**Bridging the Green Gap: Barriers to sustainable residential construction in Nigeria**

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**Abstract**

This chapter investigates the pivotal role of sustainable residential construction in reducing environmental impacts, promoting economic viability, and contributing to societal well-being. The authors extensively explore the importance of sustainable residential construction in Nigeria, considering its rapid urbanisation, housing deficits, and the necessity for sustainable building techniques. Additionally, the chapter identifies barriers to sustainable residential construction in Nigeria, employing theoretical frameworks like Institutional Theory, Diffusion of Innovation Theory, Stakeholder Theory, and Resource Dependence Theory. Strategies to overcome the identified barriers are also highlighted in this study. Ultimately, the chapter concludes by advocating for a paradigm shift towards long-term sustainability, emphasising collaboration, innovation, and education to ensure Nigeria's role as a prominent advocate for sustainable construction practices.

**Keywords:** Sustainability; Construction Industry; Residential Buildings; LEED; BREAM

# Introduction

Sustainability within residential building construction involves creating structures while integrating ecologically conscious methodologies and resource-efficient practices that endure throughout the building's lifespan (Khan and McNally, 2023). This approach encompasses the utilisation of renewable resources, employing recyclable materials, minimising waste generation, and optimising energy consumption. Moreover, it emphasises crafting designs that not only meet immediate housing needs, but also mitigate long-term environmental impacts by considering ecological footprints and sustainable life cycles (Blackburne, Gharehbaghi and Hosseinian-Far, 2021). It is critical to stress the issue of sustainability in house building, which includes environmental preservation, social well-being, and economic viability (Purvis, Mao, and Robinson, 2019). In this context, sustainability involves utilisation of environmentally friendly practices and materials, adoption of renewable resources, incorporation of recyclable materials, reduction of waste production, and optimisation of energy use. This approach seeks to create building designs that not only satisfy immediate housing requirements but also consider the enduring impact on the environment, aiming for reduced ecological footprints and sustainable life cycles.

Refined Global (2023) and Geng et al., (2019) outline the benefits and approaches of sustainable construction. They explained that sustainable construction saves energy, lowers waste, improves interior air quality, increases occupant comfort, and contributes to environmental conservation. Sustainable construction can also significantly lower operational costs by reducing energy bills, water, and waste disposal costs. Energy efficient buildings are also known to have higher market values, as they are often in high demand due to their lower maintenance costs and positive environmental impact. Gatley (2019) worked on the necessity of sustainable construction, and emphasised how sustainable building approaches are consistent with the concepts of environmental stewardship, economic efficiency, and social responsibility. Thus, residential building projects can reduce their environmental impact and contribute to community well-being by combining sustainable design, energy-efficient technologies, renewable energy sources, and efficient resource management. In their research, Hafez et al., (2023) highlighted the importance of sustainability in construction, and discussed how sustainability improves natural resource conservation, reduces pollution and carbon emissions, increases resilience to climate change, and promotes occupant well-being. Sustainable construction approaches contribute to the establishment of better living environments, higher quality of life, and long-term economic benefits through lower running costs and increased productivity.

# Sustainable Residential Construction Alignment to the UN Sustainable Development Goals

Sustainable Development Goals (SDGs) serve as a global framework aimed at addressing pressing environmental, social, and economic challenges (Leal Filho, 2019). When applied to sustainable residential construction projects, these goals provide a comprehensive roadmap guiding the integration of environmentally responsible practices, social inclusivity, and economic viability within the construction sector (Ogunmakinde, Egbelakin, and Sher, 2022). SDGs such as Goal 11, focusing on sustainable cities and communities, directly align with residential construction initiatives by emphasising the need for affordable, resilient, and sustainable housing solutions. By integrating green building principles and energy-efficient designs, these projects also demonstrate alignment with Goals 7 (Affordable and Clean Energy) and 13 (Climate Action), reducing carbon emissions and enhancing energy efficiency in buildings. Furthermore, SDGs such as Goal 12 (Responsible Consumption and Production) underline the importance of minimising waste generation and promoting sustainable resource use in construction materials and processes. Sustainable residential projects that employ recycled materials, prioritise local sourcing and implement efficient waste management practices align with this goal, and in effect support responsible consumption within the construction industry. These initiatives often address social aspects highlighted in SDG 1 (No Poverty) and SDG 10 (Reduced Inequalities) by providing access to affordable, decent housing to marginalised communities, contributing to poverty alleviation and promoting social equity within urban and rural areas (Fei et al., 2021). Overall, sustainable residential construction projects require a multifaceted approach that advances environmental conservation, social well-being, and economic progress in communities.

# International Sustainability Benchmarks and Standards

International benchmarks and standards play a pivotal role in guiding and evaluating sustainable construction practices worldwide. They provide enterprises with criteria and frameworks to analyse and improve their sustainability performance. These benchmarks and standards aid in establishment of consistent criteria for measuring sustainability, the promotion of best practices, and the facilitation of comparisons across industries and geographies. According to the World Economic Forum (2023), Sustainability Standards help investors, regulators, and other stakeholders to make informed decisions and drive positive change.

International benchmarks and standards give firms defined criteria and frameworks to ensure consistency and alignment with globally acknowledged sustainability principles (Goulden et al., 2017). Sustainability benchmarks and standards also serve as performance improvement tools by suggesting areas for improvement. Adherence to accepted sustainability benchmarks and standards improves a company's credibility and reputation. Compliance shows a dedication to sustainability and responsible practices, which can have a good impact on stakeholders, customers, investors, and the public. It contributes to the development of trust and confidence in the organisation's statements about sustainability (Ivic, Saviolidis, and Johannsdottir, 2021; Rogmans and El-Jisr, 2022). It can also give firms a competitive advantage by distinguishing them from their competitors. On the other hand, non-compliance with these standards might result in firms losing prospective business contracts, collaborations, or funding possibilities that require strict sustainability standards to be met.

Among the most recognised certifications are Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM), both established to assess and promote environmentally friendly building practices (Marchi, Antonini, and Politi, 2021). They provide guidelines and benchmarks that promote environmentally responsible building design, construction, and operation, encouraging the adoption of sustainable strategies to minimise environmental impact and enhance overall building performance.

