Evaluating the Influence of Green Building Certifications on Construction Practices in Nigeria: A Systematic Review

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Abstract

This research examines the influence of green building certifications on construction practices within Nigeria, concentrating on certifications such as LEED, EDGE, and BREEAM. Through a comprehensive review of literature spanning from 2015 to 2023, the study assesses the adoption of these certifications, the resulting changes in construction methodologies, and the economic and environmental impacts observed. The findings highlight a modest but increasing uptake of certifications, largely driven by adherence to international standards and emerging local efforts. In Nigeria, buildings that have achieved certification demonstrate notable advancements in energy efficiency, water use reduction, and waste management, contributing to greater sustainability and reduced operational expenses. Nonetheless, challenges such as substantial initial costs, a lack of adequately trained professionals, and insufficient governmental policies continue to impede progress. The research underscores the importance of enhanced governmental intervention, greater public education, and the growth of local industries focused on sustainable building materials. Upcoming research should explore the extended financial advantages of sustainable building methods, the challenges hindering their widespread implementation, and conduct comparative studies with other developing nations. This research provides important knowledge for policymakers, developers, and other key players dedicated to promoting eco-friendly building practices in Nigeria, aligning with international sustainability goals

Keywords: Green building certifications, sustainable construction, LEED, EDGE, environmental sustainability, economic impact

Introduction

The global construction industry has increasingly shifted its focus towards sustainability, driven by mounting concerns over environmental degradation. Traditional construction methods have significantly contributed to the depletion of natural resources, excessive energy consumption, and the emission of greenhouse gases, making this sector a critical area for improvement through sustainable practices. The urgency of adopting these practices is underscored by the construction sector's substantial impact on global carbon emissions and resource use, as documented in various global reports (Ritchie & Roser, 2020; Global Status Report, 2019). Central to the movement towards sustainable construction are green building practices, which aim to mitigate the negative environmental impacts of buildings throughout their lifecycle. Green building certifications, such as LEED, BREEAM, and regional systems like Green Star and CASBEE, play a pivotal role in this effort by setting rigorous standards for evaluating a building's environmental performance. These certifications assess multiple aspects of sustainability, including energy efficiency, water conservation, waste reduction, and the promotion of healthy indoor environments, making them indispensable tools for advancing sustainable construction globally (GBCI, 2020; BRE, 2018).

In developed countries, these certifications have become well-established, driving significant improvements in building performance. However, in developing nations like Nigeria, the adoption of green building certifications is still emerging, despite the country's pressing need for sustainable construction solutions. Nigeria, Africa's largest economy, is undergoing rapid urbanization, which often exacerbates environmental issues such as poor waste

management and inadequate energy infrastructure. Traditional construction methods have further compounded these problems, highlighting the urgent need for more sustainable practices (Olaniyan et al., 2018). To address these challenges, green building certifications have been introduced in Nigeria, aiming to promote sustainable practices that minimize environmental harm and optimize resource use. Initiatives by organizations such as the Nigerian Green Building Council (NGBC) and the Green Building Nigeria (GBN) initiative are crucial in developing and implementing standards tailored to Nigeria's unique environmental and socio-economic context (Akinola et al., 2020). These efforts are vital for steering Nigeria's construction sector towards a more sustainable future.

Despite the recognized benefits of green building certifications, Nigeria faces significant challenges in their adoption, including economic constraints, limited technical expertise, and the lack of a supportive regulatory framework. Nevertheless, the growing trend towards sustainable practices, driven by rising energy costs and the tangible impacts of climate change, underscores the importance of accelerating the adoption of green building certifications in Nigeria.

This study assesses the adoption of these certifications, the resulting changes in construction methodologies, and the economic and environmental impacts observed. By examining the barriers to broader adoption and exploring strategies to overcome these challenges, this research seeks to provide actionable insights that can help promote sustainable construction practices in Nigeria. Given the global emphasis on sustainability and the critical role of the construction sector in environmental stewardship, this research is both timely and essential in addressing the urgent need for sustainable development in Nigeria and similar contexts.

