoing organisational innovation process, not merely technological installations. From a teleological standpoint, green building is seen as a means to reduce marginal external costs or negative ecological consequences (Ghisellini *et al*., 2016). In contrast, process theorists view GBT as spanning all stages of a building's lifecycle from design and procurement to construction, operation, and decommissioning (Ahn *et al*., 2013). Sang-Ho *et al*. (2015) extended this notion to include emerging technologies in information systems, construction automation, and digital networks, indicating a fusion of environmental and digital sustainability.

In recent studies, Ahmad et al. (2020) categorise GBT into seven broad groups: indoor lighting systems, environmental control systems, energy and water-saving innovations, renewable energy technologies, heat and resource recovery units, air quality enhancement systems, and comfort-oriented HVAC systems. These systems are instrumental not only in environmental sustainability but also in enhancing occupant satisfaction and operational cost reduction (Zuo *et al*., 2017).

Despite the breadth of definitions, certain themes are consistent across literature: (1) a goal of minimizing environmental loads and supporting sustainable development; (2) implementation across the lifecycle of the building; and (3) requirement for a multi-disciplinary, stakeholder-inclusive approach. In the context of this study, GBTS are defined as the collective suite of tools, strategies, and technologies employed during the building design phase to achieve the objectives of energy efficiency, reduced emissions, enhanced indoor air quality, and ecological balance.

Built Environment

The concept of the 'built environment' is used to explain the surroundings made for humans, by humans and to be used for humans (Rahman, *et.al* 2022). Deliberations on the built environment are closely associated with the concept of culture, one of the broadest terms to describe the human world. This term, by definition, contains the whole spiritual and material heritage of humanity, and thus everything that creates the built environment (Adeyemi, *et.al* 2024). The existence of a relationship between people and their surroundings is obvious, as confirmed in the definitions of culture. In the literature, especially in anthropological studies, it is repeatedly emphasised that human culture is composed of two types of artefacts: human behaviour and material culture (Jiaxuan, *et al*., 2025). Material culture includes items of material nature, that is, all kinds of artefacts, including elements of spatial planning.

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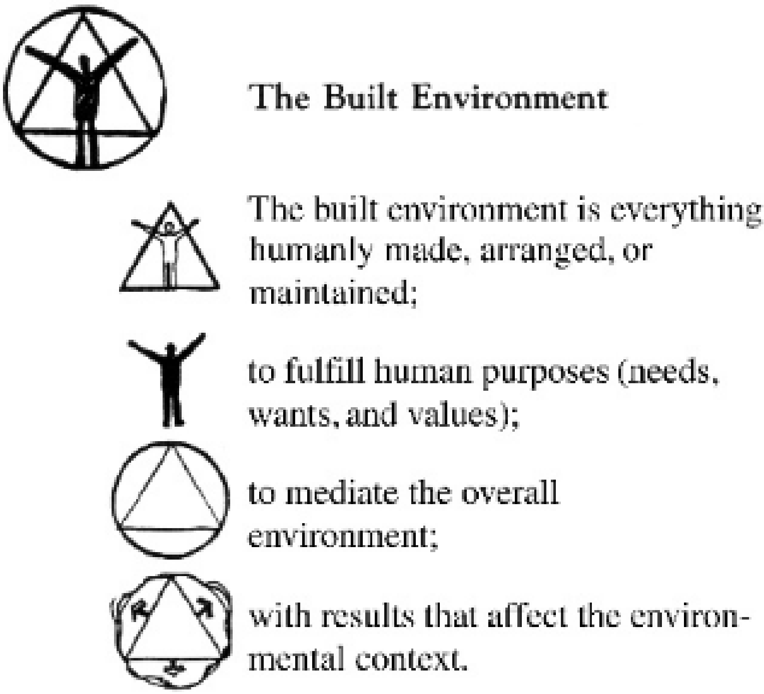

Figure 1: Definition of the built environment and its four related characteristics. Source: (Bartuska, 2020).

The illustration in Figure 1 is intended to help visualize and define the built environment by these four interrelated characteristics. This is because the triangle symbolizes the designed/built aspects of this definition. The features of the built environment and the importance of its components are decided by humans. Notwithstanding, the built environment has a significant impact on individuals and communities, influencing their quality of life, health, well-being, and overall sustainability. Factors such as architectural design, urban planning, accessibility, transportation options, and the availability of amenities and services all contribute to shaping the built environment. As such, understanding and designing the built environment thoughtfully and sustainably is essential for creating functional, healthy, and thriving communities.

Theoretical Underpinnings: The Theory of Planned Behaviour and GB Adoption

The Theory of Planned Behaviour (TPB) provides a robust framework for understanding the psychological and contextual factors that influence behavioural intentions, particularly in professional decision-making contexts (Ajzen, 1991). TPB posits that behaviour is driven by three core elements: attitudes toward the behaviour, subjective norms, and perceived behavioural control. In the context of GB, these translate to designers' belief in the effectiveness and necessity of green technology, perceived peer or organisational expectations, and the availability of skills or resources to implement the technology. Ajzen and Fishbein (2005) argue that behavioural intention is a strong predictor of actual behaviour, especially when the behaviour is under volitional control. For BEPs, the intention to adopt GB is influenced by both internal factors (e.g., belief in the environmental benefits) and external constraints (e.g., lack of management support or insufficient technical knowledge). Empirical studies have supported the utility of TPB in green technology contexts, finding that behavioural attitude, subjective norms, and perceived control significantly influence the adoption of sustainable design practices (Hwang & Ng, 2013; Chan *et al*., 2018,). The TPB also supports the integration of contextual variables, such as organisational culture, policy environment, and financial incentives, into the behavioural intention model. This is especially relevant in multi-stakeholder environments like architecture and construction, where Architects and Engineers operate within organisational hierarchies and must align with client expectations, regulatory demands, and engineering constraints.