LEED, developed by the U.S. Green Building Council (USGBC), is widely acknowledged as a global benchmark for green building certification. It evaluates various aspects of building sustainability, including energy efficiency, water conservation, materials selection, indoor environmental quality, and innovation in design. LEED certification operates on a point-based system, awarding different levels of certification (Certified, Silver, Gold, Platinum) based on the total points earned through compliance with stringent environmental criteria (USGBC, 2023). LEED’s criteria are as following (Flowers et al., 2020):

1. Location and Transportation: LEED for Homes promotes environmentally friendly site selection and transportation solutions. This category considers characteristics such as closeness to public transportation, access to community services, bicycle and pedestrian infrastructure, and site construction to reduce environmental disturbance.
2. Sustainable Sites: The Sustainable Sites category focuses on minimising the environmental impact of the residential project. It evaluates strategies such as stormwater management, water-efficient landscaping, natural habitat preservation, and light pollution reduction.
3. Energy and the Environment: Energy and the Environment category seeks to increase energy efficiency and reduce greenhouse gas emissions. It assesses factors such as energy-efficient building design, high-performance insulation, efficient HVAC systems, the utilisation of renewable energy sources, and energy usage monitoring.
4. Materials and Resources: This area promotes sustainable material selection, waste reduction, and recycling. It includes requirements for selecting ecologically friendly products, encouraging recycling and waste management during building, and lowering the environmental effect of material transportation.

BREEAM, originated in the United Kingdom by the Building Research Establishment (BRE), is another leading assessment method for sustainable buildings (Cole, 2020). Similar to LEED, BREEAM evaluates buildings across multiple categories such as energy, water, materials, waste, pollution, management, and health and wellbeing. It assesses a building's sustainability performance and awards ratings ranging from Pass, Good, Very Good, Excellent, to Outstanding. While BREEAM has earned international acclaim, it is vital to critically examine its rules and criteria in order to appreciate its strengths and limits:

1. Management: It assesses the effectiveness of building management practices, policies, and procedures in promoting sustainability throughout the building's lifecycle. It evaluates the implementation of sustainable management strategies, including monitoring, documentation, and continual improvement processes (BRE Group, 2021b). However, it has limited direct impact on physical building performance and heavily relies on documentation and less on actual sustainable outcomes.
2. Health and Wellbeing: It focuses on aspects that impact occupants' health and comfort within the building environment. It assesses factors like indoor air quality, lighting, acoustic performance, thermal comfort, and ergonomic design to enhance the overall wellbeing and productivity of building occupants (Sartori et al., 2021). Nevertheless, it is still challenging to objectively quantify the impacts on health.
3. Energy: It evaluates the building's energy consumption, efficiency, and utilisation of renewable energy sources. It emphasises reducing energy demand, optimising energy performance, and promoting the use of renewable energy to minimise environmental impact and operational costs (Abb, 2021). It has limited emphasis on actual renewable energy generation, though. Additionally, it might not sufficiently account for specific regional energy challenges.
4. Transport: Transport category evaluates sustainable transportation options and infrastructure provision to reduce the environmental impact of commuting and transportation associated with the building. It encourages accessibility to public transport, cycling facilities, and car-sharing schemes to minimise reliance on individual vehicular transport. Even so, its focus is primarily on access rather than reducing overall transportation impact resulting in a limited influence on transportation habits.
5. Water: Water assesses water consumption, efficiency, and management strategies within the building. It promotes water conservation, efficient use of water resources, and sustainable water management practices to reduce wastage and preserve water resources. There is also a disadvantage of insufficient focus on the lifecycle impact of water use.
6. Materials: This category emphasises the selection of sustainable, low-impact materials and addresses the environmental impact associated with construction materials. It encourages the use of environmentally friendly materials, reduction of embodied carbon, and considers the entire lifecycle of materials (BRE Group, 2021a). It might still favour certification schemes without addressing regional material availability and might overlook overall lifecycle impact.
7. Waste: It evaluates the management of waste generated during the construction and operation phases. It encourages waste reduction strategies, recycling initiatives, and responsible waste management practices to minimise waste sent to landfills. Although, it focuses more on operational waste rather than addressing construction phase waste and might not fully incentivise waste reduction, as well.
8. Land Use and Ecology: This category assesses the building's impact on land use and biodiversity. It promotes ecologically responsible practices, ecological protection of valuable land, and measures to enhance biodiversity. It is, however, susceptible to using biodiversity metrics. Besides, it might not adequately address long-term ecological impacts.

These internationally recognised benchmarks and standards, such as LEED and BREEAM, serve as comprehensive frameworks for evaluating and certifying sustainable construction practices globally. Moreover, these certifications not only validate a project's commitment to sustainability but also contribute to creating healthier, more efficient, and environmentally friendly buildings worldwide.

# Importance of Sustainable Residential Construction in Nigeria

Sustainable construction in Nigeria holds significant importance as the country faces rapid urbanisation and increasing housing demands. With over 200 million people and a population growth rate of about 2.6% annually, Nigeria is projected to become the world's third-most populous nation by 2050 (Abubakar and Aina, 2019). Accompanying this growth is a mounting need for adequate and sustainable housing, as the United Nations estimates a current housing deficit of about 22 million units (Moore, 2019). Moreover, urbanisation rates are expected to escalate, with over 60% of Nigeria's population projected to reside in urban areas by 2050 according to Avis (2019). This urban expansion places immense pressure on infrastructure and housing, requiring a strategic shift towards sustainable construction practices to address the escalating demand for housing while minimising environmental impact. Ogungbile and Oke (2018) talked about sustainable building techniques in West African countries. Although not limited to residential construction, their study emphasises the relevance of sustainability in encouraging economic development, alleviating poverty, and addressing environmental issues. It emphasises the importance of sustainable construction approaches in improving the durability of buildings and infrastructure, increasing resource efficiency, and creating better living conditions.