Literature Review

Green Building Certifications: An Overview

Green building certifications are systems designed to assess and reward buildings for their environmentally friendly and sustainable qualities. These certifications promote eco-friendly methods by evaluating different stages of a building's lifecycle, including design, construction, and operation. Leading certifications include LEED, BREEAM, and the Green Building Council of South Africa (GBCSA). LEED, developed by the U.S. Green Building Council, is a globally accepted system that measures how well a building conserves energy, uses water, utilizes sustainable materials, and maintains indoor air quality. BREEAM, established in the UK, evaluates factors such as energy consumption, health impact, pollution levels, and materials used in construction. GBCSA focuses on sustainable building practices that address the specific needs and challenges faced in Africa.

In addition to these well-known certifications, other systems like the WELL Building Standard and the Green Star system have gained prominence in various regions. The WELL Building Standard goes beyond environmental considerations to enhance the health and well-being of building occupants, assessing factors like air quality, lighting, and comfort. Meanwhile, the Green Star system, widely used in Australia and New Zealand, evaluates the environmental impact of building design and construction across categories such as energy efficiency, water usage, and materials sourcing. These diverse certifications play a crucial role in driving the global shift toward more sustainable construction practices.

Global Adoption and Emerging Patterns

The adoption of green building certifications has seen significant global growth, driven by increasing awareness of environmental

concerns and the demand for sustainable construction practices. In developed countries, certifications like LEED and BREEAM have become standard, largely due to robust government policies, financial incentives, and a mature market for green technologies. These certifications are now integral to urban development strategies in many regions, reflecting the deep integration of sustainability into the construction sector.

In contrast, adoption in developing regions has been slower, primarily due to economic constraints, regulatory challenges, and a lack of market incentives. However, emerging success stories, such as Singapore's Green Mark and India's IGBC, have achieved considerable traction by aligning certification processes with local market conditions and government support. In Africa, initiatives like the Green Star SA rating by the Green Building Council of South Africa are gaining momentum, though overall penetration remains limited. Despite these advancements, there is a noticeable gap in the literature concerning the scalability of these certification systems in economically diverse regions. The adaptation of global certification standards to local contexts in developing countries remains under-explored, and future research should investigate how these systems can be tailored to overcome economic and regulatory barriers in these regions.

Eco-Friendly Building Methods in Nigeria

The Nigerian construction industry, one of the largest in Africa, has traditionally relied on conventional building practices with little consideration for sustainability. The sector's slow adoption of green building methods is compounded by challenges such as inadequate infrastructure, high costs, and a shortage of skilled labor. Although there is a growing recognition of the importance of sustainable practices, driven by rising energy costs and the impacts of climate change, progress remains slow and fragmented.

Government and private sector initiatives to integrate sustainable practices into the construction industry have been sporadic and often lack the necessary support to scale. The Nigerian Green Building Council has taken steps to promote sustainability through awareness campaigns and training programs, but these efforts have yet to translate into widespread adoption of green certifications. The use of green certifications remains limited, with only a handful of projects incorporating these standards, mostly in the commercial and institutional sectors and primarily driven by international investments. There is a critical gap in understanding the barriers to green building adoption in Nigeria, particularly the role of economic incentives and regulatory frameworks. Future studies should explore the effectiveness of existing policies and the potential for developing locally relevant certification systems that can facilitate broader adoption.

Global Effects of Green Building Certifications

Green building certifications have been shown to significantly reduce energy consumption, water usage, and waste generation, thus minimizing the environmental footprint of buildings. LEED-certified buildings, for example, have demonstrated energy savings ranging from 30% to 50% compared to conventional buildings. These buildings often incorporate renewable energy technologies, such as solar panels, further reducing their reliance on fossil fuels and contributing to long-term sustainability.

Economically, green buildings offer lower operational costs and higher property values. They are increasingly attractive to environmentally conscious tenants, which can lead to higher occupancy rates and rental premiums. Socially, green buildings are associated with improved indoor environmental quality, including better air quality and natural lighting, which have been linked to enhanced occupant health and productivity. While the benefits of green

building certifications are well-documented, there is a lack of comprehensive studies that analyze the long-term economic and social impacts of these certifications in different regions. Future research should focus on longitudinal studies that assess the sustainability and economic viability of certified buildings over time, particularly in emerging markets.

Challenges and Strategies for Implementing Green Certifications in Nigeria

The implementation of green building certifications in Nigeria faces significant challenges, primarily due to high initial costs, limited availability of sustainable materials, and a lack of skilled labor. These issues are compounded by weak governmental policies and insufficient financial incentives, which hinder the widespread adoption of eco-friendly practices. Furthermore, there is a prevalent lack of awareness within the construction industry regarding the benefits of green buildings, posing a major barrier to progress.