Furthermore, TPB underscores the importance of knowledge and perceived capacity as key elements in enabling behaviour. For GB, this means that enhancing the BEPs' understanding of green systems and their confidence in using them can significantly boost adoption rates (Zhang *et al*., 2020). Thus, the TPB provides a conceptual lens through which to analyse the interplay between personal, organisational, and systemic factors affecting GB adoption

Knowledge Structure and Green Building Technology Systems (GB)

The Critical Role of Knowledge Dimension in Professional Practice

In the realm of green building systems, the breadth and depth of the BEPs' knowledge directly influence the quality, feasibility, and effectiveness of sustainable designs. A rich knowledge structure refers to the BEPs' familiarity with concepts, tools, materials, and performance metrics integral to GB implementation (Adamu & Daniel, 2022). Important domains include:

Building science fundamentals: Heat transfer, daylight analytics, and thermal mass (Onyebueke *et al*., 2021).

Systems understanding: Renewable energy systems (solar PV, thermal collectors), HVAC optimization, rainwater harvesting, greywater systems, and waste recycling (Uloh, 2020).

Lifecycle sustainability: Whole-Life Cost Analysis (LCCA), Environmental Product Declarations (EPDs), Building Information Modelling (BIM) for energy performance, and carbon footprint calculation (Onyekuru & Akachukwu, 2022).

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Regulatory and contextual awareness: Knowledge of building codes (e.g., often overlooked Nigerian standards), performance benchmarks, green ratings (GBCN/NIA/LEED), and international best practices (Ezeokoli *et al*., 2023).

Unlike the standardised system in more developed markets, green design education remains fragmented in Nigeria. University courses seldom integrate performance simulation, lifecycle assessment, or renewables-based case studies, limiting BEPs' practical capacity to propose GB solutions (Salami & Emeka, 2021). Additionally, CPD sessions offered by industry bodies remain sporadic and localised, meaning engagement depends largely on individual initiative.

Knowledge Gaps and Their Impact on Design Decisions

Scholars emphasise that knowledge deficits can lead to:

Over-reliance on conventional design: BEPs default to familiar methods, even when inefficient (Adamu & Daniel, 2022).

Misapplication of green variants: Without a holistic understanding, isolated measures like low-flow fixtures or LED lighting fail to deliver lifecycle performance.

Resistance to green innovation: Perceptions that GB are impractical or client-opposed become self-fulfilling barriers (Onyebueke *et al*., 2021).

Fragmented project integration: When knowledge is restricted to one discipline, opportunities for cross-functional synergy are missed (e.g., integrating daylight design with HVAC systems).

Field research indicates these patterns are widespread. For instance, a survey across Lagos architects (Salami & Emeka, 2021) found that while 78% had heard of passive cooling strategies, only 32% had applied them, often incorrectly. Similarly, life-cycle analysis is mentioned in passing by 90% of respondents, but fewer than 5% use LCCA during design.

Knowledge of GB Adoption

Consistent with the TPB framework, knowledge enhances positive attitude, perceived ease-of-use, and self-efficacy (Ajzen, 1991). Empirical studies reinforce this link:

Onyeleke & Igwe (2022): Using structural equation modelling (SEM), they found that designers' GB knowledge ($\beta = .47$, $p < .01$) significantly predicted their intention to specify green systems.

Adamu & Daniel (2022): Mixed-method interviews revealed that when BEPs had conducted performance simulations (e.g., for a net-zero concept), they were three times more likely to include renewables.

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Onyebueke *et al.* (2021): Highlighted case studies where the lack of IEC standards for efficient lighting led to GBTS failure, further discouraging designers.

GB Capability and Stakeholder Dynamics

The Collective Nature of GB Provision

Implementing GB is rarely a single-discipline effort. These initiatives require coordination among architects, mechanical/electrical engineers, contractors, suppliers, and asset managers (Onyema *et al*., 2020). The breadth of stakeholder involvement renders successful adoption contingent on team-wide expertise. Ghana's Green Building Council (2022) emphasises that even a high-performing architectural team may fail if contractors cannot adapt execution methods the right way. The same applies in Nigeria, where construction firms often lack both guidance and capacity to execute sustainable specifications.

Contractor and Supplier Dispositions

Several studies identify a stark lack of incentives for contractors to pursue green methods:

Financial disincentives: Limited profit margins mean green add-ons are viewed as non-core (Ibrahim & Musa, 2020).

Training gaps: Field-level contractors often miss out on technical upskilling related to new materials or mechanised installation (e.g., PV mounts, rainwater systems).

Supply chain limitations: GB materials are largely imported, inconsistent in availability, and often expensive due to FX volatility (Salami & Emeka, 2021).

As a result, planned GB solutions at design are frequently omitted or inadequately executed at construction. Interviews in Abuja-based firms confirm this: contractors often suggest removing costly features like solar systems, sealing installations with a standard building envelope, and compensating with enhanced HVAC demand.

Organisational Roles and Power Dynamics

Even when designers conceptualise GB, their capacity to enforce them depends on organisational hierarchy and culture:

Decision authority: Architects often serve advisory roles, with clients and senior engineers holding final say (Ibrahim & Musa, 2020).

Firm culture: Organisations that embed sustainability in mission statements, branding, and performance indicators tend to allocate more resources to GB (Onyema *et al*., 2020).

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Design liability: In firms where architects are held accountable for lifecycle performance, there's a stronger case for GB adoption (Uloh, 2020).

This matches global findings: Green-trained managers and design leaders significantly drive green project uptake (Chan *et al.*, 2018). The converse is also true. Without institutional backing, even motivated designers are unable to change entrenched practices.