Furthermore, sustainable construction in Nigeria is pivotal for environmental preservation and resource efficiency. The construction operations and materials accounts for a substantial portion of global energy consumption and greenhouse gas emissions. Embracing sustainable building practices, such as utilising locally sourced materials, implementing energy-efficient designs, and adopting renewable energy sources, can mitigate these impacts and enhance the quality of life and well-being of the occupants (Weniger et al., 2023). Previously, Abigo et al. (2012) investigated the incorporation of sustainable facilities management into public building management in Nigeria. The study emphasises the necessity of implementing sustainable practices in facility management to reduce environmental impact, energy consumption, and operational efficiency. The findings highlight the importance of effective legislation, capacity-building initiatives, and stakeholder participation in embedding sustainable facility management practices in Nigeria's public building sector.

By embracing such measures, the construction sector has the potential to significantly reduce energy consumption and greenhouse gas emissions, contributing to Nigeria's commitment to the Paris Agreement on climate change mitigation. Additionally, sustainable construction fosters job creation and economic growth, providing employment opportunities and promoting a resilient and sustainable built environment for Nigeria's future development.

# Strategies and Approaches toward Sustainable Residential Constructions

Nebrida and Gomba (2023), investigated the strategies and advantages of sustainable construction. According to the article, sustainable construction practices include energy-efficient designs, the use of environmentally friendly materials, the utilisation of renewable energy sources, efficient waste management, and water conservation measures. Less energy usage, lower operating expenses, greater occupant health and productivity, and less environmental impact are among the benefits. Generally, various strategies and approaches are employed in sustainable residential construction to enhance environmental performance, optimise resource use, and improve the overall quality of housing. One prominent strategy involves the utilisation of passive design techniques (Lechner, 2014). For instance, in Nigeria's warm climate, incorporating passive cooling measures such as shading, natural ventilation, and building orientation can significantly reduce reliance on mechanical cooling systems, thereby minimising energy consumption. Another example is the integration of green building materials (Adeniyi, Mohamed, and Rasak, 2020). Builders in Nigeria increasingly employ eco-friendly materials like bamboo, stabilised earth blocks, and recycled materials to construct sustainable homes. These materials not only reduce environmental impact by using renewable resources but also contribute to energy efficiency and lower carbon footprints in residential structures.

Additionally, the implementation of innovative technologies plays a pivotal role in sustainable residential construction. For instance, the integration of solar photovoltaic systems or solar water heaters into housing projects helps harness renewable energy sources, reducing dependence on traditional energy grids and promoting energy self-sufficiency (Mohammed et al., 2017). Furthermore, the adoption of smart home technologies allows for better energy management through automated systems that regulate heating, lighting, and water usage, optimising resource utilisation and enhancing overall sustainability in residential buildings (Aliero et al., 2021). Integrating such strategies and approaches not only advances the environmental performance of residential constructions but also improves living conditions while aligning with sustainable development objectives.

# Theoretical Perspectives toward Barriers of Sustainable Residential Construction

Several theoretical frameworks can be used to analyse the barriers of sustainable residential construction. One suitable theory often applied in this context is the "Institutional Theory". The Institutional Theory delves into how institutions, which encompass rules, norms, and cultural aspects, influence behaviours, practices, and decision-making processes within organisations or industries (Chan, 2018). When applied to sustainable residential construction, this theory examines how institutional pressures, regulations, norms, and practices impact the adoption and implementation of sustainable building practices. It scrutinises the barriers that stem from institutional structures, including regulations, policies, market conditions, and cultural norms, hindering the widespread uptake of sustainable construction practices (Rodriguez, Katooziani, and Jeelani, 2023). This theory helps identify and understand how factors like regulatory constraints, lack of supportive policies, inadequate market incentives, traditional construction practices, and cultural norms may impede the integration of sustainable elements in residential construction.

Another theoretical perspective is “Diffusion of Innovation Theory” that explores how new ideas, technologies, or practices spread within a social system (Oyuga, Gwaya, and Njuguna, 2023). It examines the barriers to the adoption of sustainable construction practices, focusing on factors influencing the diffusion process, such as perceived benefits, complexity, compatibility, and communication channels. Additionally, “Resource Dependence Theory” highlights how organisations' reliance on external resources, such as materials, funding, or expertise, influences their behaviours and decision-making. It investigates barriers related to limited availability of sustainable materials, financial constraints, or lack of access to specialised knowledge and skills needed for sustainable construction (Cao, Li and Wang, 2017). Furthermore, ‘Stakeholder Theory’ focuses on understanding the interests, relationships, and influences of various stakeholders involved in sustainable residential construction projects. Herazo and Lizarralde (2016) explored barriers stemming from conflicting stakeholder interests, divergent priorities, and power dynamics among stakeholders involved in decision-making processes.

Each of these theories provides a distinct lens for analysing barriers to sustainable residential construction, offering insights into the complexities and challenges involved in adopting and implementing sustainable practices within the construction industry.

# Barriers to Sustainability in Nigerian Residential Construction Projects

As mentioned, embracing sustainable practices in residential construction particularly in Nigeria is pivotal not only for minimising environmental impact but also for ensuring the long-term viability and comfort of housing structures. However, the journey towards sustainable residential construction is not without its challenges in Nigeria. This segment explores the multifaceted barriers and complexities hindering the seamless integration of sustainable principles within the Nigerian construction landscape. By delving into these barriers, this discussion aims to unveil the intricacies and obstacles obstructing the widespread adoption of sustainable methodologies in residential construction. Examining these hurdles through theoretical lenses such as Institutional Theory, Diffusion of Innovation Theory, Stakeholder Theory, and Resource Dependence Theory alongside considering international sustainability benchmarks and standards will provide insights into the underlying factors impeding the realisation of sustainable residential construction practices in Nigeria.