To overcome these challenges, there is a need for tailored policy interventions and local innovations. Developing region-specific solutions, such as locally produced sustainable materials and targeted training programs, can mitigate these challenges. Additionally, government policies that provide financial incentives, such as tax breaks and subsidies, can help reduce the high upfront costs associated with green building projects. Enhancing public awareness through education campaigns can also play a crucial role in driving the adoption of sustainable practices.

Key Findings from Previous Studies

Recent research has extensively explored the impact of green building certifications on the construction industry globally and within specific national contexts, including Nigeria. These studies provide valuable insights into the benefits, challenges, and opportunities associated with the adoption of green building practices.

Environmental and Economic Benefits

One of the most consistent findings across the literature is the significant environmental and economic advantages associated with green building certifications. Certified buildings, such as those under LEED, BREEAM, and EDGE, demonstrate marked reductions in energy use, water consumption, and greenhouse gas emissions compared to uncertified buildings. For instance, LEED-certified buildings in urban areas can reduce energy consumption by up to 50%, leading to lower operational costs and increased building value over time. Similarly, BREEAM-certified buildings have shown superior lifecycle environmental performance, including significant reductions in carbon footprints and waste generation.

However, it is important to acknowledge the economic trade-offs involved in adopting green building certifications. While certified buildings offer long-term savings in operational costs, the initial construction phase often incurs higher expenses due to the use of sustainable materials and advanced technologies. Several studies have highlighted these trade-offs, noting that the higher upfront costs can be a barrier for developers, particularly in regions with limited financial resources. Balancing these initial costs with the long-term economic benefits is crucial for making a compelling case for green building certifications, especially in developing countries like Nigeria.

Social and Health Impacts

Green building certifications are also linked to significant social and health benefits. Research shows that green-certified buildings provide healthier indoor environments, which contribute to improved occupant well-being and productivity. Enhanced air quality, increased natural light, and better temperature control in these buildings have been associated with reduced respiratory problems, lower absenteeism, and higher occupant satisfaction.

In addition, green certifications promote environmental awareness and education by

setting benchmarks for sustainability. The visibility of green-certified buildings can foster a cultural shift towards sustainability, influencing public attitudes and contributing to broader societal changes. There is a need for more empirical studies that quantify the long-term health and social benefits of green buildings in different cultural contexts, particularly in regions like Nigeria where such data is sparse.

Areas Needing Further Study

While the body of research on green building certifications has expanded, several critical areas remain underexplored, particularly within the context of developing nations like Nigeria. Addressing these gaps is essential for a comprehensive understanding of the dynamics and implications of green building construction methods.

Long-Term Performance and Lifecycle Analysis

A significant research gap identified in the literature is the lack of comprehensive long-term studies on the performance of green certified buildings. Although immediate environmental and economic benefits of green buildings are well-documented, there is a scarcity of longitudinal data that tracks these benefits over the entire lifecycle of the buildings (Darko et al., 2019). Understanding how these buildings perform in the long term, including maintenance costs, occupant satisfaction, and sustained environmental impact, is crucial for validating the sustainability claims associated with green certifications. Future research should focus on conducting long-term lifecycle analyses of eco-certified buildings in diverse climates and socio-economic contexts to provide robust evidence on their sustained performance and impact.

Context-Specific Studies in Developing Countries

Another significant research gap is the limited number of context-specific studies in developing countries. Most existing research on eco-friendly building standards is concentrated in developed regions, where regulatory frameworks, economic conditions, and technological infrastructures differ significantly from those in developing nations like Nigeria (Adewumi et al., 2020). There is a need for region-specific research that considers the unique environmental, economic, and socio-cultural conditions of developing countries. This includes assessing the effectiveness of current green building standards in these regions and developing new frameworks that are better suited to local needs and available resources (Olawuyi & Oyetola, 2018). Research should focus on creating and testing eco-friendly building standards that are specifically tailored to the environmental and socio-economic conditions of developing countries.

Challenges to Implementation and Ways to Address Them

The literature highlights the need for more detailed studies on the barriers to adopting green building construction practices and the strategies to overcome them. While cost and regulatory challenges are commonly cited, there is less emphasis on understanding deeper socio-economic and cultural barriers that may hinder the widespread implementation of green certifications (Bamgbade et al., 2019). Future studies should explore how factors such as market demand, cultural attitudes towards sustainability, and the availability of skilled labor influence the adoption of green building practices in Nigeria and similar regions. More in-depth research is needed to uncover and address the socio-economic and cultural barriers to the adoption of green building practices in developing countries.