Team Capability and Project Examples

Field surveys across Nigerian building projects indicate a strong correlation between team expertise and GB implementation: A study tracking 24 Lagos-wide building projects (Adamu & Daniel, 2022) showed that 80% of buildings with implemented GB had multidisciplinary teams with relevant training. Meanwhile, in Port Harcourt, contractor training from a local NGO led to a 30% increase in daylight-linked lighting control implementation (Onyema *et al.*, 2020). Conversely, Lagos pilots by university research labs failed when lead designers lacked operational understanding of planned solar-HVAC integration.

Management Support: The Organisational Backdrop

Management support plays a pivotal role in shaping the adoption of GB within design and construction firms. Leadership commitment often determines the allocation of resources, prioritisation of sustainability goals, and the cultivation of an enabling culture for innovation (Chan, Darko, Ameyaw, & Owusu-Manu, 2018).

Leadership Influence and Resource Allocation

Firm leaders who endorse green building initiatives typically ensure sufficient investment in training, procurement of sustainable materials, and deployment of necessary technologies (Zuo, Zhao, Zhao, & Ng, 2017). Without top-down endorsement, green design tends to remain marginal or superficial, relegated to token gestures or compliance rather than innovation. Studies in Nigerian contexts reveal that organisations with active management promoting sustainability had higher GB adoption rates (Onyema *et al.*, 2020). Conversely, where leadership is indifferent or views green building as costly, adoption stagnates (Ibrahim & Musa, 2020).

Training Culture and Continuous Professional Development

Management support extends to fostering a learning environment that encourages knowledge growth and technical skill enhancement. Firms that invest in Continuing Professional Development (CPD) for staff, including workshops on

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new GB, see greater confidence among professionals to integrate sustainable systems (Adamu & Daniel, 2022). This is vital because green building requires ongoing adaptation to emerging technologies and regulations.

Incentives and Performance Monitoring

Embedding sustainability targets in employee appraisal and incentive systems motivates BEPs and contractors to pursue green outcomes (Chan *et al*., 2018). For example, some Nigerian firms have started including green performance as a criterion in project evaluation, increasing accountability for GB implementation (Salami & Emeka, 2021). Performance monitoring through post-occupancy evaluation (POE) also reinforces management's commitment and feeds lessons back into the design process.

International Benchmarks and Best Practices

Nigeria can benefit from replicating management models from leading green building nations. For instance, in Singapore, regulatory mandates tied to management incentives have catalysed widespread GB integration (Tan & Ooi, 2019). Similarly, the US Green Building Council's LEED certification incentivises management by linking sustainability to market reputation and financial performance (U.S. Green Building Council, 2023).

Motivation: Internal and External Drivers

Motivation encapsulates the psychological and socio-economic factors driving BEPs' intentions to adopt GB. These factors interplay with attitudes, subjective norms, and perceived behavioural control within the Theory of Planned Behaviour framework (Ajzen, 1991).

Intrinsic Motivations: Professional Values and Environmental Ethics

Several studies highlight that BEPs with strong environmental ethics, personal commitment to sustainability, or passion for innovation are more likely to champion GB (Onyeleke & Igwe, 2022). Intrinsic motivation nurtures perseverance despite systemic barriers and enhances proactive learning.

Extrinsic Motivations: Client Demand and Regulatory Pressure

Clients increasingly seek green buildings due to rising awareness of health, energy savings, and prestige (Ezeokoli *et al*., 2023). BEPs respond to these market signals to remain competitive. Furthermore, governmental regulations and building

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codes, though currently weak in Nigeria, constitute important external motivators when enforced (Salami & Emeka, 2021).

Social Norms and Peer Influence

Professional networks and industry bodies such as the Nigerian Institute of Architects and the Green Building Council of Nigeria create social pressure that can normalise GB adoption. Peer recognition and the desire to maintain professional status motivate Architects to align with sustainable practices (Chan *et al*., 2018).

Economic Incentives and Cost-Benefit Perceptions

Economic benefits such as lifecycle cost savings, access to finance, and higher rental yields motivate to integration GBTS (Onyebueke *et al*., 2021). However, perceived high upfront costs often dampen enthusiasm, especially in a volatile Nigerian economy (Ibrahim & Musa, 2020).

Technical Barriers and Systemic Limitations

Despite growing awareness and motivation, multiple technical and systemic barriers constrain GB adoption.

Material Availability and Cost

Sustainable materials and advanced GB components are often imported, leading to high costs, delays, and quality inconsistencies (Salami & Emeka, 2021). Domestic manufacturing capacity remains underdeveloped.

Climate and Contextual Suitability

Many GB are designed for temperate climates and require adaptation to Nigeria's hot, humid conditions. Lack of local performance data and guidelines inhibits confidence in technology suitability (Uloh, 2020).

Infrastructure and Supply Chain Challenges

Unreliable power supply, poor logistics, and limited technical service providers disrupt GB installation and maintenance (Ibrahim & Musa, 2020).

Regulatory Gaps and Enforcement Weakness

Though Nigeria has standards (e.g., Nigerian Building Code), enforcement is lacking, and sustainability criteria are rarely mandated, limiting systemic drivers for GB adoption (Ezeokoli *et al*., 2023)

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Synthesis, Gaps, and Conceptual Framework Development

This literature review synthesises five critical factors influencing the adoption of GB in Nigerian building design: knowledge structure, team capability, management support, motivation, and technical barriers. Each factor aligns with the constructs of the Theory of Planned Behaviour, emphasising the roles of attitude, subjective norms, and perceived behavioural control in shaping behavioural intention. Identified gaps include limited empirical quantification of these factors in Nigerian contexts and scant exploration of how firm-level dynamics mediate individual professional decisions.

Conceptual Model

Based on the review, the conceptual model posits that:

Knowledge Structure and Team Capability positively influence Attitude and Perceived Behavioural Control, while Management Support strengthens Subjective Norms and enhances Perceived Behavioural Control by providing resources and institutional backing. Motivation (intrinsic and extrinsic) directly impacts Attitude and intention and Technical Barriers Negatively Moderate the Relationship between Intention and Actual GB Adoption.