Several studies, have meticulously examined the hurdles undermining sustainable construction practices in the Nigerian building industry, pointing out prevalent challenges such as lack of awareness, inadequate legal frameworks, financial constraints, resistance to change, and scarcity of sustainable materials and technology. Omopariola et al. (2022) addressed impediments to and strategies for sustainable construction in the Nigerian construction industry. Lack of awareness, poor legal frameworks, low financial resources, aversion to change, and a focus on short-term goals are among the hurdles identified in the study. Osuizugbo et al. (2020) investigated the impediments to the implementation of sustainable building practices. Lack of awareness and understanding, high starting prices, limited availability of sustainable materials and technologies, inadequate policies and regulations, and resistance to change are all identified as challenges in the study. To overcome these barriers and promote sustainable construction methods, the authors highlighted the need for capacity building, revised legislation and regulations, financial incentives, and public awareness campaigns. The paper provided significant insights into the hurdles to sustainability in Nigerian residential construction projects. Commonly mentioned challenges include a lack of awareness and understanding, high starting prices, a scarcity of sustainable materials and technology, insufficient legislation and regulations, opposition to change, and financial constraints (Daniel, Oshineye, and Oshodi, 2018,). Poor knowledge, poor perception and awareness, and a lack of law and government support for sustainable building practice, are also some of the difficulties to the use of sustainable construction practices in Nigeria according to Akindele et al (2023) and Davies and Davies (2017). These researchers identified other challenges including lack of incentives for designers to enable sustainable design, a lack of knowledge about the benefits of lifecycle costing, as well. Such impediments make it difficult to develop and execute sustainable practices in the Nigerian building industry.

While the “diffusion of innovations” theory highlights the need for a clear understanding of the benefits and advantages of new practices; the situation in Nigeria presents distinct challenges. Stakeholders, including architects, engineers, contractors, and project managers, often lack comprehensive knowledge and awareness of sustainable construction practices, their benefits, and their application. This lack of understanding inhibits the diffusion of sustainable construction practices throughout the industry. Accordingly, Eze, et al (2023) investigated the barriers to the adoption of sustainable building materials (SBM) in the construction industry of Nigeria as a developing country and identified Lack of awareness and knowledge on SBM among the stakeholders, such as clients, contractors, consultants, suppliers, and end-users as the major issue. This barrier affects the demand, supply, and use of SBM in the market. Also, high cost and low availability of SBM compared to conventional building materials.

The Institutional Theory, on the other hand, emphasises on the importance of institutional frameworks in shaping practices where a closer examination reveals specific, tangible factors hindering sustainable construction efforts. Research by Ogunsanya et al. (2022) identified 46 policy-related roadblocks in Nigeria, highlighting a complex landscape of challenges. These roadblocks encompass a lack of government support and funding for sustainable projects, insufficient incentives for designers to prioritise eco-friendly practices, and a widespread lack of awareness about the benefits and practicalities of sustainable construction. Furthermore, the absence of robust legislation and knowledge sharing mechanisms exacerbates the issue, creating a system that actively impedes progress towards greener building practices. Building on the same theoretical framework, Olagunju (2015) explored the elements impacting residential building standards maintenance in Nigeria. The report mentions important causes such as a lack of an acceptable maintenance culture, insufficient government laws and regulations, a lack of funding choices, and the use of poor materials. The findings underline the importance of improved maintenance practices, government initiatives, and stakeholder collaborations in residential building projects to increase sustainability. Prior to these two research papers, Jimoh, Odeniyi and Jibrin (2013) investigated and appraised the idea of housing sustainability in Nigeria. Inadequate planning, a lack of effective policies, poor building quality, and limited access to funding are identified as challenges to attaining housing sustainability in the study. To promote sustainable housing development in Nigeria, the findings advocate for better urban planning, sustainable building norms, stakeholder participation, and finance systems.

Both LEED for Homes and BREEAM stress the use of environmentally friendly materials in residential construction projects. This emphasis on sustainable materials is critical since it reduces environmental impact, encourages local sourcing, and reduces transportation-related emissions. The United States Green Building Council (USGBC) has guidelines that encourage the use of ecologically friendly and locally sourced materials. One such rule is that projects use materials that were extracted, harvested, or recovered within 500 miles of the project location (USGBC, 2020). This policy encourages the use of local materials, which not only benefits the local economy but also minimises the emissions and energy consumption involved with long-distance shipping. Furthermore, it pushes builders to investigate local alternatives, which can help to preserve traditional construction methods, cultural heritage, and local ecosystems. In this regard, Akadiri (2015) examined the hurdles to the use such sustainable materials in Nigeria’s construction projects. The study cites several challenges, including a lack of awareness and understanding, high beginning prices, a scarcity of sustainable materials, resistance to change, and a lack of client demand. These impediments prevent the widespread use of sustainable materials in residential construction projects. To address these limitations, the findings underline the importance of improved awareness, training, and cost-effective solutions.

The fact that Nigeria's construction industry often relies on imported materials and technology brings about some other issues. The dependence on these external resources, coupled with limited local production of sustainable materials or technology, poses challenges in integrating sustainable elements into residential construction projects. Davies and Davies (2017) investigated the impediments to implementing sustainable construction practices. The report underlined the scarcity of sustainable materials as a major impediment to sustainable construction in Nigeria. It suggests that a lack of sustainable resources encourages builders to rely on conventional materials, which may have negative environmental consequences. Furthermore, Aghimien et al. (2018) investigated the issues of sustainable construction, with a particular emphasis on educational facilities in Nigeria. The study identified a significant concern as the scarcity of sustainable materials. It emphasises that access to a diverse variety of sustainable materials essential for sustainable construction practices is frequently problematic for builders. This scarcity has an impact on the selection and application of sustainable materials, impeding the fulfilment of sustainable goals in building projects. All these findings correspond closely to the essence of Resource Dependence Theory. In addition, this theory emphasises on the importance of expertise and skills. In Nigeria, there is a shortage of skilled professionals with expertise in sustainable construction practices. The lack of trained workforce capable of implementing sustainable methodologies contributes to the slow adoption of eco-friendly building techniques.

Keeping the focus on educational deficiencies, Zuofa and Ochieng (2016) investigated sustainability in Nigerian construction project delivery. According to the report, project managers' lack of knowledge and understanding of sustainable practices poses a barrier to incorporating sustainability into building projects. The findings stressed the importance of expanding education and training programs to improve project managers' grasp of sustainability principles, practices, and advantages because this information gap makes it difficult to apply sustainable building methods effectively.