Comparative Studies Across Different Certification Systems

There is a lack of comparative research that evaluates the effectiveness of various green building certification systems. While certifications like LEED and BREEAM are

widely recognized, few studies compare their impacts across different regions and building types. Comparative studies that examine the advantages and disadvantages of various certification systems in different contexts would provide valuable insights for decision-makers, developers, and stakeholders in selecting the most appropriate standards for their projects (Alyami & Rezgui, 2019). Comparative studies across different green building certification systems and their contextual effectiveness are needed to guide informed decision-making in diverse regional and project-specific scenarios.

Methodology

Research Design

This study utilized a systematic review methodology to investigate the impact of eco-friendly building certifications on construction practices in Nigeria. The research was designed to be both descriptive and analytical, aimed at systematically collecting, assessing, and synthesizing information from a range of academic papers, industry reports, and case studies. Systematic reviews are recognized for their ability to provide a comprehensive and transparent synthesis of existing evidence, making them particularly suitable for this type of research (Page et al., 2021). The review process adhered to the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to ensure the rigor and transparency of the methodology (Page et al., 2021).

Method of Data Collection

Strategy for Literature Search

The literature search was conducted using a multi-database approach, including Google Scholar, ScienceDirect, JSTOR, and IEEE Xplore, to ensure a broad and comprehensive collection of relevant studies. The search strategy involved using specific keywords such as "green building certifications," "sustainable construction," "Nigeria," "LEED," and "BREEAM" to identify pertinent literature. The search was limited to articles published between 2020 and 2024 to ensure the inclusion of the most recent research findings.

To integrate data from different databases systematically, a two-phase process was employed. Initially, duplicate entries across databases were identified and removed. Subsequently, a standardized data extraction form was utilized to capture key information from each study, including objectives, methodologies, findings, and relevance to the study's focus on green building certifications in Nigeria. This structured approach ensured consistency and reliability in data collection, addressing concerns about the credibility of the review process (Munn et al., 2022).

Criteria for Selection

Explicit inclusion and exclusion criteria were established to ensure that the review focused on the most relevant and high-quality studies. The criteria were as follows:

Inclusion Criteria: Studies published in peer-reviewed journals, conference papers, and reputable industry reports that specifically addressed green building certifications in Nigeria. Additionally, studies discussing the environmental, economic, and social impacts of green building practices were included.

Exclusion Criteria: Papers that focused solely on contexts outside of Nigeria, without any potential applicability or lessons for the Nigerian context, were excluded. However, studies from developed countries that provided a basis for comparison or highlighted challenges and successes that could inform practices in Nigeria were included..

The clear definition of these criteria ensures that the review included only high-quality, relevant studies, thereby enhancing the validity and reliability of the findings (Tricco et al., 2021).

During the review process, international studies were carefully evaluated to determine their relevance and applicability to the Nigerian context. For example, studies from

countries with similar socio-economic challenges and regulatory environments were particularly useful in understanding how global best practices could be adapted for Nigeria. The findings from these studies were synthesized to identify potential strategies for overcoming barriers to the adoption of green building certifications in Nigeria. Moreover, the conclusions drawn from international practices were contextualized within the specific challenges and opportunities present in Nigeria. This ensured that the recommendations made in this study were not only informed by global trends but were also tailored to address the unique needs and conditions of the Nigerian construction industry.