METHODOLOGY

Data Collection

To examine the factors influencing architectural firms' willingness to adopt Green Building (GB) in Nigeria, we adapted a rigorous quantitative survey informed by both local and international precedents. Three key constructs: demographic characteristics of firms, team GB capability, management support, designer motivation, and technical barrier were operationalised based on prior empirical and theoretical work, including TPB and TOE frameworks (Islam *et al.*, 2024; Unegbu *et al.*, 2025).

Instrument Design and Description

The primary instrument for data collection in this study was a structured questionnaire designed to capture perceptions, awareness, and experiences of built environment professionals regarding green building adoption and implementation in Nigeria. The questionnaire comprised five sections:

Section A: Demographic Information (e.g., age, gender, education, professional discipline, years of experience, professional membership).

Section B: Awareness of Green Building Principles.

Section C: Sources of Information and Influence.

Section D: Adoption Factors (e.g., technical, institutional, financial, socio-cultural).
Section E: Critical Success Factors and Recommendations.

The response format for Sections B through E was based on a 5-point Likert scale, allowing respondents to indicate their level of agreement or importance, ranging as follows:

1 – Strongly Disagree / Not Important
2 – Disagree / Slightly Important
3 – Neutral / Moderately Important
4 – Agree / Important
5 – Strongly Agree / Very Important

This scaling system was chosen due to its reliability in attitudinal and behavioral studies, enabling clear measurement of respondents' perceptions and attitudes (Boone & Boone, 2012).

Population, Sampling Procedure and Data Collection Procedure

Between March and May 2025, 402 questionnaires were personally distributed at architecture buildings, contracting and construction firms and quantity surveying offices through WhatsApp platforms in Lagos and Abuja. Questionnaires were also administered using both physical distribution (hand-delivered to offices and project sites) and online platforms (Google Forms) to accommodate professionals who preferred digital responses. A total of 360 were returned (80% response rate). After eliminating incomplete responses, 312 valid questionnaires were retained for analysis (effective return rate = 76%).

Before administration, informed consent was obtained, and the confidentiality of respondents was assured. Participants were assured that data would be used strictly for academic purposes, and no identifying personal information was required.

To enhance the response rate and reduce non-response bias, reminders were sent periodically, and field assistants followed up with selected professionals during the physical distribution phase.

Validity and Reliability of the Instrument

Content and Face Validity

The initial draft of the questionnaire was subjected to expert review by three university professors and two industry practitioners with experience in sustainable construction and environmental design. Their feedback was used to refine the clarity, sequence, and relevance of questions to ensure content validity.

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Face validity was confirmed through a pilot test involving 20 professionals in Lagos, not included in the final sample. Feedback from the pilot test led to the rephrasing of ambiguous items and adjustment of response scale consistency.

Reliability Test

To assess the internal consistency of the instrument, Cronbach's Alpha reliability coefficients were computed using SPSS version 25.0. The results are summarised below:

Section B (Awareness): α = 0.84

Section C (Sources): α = 0.79

Section D (Adoption Factors): α = 0.86

Section E (Critical Factors): α = 0.88

These values exceed the commonly accepted threshold of 0.70, indicating high reliability (Nunnally & Bernstein, 1994).

RESULTS/ FINDINGS

Objective 1: Demographic characteristics of representatives of the selected firms

Table 1: Gender distribution

Gender	Count	Percent
Female	90	28.85%
Male	222	71.15%
Grand Total	**312**	**100.00%**

Source: Survey (2025)

The gender distribution presented in Table 1 reveals a significant male dominance within the built environment profession in Lagos, with 71.15% male and 28.85% female respondents.

Table 2: Education distribution

Education	Count	Percent
HND/ BSC	61	19.55%
M.Sc.	239	76.60%
PHD	12	3.85%
Grand Total	**312**	**100.00%**

Source: Survey (2025)

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Table 2 reveals that the majority of professionals in the built environment sector in Lagos possess a high level of academic qualification. Specifically, 76.60% of respondents hold a Master's degree, while 19.55% have an HND or B.Sc., and only a small proportion (3.85%) possess a PhD.

Objective 2: To Investigate the Relationship Between the Establishment Year of Firms and The Distribution of Working Experience Among Built Environment Professionals

Table 3: Type of firm distribution

Firm type	Count	Percent
Architectural	152	48.72%
Architectural, building consulting & contracting	38	12.18%
Architectural, building consulting & contracting, Engineering	20	6.41%
Architectural, building consulting & contracting, Quantity surveying	6	1.92%
Building consulting & contracting	48	15.38%
Engineering	48	15.38%
Grand Total	**312**	**100.00%**

Source: Survey (2025)

Table 3 highlights the types of firms represented in the study. Architectural firms constitute the largest share (48.72%), followed by building consulting & contracting firms (15.38%) and engineering firms (15.38%).

Table 4: Distribution of working experience with firm

Years of working experience with firm	Count	Percent
1-5 years	69	22.12%
6-10 years	125	40.06%
11- 15 years	61	19.55%
16 years+	57	18.27%
Grand Total	**312**	**100.00%**

Source: Survey (2025)

The data in Table 4 highlights the duration of respondents' professional engagement with their current firms. The largest group (40.06%) has worked with their firm for 6–10 years, followed by 22.12% (1–5 years), 19.55% (11–15 years), and 18.27% with over 16 years of tenure.

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Table 5: Establishment year distribution

Establishment year	Count	Percent
2000	97	30.99%
2016	33	10.63%
2013	28	9.00%
2018	24	7.74%
2012	19	6.11%
2021	16	5.17%
2009	14	4.49%
2006	11	3.53%
1967	11	3.46%
2005	9	2.90%
2015	9	2.88%
2017	8	2.58%
1998	7	2.25%
1960	7	2.23%
2011	7	2.19%
2010	6	1.93%
2014	6	1.93%
Grand Total	**312**	**100.00%**

Source: Survey (2025)

Table 5 illustrates the distribution of firms' establishment years, revealing that a significant portion (30.99%) of firms were founded in the year 2000. This is followed by firms established in 2016 (10.63%), 2013 (9.00%), and 2018 (7.74%).