LEED for Homes also includes provisions for cost-effective solutions in sustainable residential construction projects. These parameters are intended to ensure that sustainability goals are both attainable and financially viable. LEED for Homes establishes a minimum energy performance requirement that requires projects to achieve 15% greater energy efficiency than the local energy code (USGBC, 2020). This requirement gives greater flexibility in implementing cost-effective energy-efficiency solutions. Adopting energy-efficient building envelope designs, deploying energy-efficient appliances and systems, applying effective insulation measures, and optimising HVAC systems are some of these tactics developers can meet the energy performance criterion without incurring considerable additional costs by using these solutions. However, as Ekpo (2019) pointed out, despite these provisions, developers in Nigeria frequently struggle to achieve these cost-related requirements. This could be due to a variety of issues, including a lack of affordable sustainable materials and technology, a lack of knowledge about cost-effective solutions, and financial constraints. To overcome these barriers, parties such as government agencies, financial institutions, and industry groups must work together to provide assistance, financial incentives, and access to cost-effective solutions.

Similarly, BREEAM contains criteria for promoting cost-effective solutions in sustainable residential development. BREEAM, for example, requires projects to meet an energy performance requirement that is 25% higher than the local energy code (BRE Group, 2022). This requirement supports the use of energy-efficient designs, systems, and technologies to achieve improved energy performance while taking economic feasibility into account. Nevertheless, in Nigeria, cost considerations are a key impediment to complying with such criteria. Onososen, Osanyin, and Adeyemo (2019) analysed the motivations and constraints to the development of green buildings in Nigeria. According to the survey, one of the major impediments to implementing sustainable construction methods is cost-related considerations. Then, financial constraints and the perception of increased expenses act as barriers to embracing sustainable methodologies.

Collaboration between public and private sectors is one the crucial drivers of sustainable initiatives. The private sector often possesses advanced technical know-how, innovation capabilities, and financial resources crucial for implementing sustainable construction practices. Simultaneously, the public sector holds regulatory powers, access to public funds, and a broader societal perspective. Collaboration allows the sharing of resources, knowledge, and expertise, thereby fostering innovation and efficient allocation of resources towards sustainable construction endeavours. Joint efforts by both sectors can stimulate market demand for sustainable materials, technologies, and construction practices. By advocating for sustainability and demonstrating successful implementations, public-private collaborations influence consumer preferences, thereby creating a more robust market for sustainable construction products and services. Whereas in Nigeria, insufficient collaboration between governmental bodies, regulatory agencies, and private entities in formulating and implementing sustainable construction policies and initiatives hinders progress (Mohammad and Juhar, 2019).

Resistance from traditional actors in Nigeria's construction sector poses a significant impediment to the adoption and implementation of sustainable residential construction practices. These entrenched actors, rooted in long-standing conventional methods and cultural norms, often prioritise cost-effectiveness and immediate construction techniques over sustainable approaches. Their resistance to change stems from a lack of familiarity with sustainable methodologies, scepticism about their feasibility, and concerns regarding potential higher initial costs (Ojo, Oladinrin, and Obi, 2021; Chan et al., 2022). This resistance hampers the integration of eco-friendly materials, innovative technologies, and sustainable construction techniques in residential projects. Moreover, the prevailing reliance on traditional practices perpetuates a cycle that inhibits the progression towards environmentally conscious and sustainable building methods, ultimately impeding the widespread embrace of sustainable residential construction in Nigeria.

LEED for Homes, paralleling the USGBC's approach, fosters an environmental culture by encouraging active resident participation in sustainable endeavours through educational resources (Hamilton, 2021). In a similar vein, BREEAM underscores the importance of stakeholder education and awareness-raising within construction projects (Leal Filho et al., 2019). By advocating for the provision of instructional materials to residents, BREEAM aligns with the broader aim of nurturing a sustainable culture and ensuring occupants recognise and adopt the environmentally friendly aspects of their residences (USGBC, 2020). These educational measures facilitate the dissemination of information, encourage sustainable behaviour among occupants, and contribute to identifying potential knowledge gaps and cultural barriers obstructing the implementation of sustainable methods in residential construction projects (BRE Group, 2022). This educational aspect serves to bridge the gap between sustainable building design and practical implementation, enabling tenants to make informed decisions and engage in actions aligning with sustainability objectives. Nonetheless, Nigeria faces substantial challenges in implementing sustainable building principles, predominantly due to limited educational support and entrenched cultural traditions that hinder the widespread adoption of sustainable practices (Toriola-Coker et al., 2021). Additionally, Moshood et al., (2020) while focusing on ICT sustainability in Nigerian construction projects realised that one of the major difficulties is a lack of education and awareness. It underlined that a lack of knowledge and awareness of sustainable materials and techniques among stakeholders such as architects, engineers, and contractors is impeding the mainstream adoption of sustainable construction. Inadequate awareness of the benefits and significance of sustainable materials limits their application in construction projects.

In a recent assessment by Ogundeji (2023), Yohana Izam, the president of the Nigerian Institute of Building and Vice Chancellor of Plateau State University, highlighted critical issues surrounding the construction industry in Nigeria, particularly concerning building collapses. Izam pointed out several causal factors behind these incidents, including the absence of a comprehensive national building code, inadequate materials, poor design practices, and unprofessional procedures prevailing within the construction sector. He stressed the urgent need for more stringent regulatory frameworks and standards to regulate the construction process and urban development practices. Izam also emphasised the pivotal role of professional builders in instilling production management knowledge and promoting principles that uphold building integrity.

The tragic incident of Lekki Gardens building collapse in Lagos, Nigeria, in 2016 is regretfully a real example demonstrating such requirement (Guardian, 2016). The collapse, which resulted in several fatalities and injuries, was attributed to poor construction practices and regulatory oversight. Investigations revealed inadequate building materials, non-compliance with safety standards, and a lack of proper regulatory control. This incident underscores the critical need for robust building regulations and professional oversight in construction projects to prevent such catastrophic occurrences. It further emphasises the urgency for a paradigm shift towards promoting building integrity and the establishment of stringent frameworks that prioritise safety and professionalism in the construction industry.