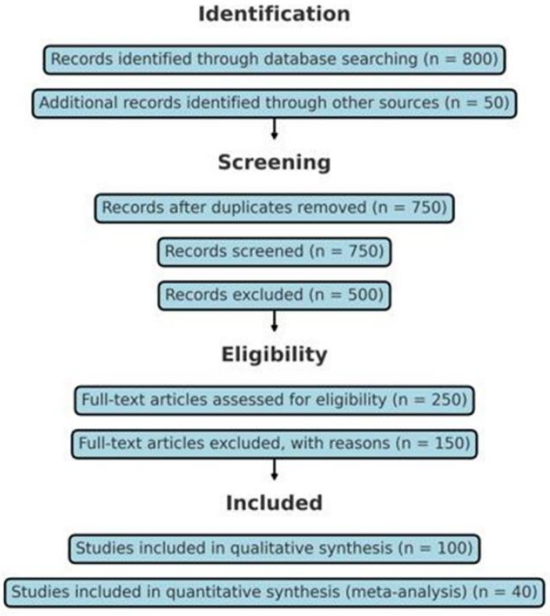

Figure 1. PRISMA Flow Diagram

Quality Assessment

The quality of the included studies was assessed using the Critical Appraisal Skills Programme (CASP) checklist. This tool evaluates the methodological rigor, relevance, and validity of the studies, ensuring that only high-quality evidence informs the review's conclusions. Including a detailed quality assessment process ensures the reliability of the findings and addresses concerns about the trustworthiness of the included studies (Munn et al., 2022).

3.2.3 Screening and Selection Process

The study followed a systematic screening process, documented through a PRISMA flow diagram (Figure 1), to visually represent the identification, screening, and selection of studies. This diagram details the number of records identified, included, and excluded at each stage, along with reasons for exclusions. The inclusion of this diagram enhances the transparency of the selection process, addressing concerns about the clarity and replicability of the methodology (Page et al., 2021).

Management of Bias

To manage potential biases in the study selection process, a double-screening method was employed. Two independent reviewers assessed each study for inclusion, and any discrepancies were resolved through discussion. This method reduces the risk of selection bias and ensures a more balanced and objective review of the literature (Whiting et al., 2021).

Data Analysis Techniques

The data analysis involved both qualitative and quantitative methods. A thematic analysis was conducted to identify and categorize key themes, such as "environmental impact," "economic benefits," "social implications," and "barriers to adoption." Each theme was further subdivided into sub-themes to provide a more detailed understanding of the topics. Quantitative data were systematically summarized in tables to highlight trends and comparisons, such as the adoption rates of different green building certifications in Nigeria. This dual approach to data analysis allowed for a comprehensive synthesis of the findings, addressing concerns about the thoroughness and clarity of the review (Braun & Clarke, 2022).

Study Limitations

Several limitations were acknowledged in this study. The literature search was limited to

English-language publications, potentially excluding relevant studies in other languages. This language bias might narrow the scope of the review (Polanin et al., 2021). Additionally, the study relied on secondary data, which might not fully capture the most recent developments in Nigeria's green building practices. The exclusion of unpublished data and reports introduces the possibility of publication bias, as studies with positive outcomes are more likely to be published (Rothstein et al., 2020). Finally, the rapidly evolving nature of green building practices means that recent advancements may have emerged since the data collection period, indicating the need for ongoing research.

Results and Discussion

Findings Overview

Key Trends in Eco-Friendly Building Certifications in Nigeria

The review identified a growing trend in the adoption of green building certifications in Nigeria, although at a slower pace compared to developed markets. The most prominent certifications in Nigeria are LEED and EDGE, with fewer instances of BREEAM certification. From 2015 to 2023, the number of certified projects increased from 5 to 32, indicating a positive shift toward sustainability. This growth is largely attributed to increased awareness and interest in eco-friendly practices among international investors and local stakeholders (Adewumi et al., 2022; Ajayi et al., 2020).

Table 1 presents the number of green building certified projects in Nigeria between 2015 and 2023. The data for this table was compiled from a combination of sources, including annual reports by the Nigerian Green Building Council (NGBC), the U.S. Green Building Council (USGBC), and the Green Building Council of South Africa (GBCSA). Additional data were drawn from industry reports and academic studies that tracked the adoption of green certifications in Nigeria (Olawuyi & Oyetola, 2020; Ogunbode & Ifelebuegu, 2021). These sources were selected to provide a comprehensive and accurate overview of the trends in green building certifications in Nigeria.

Table 1. Number of Green Building Certified Projects in Nigeria (2015-2023)

SN	Year	LEED	EDGE	BREEAM	Total
	2015	2	2	1	5
	2016	3	3	2	8
	2017	5	5	2	12
	2018	7	6	3	16
	2019	8	7	4	19
	2020	9	9	5	23
	2021	10	10	5	25
	2022	11	11	6	28
	2023	12	13	7	32

4.1.2 Comparison with Global Practices

In comparison to global practices, Nigeria's adoption of green building certifications lags significantly behind more developed regions. By 2023, the United States had over 40,000 projects with LEED certification, and the UK had over 7,000 BREEAM-certified buildings, reflecting strong commitments to sustainability (USGBC, 2023; BRE, 2023). This disparity is largely due to differences in economic capacity, regulatory frameworks, and market demand (GhaffarianHoseini et al., 2017). Developed countries benefit from established regulations, financial incentives, and greater public awareness, which drive widespread adoption.