Table 6: Distribution of designations in the firm

Designation in your Firm	Count	Percent
Architect	195	62.50%
Architect, project manager	36	11.54%
Builder	14	4.49%
Engineer	29	9.29%
project manager	38	12.18%
Grand Total	**312**	**100.00%**

Source: Survey (2025)

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Table 6 reveals that architects represent the majority of respondents (62.50%), followed by project managers (12.18%), those holding both architectural and project management roles (11.54%), engineers (9.29%), and builders (4.49%).

Table 7: Crosstabulation of firm type and size of green building projects

Firm type	No of green building projects involved in					
	1	2	3	4	5	6
Architectural	14	14	118	0	5	0
Architectural, building consulting & contracting	0	0	27	4	0	0
Architectural, building consulting & contracting, Engineering	0	10	10	0	0	0
Architectural, building consulting & contracting, Quantity surveying	0	6	0	0	0	0
Building consulting & contracting	4	7	26	0	0	11
Engineering	0	0	48	0	0	0

Source: Survey (2025)

Table 7 presents a crosstabulation of firm types and the number of green building projects they had been involved in. This provided valuable insight into both the breadth and intensity of green building adoption across different segments of the built environment sector in Lagos, Nigeria.

Objective 3: Critical Factors Influencing the Adoption of Green Building

Table 8: Critical factors affecting green building projects

Question	Mean rating
Lack of skill for its adoption.	4.03
Lack of awareness	4.07
Lack of firm support	4.00
Lack of know-how knowledge	4.01
Cumbersomeness of its processes	3.68
Lack of support of government policies.	4.18
Present methods used in the building industry does not support it.	3.67
Fragmented nature of the building industry	3.88
Building industry stakeholders believes it is not in their culture to reduce carbon emission.	3.18
Nature of the building industry does not encourage innovation adoption.	3.45
Client cannot afford cost of its adoption.	3.40
Difficulty in finding and paying expert that can implement it.	3.71

Source: Survey (2025)

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Table 8 identifies the most critical barriers to green building adoption, as perceived by industry professionals. Rated on a 5-point Likert scale, the results reflect strong agreement on systemic, institutional, and technical limitations that hinder the widespread implementation of sustainable building practices in Nigeria. The top five barriers, all with mean ratings ≥ 4.00, are: Lack of support of government policies (M = 4.18), Lack of awareness (M = 4.07), Lack of skill for its adoption (M = 4.03), Lack of know-how knowledge (M = 4.01), Lack of firm support (M = 4.00).

Table 9: KMO Test

Measures	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.844
Bartlett's Test of Sphericity (Chi-Square)	3654.47
Degree of freedom	66
P-value	0.000

Source: Survey (2025)

Table 9 presents the results of the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity, both of which are preliminary diagnostics used to determine the appropriateness of applying exploratory factor analysis (EFA) to a dataset. The results were as follows:

i. KMO Measure of Sampling Adequacy = 0.844
ii. Bartlett's Test of Sphericity: Chi-square = 3654.47, df = 66, $p < 0.001$

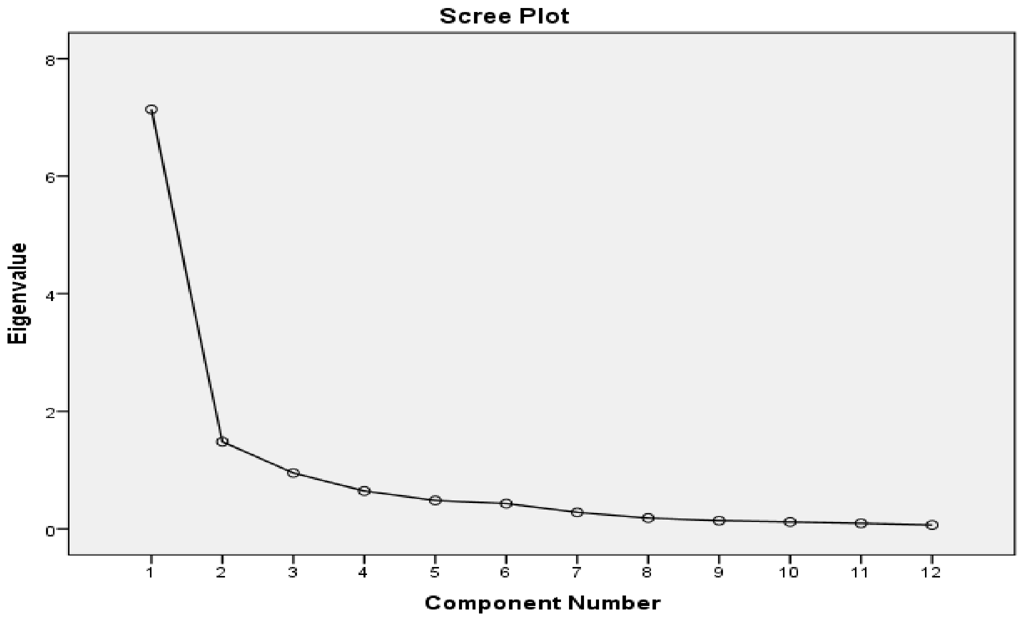

Figure 2: Scree Plot
Source: Survey (2025)

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Table 10: Rotated factor loadings

Question	Factor	
	1	2
Lack of skill for its adoption	0.771	0.308
Lack of Awareness	0.911	
Lack of Firms' Support	0.843	0.310
Lack of Know how knowledge	0.846	0.217
Cumbersomeness of its processes	0.513	0.591
Lack of support of government policies	0.813	0.324
Present methods used in the building industry does not support it	0.457	0.761
Fragmented nature of the Building Industry	0.732	0.512
Building Industry stakeholders believe it's not in their culture to reduce carbon emission	0.379	0.534
Nature of the building industry does not encourage innovation adoption	0.369	0.768
Clients can't afford cost of its implementation		0.770
Difficulty in finding and paying expert implementation	0.357	0.823

Source: Survey (2025)

Table 10 shows the rotated factor loadings of barriers to green building adoption, with items grouped based on correlation strength into two distinct factors.