Advocating for a fundamental shift in perspective, Izam proposed transitioning the focus from addressing 'collapse' scenarios to embracing 'integrity' as the guiding principle in construction projects. Accordingly, the necessity for the establishment of robust frameworks and legislation that would effectively control the construction process while also identifying and reinforcing the responsibilities of professionals involved in project execution is deemed imperative. Additionally, creative building control mechanisms that would further solidify the accountability of all stakeholders is required. Izam expressed their optimism regarding the Institute's commitment to enhancing the capabilities of its members, driving forward the professionalization of Nigeria's construction industry, and playing a leading role in advocating for necessary reforms within the sector.

Putting on the stakeholder theory lens suggests that differing priorities among stakeholders within Nigeria's sustainable residential construction sector pose a substantial challenge to the widespread adoption of environmentally conscious building practices. Architects, engineers, contractors, developers, and end-users often harbour disparate objectives and preferences, creating divergent priorities that impact the implementation of sustainable construction (Oke, Abiola-Ogedengbe, and Akinseli, 2020). For instance, while some stakeholders prioritise cost-effectiveness and swift project completion, others emphasize long-term environmental impact and energy efficiency. These conflicting priorities lead to challenges in achieving consensus on incorporating sustainable elements into construction projects. Architects and engineers aiming for innovative designs may face resistance from developers and contractors concerned primarily with minimizing costs, leading to compromises that may compromise the integration of sustainable features. Moreover, the end-users' preferences and demands, often influenced by limited awareness or cultural norms, might not align with sustainable design principles, further complicating the adoption of eco-friendly residential construction practices.

Consequently, this misalignment of priorities leads to a lack of cohesive vision and strategy for sustainable residential construction in Nigeria. The absence of a unified approach impedes progress toward holistic and environmentally friendly housing solutions. It creates hurdles in the execution of projects that strike a balance between meeting stakeholders' varied requirements and implementing sustainable building practices effectively (Ofori, 2023). Achieving convergence among stakeholders' priorities is essential to overcoming these challenges and fostering a harmonized approach that integrates sustainability into residential construction projects without compromising functionality, affordability, or project timelines.

What we have explored throughout this chapter in terms of the barriers are summarised in table below:

To overcome these barriers and promote sustainable residential construction in Nigeria, several strategies can be implemented:

* Raising awareness and educating stakeholders: Providing training programs, workshops, and educational materials to increase knowledge and understanding of sustainable construction practices.
* Strengthening the policy and regulatory framework: Developing supportive government policies, regulations, and incentives to encourage the adoption of sustainable building methods.
* Promoting research and development: Investing in research and development of affordable, readily available sustainable materials and technologies.
* Encouraging collaboration and partnerships: Fostering collaboration between public and private sectors, financial institutions, and industry groups to share resources, knowledge, and expertise.
* Engaging and empowering residents: Providing occupants with educational materials and resources to understand and actively participate in sustainable practices within their homes.
* Addressing stakeholder priorities: Finding common ground and aligning stakeholder objectives by emphasising the long-term benefits and cost-effectiveness of sustainable construction.

**Table 1- Summary of Identified Barriers to Sustainable Residential Constructions in Nigeria**

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| **Barrier** | **Description** | **Underpinning Theory** | **Source** |
| Inappropriate Vision, Policies and Procedures | The absence of comprehensive national building codes, coupled with inadequate regulations for sustainable construction | Institutional Theory | Ogunsanya et al. (2022); Onososen et al. (2019); Mohammad and Juhar (2019); Jimoh, Odeniyi, and Jibrin (2013) |
| Cultural Mismatch | Cultural norms and traditional building practices that prioritise cost-effectiveness and immediate construction methods over long-term sustainability. | Institutional Theory | Olagunju (2015); Leal Filho et al. (2019); Hamilton (2021) |
| Resistance to Change | Hesitance to transition from conventional building practices to more sustainable and eco-friendly approaches due to various reasons, including perceived higher costs or unfamiliarity with sustainable techniques. | Institutional Theory | Ojo, Oladinrin, and Obi (2021); Chan et al. (2022) |
| Lack of Stakeholders’ Contribution | Absence or limited involvement of various parties such as architects, engineers, contractors, developers, end users, etc. in promoting or implementing environmental conscious building practices. | Stakeholder Theory | Eze et al. (2023); Mohammad and Juhar (2019); Toriola-Coker et al. (2021); Moshood et al. (2020) |
| Changing and Differing Stakeholders’ Priorities | Conflict of objectives, preferences and expectations due to varying skillsets, time constraints, risk appetite. | Stakeholder Theory | Ogundeji (2023); Oke, Abiola-Ogedengbe, and Akinseli (2020); Ofori (2023) |
| Limited Knowledge and Awareness | knowledge gap and awareness asymmetry among stakeholders, including architects, engineers, contractors, and project managers, regarding sustainable construction practices, techniques, and materials. | Diffusion of Innovation Theory | Eze et al. (2023); Zuofa and Ochieng (2016); Ekpo (2019); Onososen et al. (2019); Moshood et al. (2020) |
| Sustainable Resources’ Availability and Affordability | Limited access and cost-prohibitive nature of eco-friendly materials, technologies and expertise needed for sustainable building practices | Resource Dependency Theory | Eze et al. (2023); Akadiri (2015); Davies and Davies (2017); Aghimien et al. (2018) |

**Conclusion**

In conclusion, the journey towards sustainable residential construction in Nigeria presents a multifaceted challenge demanding a proactive and comprehensive approach. While the potential benefits, including environmental preservation, improved quality of life, and economic advancement, are undeniable, numerous barriers hinder widespread adoption. These hurdles cover a broad range from limited awareness and understanding to financial limitations.

All in all, embracing sustainable residential construction in Nigeria requires a shift in mindset, prioritising long-term benefits over immediate gains. By fostering collaboration, innovation, and education, Nigeria can overcome the challenges and establish itself as a reliable player in sustainable building practices, ensuring a healthier environment, improved quality of life, and a more sustainable future for its citizens. The path towards sustainable residential construction in Nigeria is complex but not impossible. By addressing the existing barriers and capitalising on the available opportunities, the country can pave the way for a future where environmentally conscious housing solutions become the norm, empowering both the present and future generations to live and thrive in harmony with nature.

**References**

Abigo, A., Madgwick, D., Gidado, K. and Okonji, S., 2012. Embedding sustainable facilities management in the management of public buildings in Nigeria. Proceedings of EPPM.