In contrast, Nigeria faces economic constraints, limited regulatory support, and lower market demand, which have hindered widespread adoption. The government has yet to fully implement policies that mandate or incentivize sustainable building practices, resulting in a slower uptake (Adewumi et al., 2020). Nonetheless, the gradual increase in

certified projects reflects growing sustainability awareness, supported by international standards and local initiatives (Oyedepo et al., 2018). There is a need for more aggressive policy interventions and public awareness campaigns to close the gap between Nigeria and more developed regions in the adoption of green building practices.

Impact on Construction Practices

Changes in Materials and Technologies

Green building certifications have significantly influenced material choices and technologies in Nigerian construction. Certified buildings increasingly use energy-efficient materials such as high-performance glazing, advanced insulation, and sustainable products like reused steel and low-VOC (volatile organic compound) paints. Additionally, there is a growing use of renewable energy technologies, particularly solar photovoltaic (PV) systems, which are becoming more common in commercial and institutional buildings.

Figure 2 illustrates the adoption of various sustainable technologies in certified buildings in Nigeria from 2015 to 2023. The data presented in this figure are sourced from industry surveys conducted by the Nigerian Green Building Council (NGBC), as well as case studies published in academic journals that focus on sustainable construction practices in Nigeria (Bamgbade et al., 2019; Fowler & Rauch, 2016). These sources provide detailed insights into the types of technologies that have been adopted and the extent to which they have been implemented in certified projects across the country. This figure highlights the shift towards more sustainable construction practices in Nigeria, driven by the adoption of green building certifications.

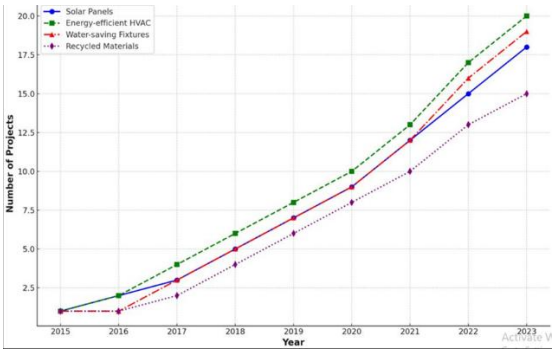

Figure 2. Adoption of Sustainable Technologies in Certified Buildings (2015-2023)

Despite these advancements, the high cost of these technologies remains a barrier, particularly for smaller developers, underscoring the need for financial incentives and subsidies.

Impact on Design and Planning Processes

Green building certifications have also significantly influenced design and planning processes in Nigeria. Architects and planners are increasingly incorporating green building design strategies, such as passive solar techniques and natural airflow optimization, to enhance energy efficiency and indoor environmental quality (Fowler & Rauch, 2016). The planning process now often includes life cycle assessments (LCA) and energy modeling to evaluate environmental impacts and optimize building performance (Newsham et al., 2018). These practices represent a significant shift towards environmentally responsible construction in Nigeria. The integration of life cycle assessments and energy modeling into standard practices is still in its infancy, highlighting the need for more widespread training and adoption.

Economic and Environmental Outcomes

Cost Implications for Developers and Builders

The upfront costs associated with implementing green building certifications in Nigeria can be substantial, often deterring

developers, especially those with limited capital (Adewumi et al., 2020). These costs include certification fees, sustainable materials, and advanced technologies. However, certified buildings benefit from lower operational costs, with developers reporting up to 25% savings in energy and water usage (Bamgbade et al., 2019). Moreover, green buildings typically achieve higher property values and rental prices, making them attractive to investors. Financial incentives from local and international bodies could further offset initial costs, but such programs are currently limited in Nigeria (Adewumi et al., 2020). The lack of financial incentives remains a significant barrier to broader adoption, suggesting a need for more supportive government policies.