DISCUSSION

Gender Distribution (Table 1)

This study revealed that 71.15% of the respondents are male and 28.85% female, highlighting a marked gender imbalance in Lagos's built environment sector. This aligns with broader patterns in Nigeria: national statistics show women constitute only 2.4% of registered architects and 3.5% of quantity surveyors, compared to their male counterparts (Female Education in Nigeria, 2025). Chiwuzie & Oloukoi (2024) noted socio-cultural norms, masculine workplace cultures, and limited mentoring as drivers of women's underrepresentation in the built environment. Furthermore, research into females' involvement in Nigerian construction highlights structural and attitudinal barriers: long working hours, a male-dominated field, family responsibilities, and pervasive stereotyping discourage women from pursuing or sustaining these careers. These dynamics likely contributed to your observed gender distribution.

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The implications for green building adoption are significant. Literature suggests that gender-diverse project teams often perform better in innovation-oriented tasks (Darko & Chan, 2017; Onyeleke & Igwe, 2022). Lagos's low female representation may constrain the diversity of thought in green building design and implementation. Encouraging greater gender balance through targeted mentorship, flexible work models, and equitable organisational policies could strengthen green project outcomes.

Educational Qualifications (Table 2)

The data shows a highly educated respondent pool: 76.6% hold Master's degrees, 19.6% have BSc/HND, and only 3.85% hold PhDs. This elevated academic profile compares favorably with global professional norms (Ojelabi *et al*., 2024; Jung et al, 2024). Nigerian studies indicate that postgraduate-level built environment professionals often exhibit stronger awareness of sustainability principles and the capability to implement innovative practices (Ojelabi *et al*., 2024; Damu & Daniel, 2022). Despite advanced qualifications, green building adoption remains low. This suggests systemic issues exist beyond education, such as inadequate policy frameworks, cost disincentives, limited firm support, and cultural resistance, aligned with barriers cited in your factor analysis. Onalele *et al*. (2020) argue that technical knowledge alone is insufficient; supportive institutional environments are also critical. The high educational attainment, then, represents an underutilised asset that could be leveraged via continuing professional development and firm-level incentives.

Experience with Current Firms (Table 4)

Distribution of tenure shows 22.1% with 1–5 years, 40.1% with 6–10 years, 19.6% with 11–15 years, and 18.3% over 16 years. This reflects a moderately experienced workforce. Studies from southwest Nigeria show professional familiarity with construction norms correlates positively with green awareness, but professional inertia and risk-aversion often inhibit innovation (Awareness of Green Building Prerequisite, 2020). Experienced staff may resist departing from conventional methods unless motivated by external incentives (Chan *et al.,* 2018). Mid-career professionals (6–10 years) in your sample may thus represent key champions for green adoption if supported with targeted training and leadership roles.

Firm Characteristics and Age (Tables 3 and 5)

Almost half (48.7%) of the sample represents architectural-only firms, with smaller proportions in multidisciplinary configurations. Company founding year data show

31.0% have been operating since 2000, and others span 1960–2021. Younger firms (established after 2015) may inherently adopt more modern approaches, including green building, while older, established firms risk becoming complacent and locked into traditional business models (Wang *et al.*, 2018; Chan *et al.*, 2018). There's limited local research correlating firm age with green engagement. However, Tan & Ooi's (2019) Singaporean study suggests that younger firms benefit from dynamic cultures that more easily adopt innovation. In Lagos, newer firms can leverage green credentials for competitive advantage, especially in high-end or upscale markets where sustainable certification is valued. The data in the survey provides fertile ground for exploring these dynamics through regression or qualitative follow-up.

Designations within Firms (Table 6)

Respondents were primarily architects (62.5%), with project managers (12–11%), engineers (9.3%), and builders (4.5%). The dominance of architects indicates that design decisions and, by extension, green building direction are largely shaped at the conceptual stage. Onyeleke & Igwe (2022) emphasise the influence of architectural leadership and firm culture in green-building adoption. If architects within these firm's champion sustainability, implementation becomes more feasible. Conversely, project managers and engineers (20% combined) are essential in technical adoption. Strengthening cross-disciplinary collaboration is thus vital: Nguyen *et al.* (2020) found that sustainable innovation thrives when technical and managerial staff participate jointly (Jung *et al*, 2024).

Participation in Green Building Projects (Table 7)

The crosstabulation reveals that architectural-only firms were involved in up to 3 projects, with a few reaching 5. Engineering firms rarely exceeded 3 projects, while building consulting & contracting firms achieved up to 6. This suggests that multidisciplinary firms may facilitate more extensive green engagement by integrating design, consulting, and construction expertise, supporting the concept of integrated project delivery (IPD) praised in literature (Shiotani *et al.*, 2024; Wang *et al.*, 2018). This aligns with global evidence: integrated and collaborative firm models more consistently deliver certified green buildings (Chan *et al.*, 2018; Zuo *et al.*, 2017). It also resonates with your factor loadings: "fragmented industry" (0.732 factor 1) and "lack of firm support" (0.843) were major barriers. Encouraging multidisciplinary collaboration within firms might reduce those barriers and accelerate adoption.

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Critical Barriers to Adoption (Tables 9–10)

Top perceived barriers include:

- Lack of government policy support (M=4.18),
- Lack of awareness (4.07),
- Lack of skills (4.03),
- Lack of know-how (4.01),
- Lack of firm support (4.00).