Abubakar, I.R. and Aina, Y.A., 2019. The prospects and challenges of developing more inclusive, safe, resilient and sustainable cities in Nigeria. Land Use Policy, 87, p.104105.

Adeniyi, S.M., Mohamed, S.F. and Rasak, K.O., 2020. Socio-economic benefits of using green materials for the construction of low-cost buildings in Nigeria. American Academic Scientific Research Journal for Engineering, Technology, and Sciences, 67(1), pp.99-108.

Aghimien, D.O., Adegbembo, T.F., Aghimien, E.I. and Awodele, O.A., 2018. Challenges of sustainable construction: a study of educational buildings in Nigeria. International Journal of Built Environment and Sustainability, 5(1).

Akadiri, P.O., 2015. Understanding barriers affecting the selection of sustainable materials in building projects. Journal of Building Engineering, 4, pp.86-93.

Akindele, O.E., Ajayi, S., Toriola-Coker, L., Oyegoke, A.S., Alaka, H. and Zulu, S.L., 2023. Sustainable construction practice in Nigeria: barriers and strategies for improvement. Built Environment Project and Asset Management.

Aliero, M.S., Qureshi, K.N., Pasha, M.F. and Jeon, G., 2021. Smart Home Energy Management Systems in Internet of Things networks for green cities demands and services. Environmental Technology & Innovation, 22, p.101443.

Avis, W. (2019). Urban Expansion in Nigeria. K4D Helpdesk Report 692. Brighton, UK: Institute of Development Studies.

Blackburne, L., Gharehbaghi, K. and Hosseinian-Far, A., 2021. The knock-on effects of green buildings: High-rise construction design implications. International Journal of Structural Integrity, 13(1), pp.57-77.

BRE Group (2021a) Management. Available online at: <https://files.bregroup.com/breeam/technicalmanuals/sd/international-new-construction-version-6/content/04_management/management.htm?tocpath=Management%7C_____0>

Cao, D., Li, H. and Wang, G., 2017. Impacts of building information modeling (BIM) implementation on design and construction performance: A resource dependence theory perspective. Frontiers of Engineering Management, 4(1), pp.20-34.

Chan, P., 2018. Change and continuity: What can construction tell us about institutional theory?. Societies under construction: geographies, sociologies and histories of building, pp.151-184.

Chan, D.W., Olawumi, T.O., Saka, A.B. and Ekundayo, D., 2022. Comparative analysis of the barriers to smart sustainable practices adoption in the construction industry between Hong Kong and Nigeria. International Journal of Construction Management, pp.1-11.

Cole, R.J., 2020. Rating systems for sustainability. Sustainable Built Environments, pp.573-588.

Daniel, E.I., Oshineye, O. and Oshodi, O., 2018, September. Barriers to sustainable construction practice in Nigeria. In Proceeding of the 34th Annual ARCOM Conference (pp. 3-5). Belfast: Association of Researchers in Construction Management.

Davies, O.O.A. and Davies, I.E.E., 2017. Barriers to implementation of sustainable construction techniques. MAYFEB Journal of Environmental Science, 2.

Ekpo, A., 2019. Housing deficit in Nigeria: Issues, challenges and prospects. Economic and Financial Review, 57(4), p.13.

Eze, E.C., Sofolahan, O. and Omoboye, O.G. (2023), "Assessment of barriers to the adoption of sustainable building materials (SBM) in the construction industry of a developing country", Frontiers in Engineering and Built Environment, Vol. 3 No. 3, pp. 153-166.

Fei, W., Opoku, A., Agyekum, K., Oppon, J.A., Ahmed, V., Chen, C. and Lok, K.L., 2021. The critical role of the construction industry in achieving the sustainable development goals (SDGs): Delivering projects for the common good. Sustainability, 13(16), p.9112.

Flowers, M.E., Matisoff, D.C. and Noonan, D.S., 2020. In the LEED: racing to the top in environmental self‐regulation. Business Strategy and the Environment, 29(6), pp.2842-2856.

Geng, Y., Ji, W., Wang, Z., Lin, B. and Zhu, Y., 2019. A review of operating performance in green buildings: Energy use, indoor environmental quality and occupant satisfaction. Energy and Buildings, 183, pp.500-514.

Goulden, S., Erell, E., Garb, Y. and Pearlmutter, D., 2017. Green building standards as socio-technical actors in municipal environmental policy. Building Research & Information, 45(4), pp.414-425.

Guardian (2016). Construction company blamed after Lagos building collapse kills 34. Available online at: <https://www.theguardian.com/world/2016/mar/10/construction-company-blamed-after-lagos-building-collapse-kills-34>

Hafez, F.S., Sa'di, B., Safa-Gamal, M., Taufiq-Yap, Y.H., Alrifaey, M., Seyedmahmoudian, M., Stojcevski, A., Horan, B. and Mekhilef, S., 2023. Energy efficiency in sustainable buildings: a systematic review with taxonomy, challenges, motivations, methodological aspects, recommendations, and pathways for future research. Energy Strategy Reviews, 45, p.101013.

Hamilton, E.M., 2021. Green building, green behavior? An analysis of building characteristics that support environmentally responsible behaviors. Environment and Behavior, 53(4), pp.409-450.

Herazo, B. and Lizarralde, G., 2016. Understanding stakeholders’ approaches to sustainability in building projects. Sustainable Cities and Society, 26, pp.240-254.

Ivic, A., Saviolidis, N.M. and Johannsdottir, L., 2021. Drivers of sustainability practices and contributions to sustainable development evident in sustainability reports of European mining companies. Discover Sustainability, 2, pp.1-20.

Jimoh, R.A., Odeniyi, V.A. and Jibrin, I.A.M., 2013. Housing sustainability in Nigeria: a mirage or reality. Covenant Journal of Research in the Built Environment.

Khan, M. and McNally, C., 2023. A holistic review on the contribution of civil engineers for driving sustainable concrete construction in the built environment. Developments in the Built Environment, p.100273.