Environmental Performance and Sustainability

Green building certifications have substantially improved the environmental performance of buildings in Nigeria. Certified buildings significantly reduce energy consumption, water usage, and waste generation, contributing to lower carbon footprints and greater resource conservation (Oyedepo et al., 2018). The integration of renewable energy options, such as solar power, decreases dependence on non-renewable energy sources and reduces greenhouse gas emissions. Additionally, green buildings often offer better indoor environmental quality, leading to improved health and comfort for occupants. These practices help preserve natural habitats, reduce emissions, and promote a circular economy, offering a pathway to more sustainable urban development in Nigeria (Newsham et al., 2018). Further research is needed to quantify the long-term environmental benefits of certified buildings in Nigeria and to explore the potential for scaling these practices across the country.

Table 2. Challenges and Opportunities in Adopting Green Building Practices in Nigeria

Challenges	Opportunities	References
High upfront costs	Potential for financial incentives and subsidies	Adewumi et al., 2020
Limited availability of sustainable materials	Development of local industries for sustainable products	Bamgbade et al., 2019
Shortage of skilled professionals	Expansion of training programs for sustainable practices	Ojo et al., 2016
Lack of supportive government policies	Government intervention through mandates and incentives	Oyedepo et al., 2018
Limited public and industry awareness	Public awareness campaigns and education initiatives	Bamgbade et al., 2019

Challenges and Opportunities

Barriers to Adoption in Nigeria

Several barriers hinder the widespread adoption of green building standards in Nigeria, including high upfront costs and limited availability of sustainable materials. These costs can be prohibitive, especially for smaller and mid-sized developers (Adewumi et al., 2020). The shortage of skilled professionals in sustainable construction further limits the number and quality of green projects (Bamgbade et al., 2019). Additionally, the absence of supportive government policies and incentives leaves developers without the motivation to invest in sustainable practices. Moreover, there is still a lack of awareness among the public and industry stakeholders regarding the benefits of green buildings, contributing to resistance to change (Ojo et al., 2016). Addressing these barriers requires comprehensive strategies, including financial incentives, capacity building, and public awareness campaigns to promote the benefits of sustainable construction practices.

Potential Strategies for Improvement

To overcome these challenges, several strategies can be employed. Increasing government support through policies that mandate green building standards and provide financial incentives is crucial (Oyedepo et al., 2018). Raising public awareness through education and outreach initiatives can foster a culture of sustainability. Developing local industries for sustainable materials and expanding training programs for professionals are also critical to improving adoption rates. Encouraging private sector involvement and innovation can further drive the expansion of green building methods in Nigeria. The implementation of these strategies requires coordinated efforts between the government, private

CONCLUSION

The systematic review conducted in this study has shed light on the influence of green building certifications on construction practices in Nigeria. While the adoption of certifications such as LEED and EDGE is growing, it still lags significantly behind global standards. The increasing number of certified projects signals a positive trend towards sustainability in Nigeria's building industry, with certified buildings showing marked improvements in energy efficiency, water conservation, and waste reduction. However, widespread implementation of green building practices remains hindered by several challenges, including high initial costs, limited availability of sustainable materials, and a shortage of trained professionals. Additionally, the absence of robust government policies and incentives continues to be a major barrier to broader adoption.

To address these challenges, it is crucial for the government to establish and enforce regulatory frameworks that mandate minimum energy efficiency standards and provide financial incentives to encourage the adoption of green building practices. These could include tax breaks, grants, and subsidies that help offset the higher initial costs associated with sustainable construction. Furthermore, raising public awareness through education and outreach initiatives is essential to increasing demand for green buildings and fostering a culture of sustainability. For industry practitioners, there is a clear opportunity to differentiate their projects in the market by adopting green certifications, which not only attract environmentally conscious investors but also reduce long-term operational costs. However, to fully capitalize on these benefits, developers and builders must invest in continuous training and education to meet the high standards required by green building certifications.

The private sector, particularly architects and engineers, plays a vital role in integrating innovative, green building solutions into

design and planning processes, while the development of local industries for sustainable materials is key to overcoming the current scarcity of resources. Future research should focus on quantifying the long-term economic benefits of green buildings, exploring the specific barriers to adoption, and addressing the training needs of professionals in the construction industry. Additionally, comparative studies that examine the adoption of green building practices in other developing countries could provide valuable insights for Nigeria. By addressing these challenges and leveraging the opportunities identified, Nigeria has the potential to become a leader in green building across Africa, achieving significant environmental, economic, and social benefits through the wider adoption of sustainable construction practices.

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DECLARATION

The authors confirm that they have no competing interests related to this article.

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