These findings echo Nigerian literature: Omoniyi & Adeniyi. (2021), Ibrahim & Musa (2020), Shiotani *et al.* (2024) point to weak policy environments, limited awareness, and inadequate incentive structures as key inhibitors. Ashen et al.'s study in Abuja (2024) identified similar trends, particularly limited awareness and upfront costs. The strong loadings of awareness, skills, and firm support underline the need for capacity-building initiatives, while weak government backing emphasises policy reform.

The two-factor EFA result groups barriers into: Factor 1 (awareness, skills, firm/government support, fragmentation) and Factor 2 (industry culture, process complexity, affordability). Factor 1's prominence suggests systemic institutional issues must be addressed first to enable Factor 2 (behavioural and cost-based challenges).

Theoretical Anchors: TPB & Stern

The findings reflect Ajzen's Theory of Planned Behaviour (1991): perceived behavioural control (skills, awareness), subjective norms (industry support), and attitudes (culture, values) shape intentions towards green adoption. Similarly, Stern's Value Belief Norm theory emphasises awareness as a precursor to pro-environmental action (Hamann *et al.* 2024). Enhancing awareness and perceived control via policy, training, and organisational backing would thus likely support pro-sustainability behaviours.

In summary, this analysis highlights how firm and individual characteristics in Lagos, gender, education, experience, firm age, type, and internal structure interact with broader barriers to shape green building adoption. High professional qualifications and experience represent potential for leadership, but systemic barriers persist. Firm type and collaborative organisational models appear promising in driving green projects. Gender underrepresentation and a lack of enabling policy and awareness remain serious constraints. Future phases will offer targeted recommendations on how to leverage training, policy, firm structure, and gender equity to foster sustainable built environment practices in Lagos.

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RECOMMENDATIONS

Based on the analysis of firm characteristics and the critical factors influencing green building adoption in Lagos, Nigeria, several actionable recommendations can be proposed. These recommendations target the main stakeholders, policy-makers, professional bodies, educational institutions, and construction firms, to foster the successful adoption and implementation of sustainable building practices.

Strengthening Policy and Government Support

The most critical barrier identified in the study was the lack of supportive government policies (M = 4.18). A well-established legal and institutional framework is essential for mainstreaming green building practices.

Recommendation: The Nigerian government, through the Federal Ministry of Works and Housing and in alignment with the Climate Change Act (2021), should develop a National Green Building Policy that mandates minimum green standards for all new public construction projects.

Example: In Singapore, Tan & Ooi (2019) report that green building compliance was significantly improved following the introduction of mandatory BCA Green Mark certifications.

Local Action: Lagos State Urban and Physical Planning Authority (LASUPPA) should be empowered to enforce these policies through regulatory audits, permits, and incentives.

Enhancing Awareness and Technical Capacity

The study identified lack of awareness, lack of skill, and lack of know-how as top barriers, all with mean ratings above 4.00. This points to gaps in both formal education and professional training.

Recommendation: Professional bodies such as the Nigerian Institute of Architects (NIA), Nigerian Institute of Builders (NIOB), and Green Building Council Nigeria (GBCN) should partner with institutions like COREN and ARCON to integrate green building certification and continuous professional development (CPD) into licensing and re-licensing criteria.

Supporting Research: Damu & Daniel (2022) emphasized the pivotal role CPD plays in increasing competency among professionals in Nigeria's built environment.

Example: The United States Green Building Council's (USGBC) LEED accreditation system offers a model for structured, scalable education (USGBC, 2023).

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Encouraging Multidisciplinary Firm Structures

Data from the study shows that firms involved in architectural, consulting, and engineering services were better engaged in green building projects compared to single-discipline firms.

Recommendation: Construction firms should be encouraged to adopt Integrated Project Delivery (IPD) frameworks to enhance collaboration across disciplines.

Literature Support: Poorisat *et al.* (2024) and Shiotani *et al.* (2024) found that collaboration between architects, engineers, and contractors is crucial for effective green building delivery.

Practical Step: Built environment associations can organise inter-professional symposia and encourage shared project bidding as a method to stimulate multi-disciplinary partnerships.

Financing and Economic Incentives

Respondents highlighted the inability of clients to afford green solutions as a key challenge (M = 3.40). Financing and economic incentives can reduce the upfront cost burden.

Recommendation: Government and private sector institutions should create green financing mechanisms, including low-interest loans, tax holidays, or import duty waivers for certified green materials and technologies.

Evidence: Ogunba *et al.* (2021) discussed financing constraints as a primary challenge to green building growth in Nigeria and proposed a public-private partnership funding model.

Model Example: Kenya's Green Bond Program and South Africa's Energy Efficiency Tax Incentives could serve as benchmarks for Nigeria.

Promoting Gender Inclusion and Diversity

With only 28.85% female representation among respondents, the gender imbalance remains a barrier to inclusive innovation and equity.

Recommendation: Industry associations and firms should adopt gender mainstreaming strategies such as mentorship schemes, scholarships for women in STEM and architecture, and gender quotas in leadership roles.

Research Insight: Onyeleke & Igwe (2022) suggest that increasing women's representation can introduce fresh perspectives, foster innovation, and improve sustainability performance.

Example: The African Union's Gender Policy Framework offers a template for empowering women in traditionally male-dominated sectors.

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Improving Communication of Green Value

Despite high education levels, the gap between knowledge and implementation suggests a disconnect between green value and their communication to clients.

Recommendation: Develop and disseminate case studies, simulation tools, and performance benchmarks that demonstrate the economic, health, and environmental benefits of green buildings.

Supporting Study: Shiotani *et al.* (2024) argue that tangible demonstrations of lifecycle savings and indoor health advantages can boost client buy-in.

Platform: This content can be shared via GBCN's website, trade expos, and digital platforms targeting real estate investors and homeowners.