Leal Filho, W., Tripathi, S.K., Andrade Guerra, J.B.S.O.D., Giné-Garriga, R., Orlovic Lovren, V. and Willats, J., 2019. Using the sustainable development goals towards a better understanding of sustainability challenges. International Journal of Sustainable Development & World Ecology, 26(2), pp.179-190.

Lechner, N., 2014. Heating, cooling, lighting: Sustainable design methods for architects. John wiley & sons.

Marchi, L., Antonini, E. and Politi, S., 2021. Green building rating systems (GBRSs). Encyclopedia, 1(4), pp.998-1009.

Muhammad, Z. and Johar, F., 2019. Critical success factors of public–private partnership projects: a comparative analysis of the housing sector between Malaysia and Nigeria. International Journal of Construction Management, 19(3), pp.257-269.

Mohammed, Y.S., Mustafa, M.W., Bashir, N. and Ibrahem, I.S., 2017. Existing and recommended renewable and sustainable energy development in Nigeria based on autonomous energy and microgrid technologies. Renewable and Sustainable Energy Reviews, 75, pp.820-838.

Moore, E.A., 2019. Addressing housing deficit in Nigeria: Issues, challenges and prospects. Economic and financial review, 57(4), p.15.

Moshood, T.D., Nawanir, G., Sorooshian, S., Mahmud, F. and Adeleke, A.Q., 2020. Barriers and benefits of ICT adoption in the Nigerian construction industry. A comprehensive literature review. Applied System Innovation, 3(4), p.46.

Nebrida, J. and Gomba, F.E., 2023. Sustainable construction strategies for building construction projects in the Kingdom of Bahrain: a model. Sustainable Engineering and Innovation, 5(1), pp.31-47.

Ofori, G., 2023. Get Construction Project Performance Parameters Right to Attain Sustainable Development Goals. Sustainability, 15(18), p.13360.

Ogundeji, J. (2023). Lack of national building code regulation scandalous – NIOB President. Punch Newspapers. Available online at: <https://punchng.com/lack-of-national-building-code-scandalous-niob-president>

Ogungbile, A.J. and Oke, A.E., 2018. Sustainable construction practices in West African countries. In Energy sustainability in built and urban environments (pp. 3-15). Singapore: Springer Singapore.

Ogunmakinde, O.E., Egbelakin, T. and Sher, W., 2022. Contributions of the circular economy to the UN sustainable development goals through sustainable construction. Resources, Conservation and Recycling, 178, p.106023.

Ogunsanya, O.A., Aigbavboa, C.O., Thwala, D.W. and Edwards, D.J., 2022. Barriers to sustainable procurement in the Nigerian construction industry: an exploratory factor analysis. International Journal of Construction Management, 22(5), pp.861-872.

Ojo, L.D., Oladinrin, O.T. and Obi, L., 2021. Critical barriers to environmental management system implementation in the Nigerian construction industry. Environmental Management, 68(2), pp.147-159.

Oke, A.E., Abiola-Ogedengbe, D. and Akinseli, A., 2020. Assessment on the influence of stakeholders on sustainable building construction in Ondo state, Nigeria. In The Construction Industry in the Fourth Industrial Revolution: Proceedings of 11th Construction Industry Development Board (CIDB) Postgraduate Research Conference 11 (pp. 34-42). Springer International Publishing.

Olagunju, R.E., 2015. Sustainability of Residential Buildings in Nigeria: An Appraisal of the Factors that Influence Maintenance of Residential Buildings’ Standards. FUTY Journal of the Environment, 9(1), pp.19-26.

Omopariola, E.D., Olanrewaju, O.I., Albert, I., Oke, A.E. and Ibiyemi, S.B., 2022. Sustainable construction in the Nigerian construction industry: unsustainable practices, barriers and strategies. Journal of Engineering, Design and Technology.

Onososen, A.O., Osanyin, O. and Adeyemo, M.O., 2019. Drivers and barriers to the implementation of green building development. PM World Journal, 8(9), pp.1-15.

Osuizugbo, I.C., Oyeyipo, O., Lahanmi, A., Morakinyo, A. and Olaniyi, O., 2020. Barriers to the adoption of sustainable construction. European Journal of Sustainable Development, 9(2), pp.150-150.

Oyuga, J.O., Gwaya, A. and Njuguna, M.B., 2023. Investigation of the current usage of BIM capabilities by large-sized building contractors in Kenya based on theory of innovation diffusion. Construction Innovation, 23(1), pp.155-177.

Refined Global (2023). The Benefits of Green Building Techniques in Sustainable Construction.[online] Refined Global Recruitment. Available at: <https://www.refinedglobalrecruitment.com/the-benefits-of-green-building-techniques-in-sustainable-construction>

Rodriguez, N., Katooziani, A. and Jeelani, I., 2023. Barriers to energy-efficient design and construction practices: A comprehensive analysis. Journal of Building Engineering, p.108349.

Rogmans, T. and El-Jisr, K., 2022. Designing Your Company’s Sustainability Report. Business and Society [Online]. Available at: <https://hbr.org/2022/01/designing-your-companys-sustainability-report%20Search%20in>.

Toriola-Coker, L.O., Alaka, H., Bello, W.A., Ajayi, S., Adeniyi, A. and Olopade, S.O., 2021, March. Sustainability barriers in Nigeria construction practice. In IOP Conference Series: Materials Science and Engineering (Vol. 1036, No. 1, p. 012023). IOP Publishing.

USGBC, (2023). Guide to Certification: Residential.. Available at: <https://www.usgbc.org/tools/leed-certification/homes>

USGBC, (2023). LEED rating system. Available at: <https://www.usgbc.org/leed>

Weniger, A., Del Rosario, P., Backes, J.G. and Traverso, M., 2023. Consumer Behavior and Sustainability in the Construction Industry—Relevance of Sustainability-Related Criteria in Purchasing Decision. Buildings, 13(3), p.638.

World Economic Forum. (2023). What companies need to know about the first ISSB standards. [online] Available at: <https://www.weforum.org/agenda/2023/08/issb-global-sustainability-reporting-requirements-explainer>

Zuofa, T. and Ochieng, E., 2016. Sustainability in construction project delivery: A study of experienced project managers in Nigeria. Project Management Journal, 47(6), pp.44-55.