Adopting Locally Appropriate Green Standards

Several respondents noted that current building methods and industry culture do not support green adoption. A cut-and-paste approach of importing foreign green standards has been criticised.

Recommendation: Develop context-specific green guidelines using local materials, climatic data, and cultural considerations.

Insight: Uloh (2020) and Eze *et al.* 2025) emphasised that tropical conditions in Nigeria require a different set of thermal performance benchmarks and culturally relevant building aesthetics.

Action Plan: Universities, research institutions, and GBCN should work collaboratively to draft localised sustainability standards.

CONCLUSION

The urgent call for sustainable development in the built environment has intensified the need to examine how green building practices are adopted, particularly in developing countries like Nigeria. This study focused on identifying the critical success factors (CSFs) that affect the adoption and implementation of green buildings by built environment professionals in Lagos. It examined the professionals' awareness, attitudes, and firm characteristics, as well as the structural and institutional barriers that hinder adoption. The findings, based on the analysis of 312 valid responses from professionals across multiple disciplines, architecture, engineering, building consulting, contracting, and quantity surveying, shed light on the multifaceted nature of the challenges facing the green building movement in Lagos. One of the key takeaways from the research is that the lack of support from government policies (mean = 4.18) emerged as the most significant CSF, suggesting a critical need for regulatory frameworks and incentive structures. This aligns with previous studies (Oluwatobi *et al.*, 2021; Adegbile &

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Adebayo, 2022) that affirm the catalytic role of government in setting the pace for innovation diffusion in construction. Without enabling laws and supportive regulations, professionals lack the confidence and structure to adopt new technologies, especially when these involve initial capital investment and extensive re-training.

Similarly, lack of awareness (mean = 4.07) and lack of skills (mean = 4.03) among professionals present significant barriers. These findings are in line with empirical literature which highlights that one of the leading barriers to green building adoption in emerging economies is the knowledge gap among practitioners (Darko & Chan, 2016; Adebayo *et al.*, 2020). When professionals do not have adequate knowledge of green technologies, material selection, or sustainable design practices, the likelihood of adoption diminishes substantially.

Furthermore, the lack of know-how (mean = 4.01) and firm-level support (mean = 4.00) underscore the internal organizational challenges to adoption. Most firms in the study (nearly 58%) have fewer than 10 employees, revealing that a significant proportion are small-to-medium-sized enterprises (SMEs). This corresponds with other research suggesting that SMEs are typically resource-constrained and therefore less likely to invest in unfamiliar, innovation-driven construction practices without external support or perceived return on investment (Agyekum *et al.*, 2018).

The fragmented nature of the building industry (mean = 3.88) also reflects an institutional barrier. The separation between design, consultancy, and implementation phases weakens collaboration and information sharing, thereby stalling innovation. This is further compounded by cultural issues, as evidenced by the moderate mean score (3.18) related to stakeholders' beliefs that reducing carbon emissions is not part of their cultural orientation. This aligns with the Value-Belief-Norm (VBN) theory, which argues that personal values and cultural norms influence pro-environmental behaviour (Hamann *et al*. 2024).

Economic constraints also play a significant role. Respondents cited the cost of hiring experts (mean = 3.71) and clients' inability to afford green building costs (mean = 3.40) as major issues. This resonates with findings from similar African contexts where green building is perceived as costly and unaffordable without visible short-term returns (Amusan *et al.*, 2022). Thus, while the long-term operational savings and health benefits of green buildings are well-documented, clients and firms continue to focus on the higher upfront cost, which limits adoption.

Process-related issues, such as the cumbersome nature of green building procedures (mean = 3.68) and unsupportive existing construction methods (mean

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= 3.67), further indicate that the industry is not yet technically and logistically ready for a full-scale transition to sustainable practices. This supports the findings of scholars like Hwang & Tan (2012), who emphasised the importance of aligning construction processes with sustainable development goals.

The role of firm type and size also cannot be overstated. While architectural firms formed the largest share of respondents (48.7%), the cross-disciplinary nature of green building necessitates collaboration across engineering, surveying, and construction disciplines. However, such collaboration appears limited due to firm specialisation and small size, over 58% of respondents worked in firms with fewer than 10 employees, which may not have the technical capacity or incentive to innovate.

Overall, the study's findings validate the applicability of the Theory of Planned Behaviour (TPB) and the Value-Belief-Norm (VBN) theories in understanding the behavioural and organisational dimensions of green building adoption. Attitudes toward green building, perceived behavioural control (skills, cost, and policy environment), and subjective norms (professional expectations and client demand) all interplay in shaping the decisions of built environment professionals.

In light of these findings, it becomes evident that the road to mainstreaming green building practices in Nigeria, especially in urban hubs like Lagos, must be multifaceted and inclusive. There must be a concerted effort by government bodies, private organisations, academic institutions, and professional associations to work together toward common sustainability goals. Public policies must be re-engineered to provide tax incentives, training programs, and enforceable green codes. Education and awareness campaigns must be tailored for different firm sizes and professional groups. Clients need to be sensitized to the long-term economic and health benefits of green buildings, while professionals must embrace a lifelong learning approach that includes green certifications and continuous development.

Moreover, the construction industry must undergo a structural shift that promotes integrated project delivery (IPD) models, where stakeholders collaborate from project inception to completion, fostering shared goals and sustainable outcomes. Research and development should also be prioritised to produce cost-effective, locally sourced green materials and technologies that can reduce dependency on imported products.

In conclusion, the study has provided empirical evidence that green building adoption in Lagos is constrained by a complex interplay of knowledge, policy, economic, cultural, and organisational factors. However, these constraints are not insurmountable. By addressing the critical success factors identified in this study

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through collaborative and well-informed strategies, Lagos and, by extension, Nigeria, can accelerate the transition toward a more sustainable, environmentally responsible built environment. Future research should explore longitudinal data and include policy implementation case studies to track progress and refine strategies for greater impact.

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