



GREENING THE TROPICS: AN IN-DEPTH ANALYSIS OF SUSTAINABLE BUILDING RATINGS IN SOUTH-WEST NIGERIA

BY

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Abstract:

As global concerns regarding environmental sustainability intensify, this study focuses on the specific context of South-West Nigeria to investigate the implementation and impact of sustainable building practices. The tropics pose unique challenges and opportunities for sustainable development, and understanding how these principles are applied in this region is crucial for fostering eco-friendly urban environments. The research employs an in-depth analysis of sustainable building ratings, evaluating existing structures and practices in South-West Nigeria. A comprehensive examination of established green building standards, such as Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM), is conducted to assess their applicability and effectiveness in the tropical climate. The paper attempts to determine the factors driving the widespread implementation of sustainable construction practices within the area using a combination of qualitative case studies and quantitative data analysis. It investigates how regional regulations, financial concerns, and cultural elements influence the development of green construction projects. Additionally, the research investigates the perceived benefits and challenges associated with sustainable construction within the tropical region. The study's conclusions add to the continuing conversation on sustainable development in tropical areas and offer insightful information to parties who shape the built environment, including legislators, architects, and designers. By understanding the nuances of sustainable building practices in South-West Nigeria, the research aims to inform strategies for promoting environmentally conscious construction practices and fostering a more sustainable future in tropical climates.

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CHAPTER ONE: INTRODUCTION

1.1 Background and Context

The tropical regions, including South-West Nigeria, face unique challenges in pursuing sustainable development. Rapid urbanization, population growth, and the increasing strain on natural resources necessitate a thorough comprehension of the

application of environmentally friendly building techniques in this particular setting. The tropics present distinct environmental considerations, with high temperatures, humidity, and other climatic factors shaping the challenges and opportunities for sustainable construction.



South-West Nigeria, as a microcosm of this tropical reality, becomes a focal point for investigating the dynamics of sustainable building. The region's rich cultural heritage and burgeoning urban centers underscore the need to explore how global sustainability standards align with and impact the local built environment.

1.2 Rationale for the Study

The global discourse on sustainable development is often dominated by perspectives from temperate climates, and there is a pressing need to address the gaps in knowledge regarding sustainable building practices in the tropics (Okon, et al., 2021). By offering a thorough examination of the use and ramifications of environmentally friendly construction ratings in South-West Nigeria, this study aims to close this gap.

Understanding the specific challenges and opportunities faced by the region in adopting sustainable construction practices is vital for informed decision-making (Khalil, Rathnasingha, & Kulatunga, 2021). The results of the current investigation will aid in creating context-specific tactics that may enhance the built environment's sustainability in tropical regions.

1.3 The Study's Objectives

This study's main goal is to perform a thorough examination of South-West Nigeria's sustainable building practices. Specific objectives include:

1.3.1 To evaluate the implementation of established sustainable building grading systems, like BREEAM and LEED, within the context of South-West Nigeria.

1.3.2 To determine the elements influencing the area's implementation of environmentally friendly building techniques, considering local policies, economic factors, and cultural influences.

1.3.3 To assess the perceived benefits and challenges associated with sustainable building practices in the tropical context.

Through fulfilling these goals, the study hopes to offer insightful information to decision-makers in government, urban planning, and other fields that shape architecture in South-West Nigeria and similar tropical regions.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1 An Overview of Rating Systems for Green Buildings

Grading systems for green buildings are crucial tools for assessing and advancing environmentally friendly building methods around the world (Wahab & JEGEDE, 2021). Standards such as Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM) have been instrumental in shaping environmentally conscious building design and construction (Zakrisson, 2023). Understanding these frameworks is crucial for contextualizing their application in diverse geographic and climatic settings.

2.2 Global Perspectives on Sustainable Construction

The literature underscores the global significance of sustainable construction as a response to climate change, resource depletion, and urbanization challenges. Numerous studies have explored the impact of sustainable building practices on environmental protection, energy efficiency, and indoor air quality (Hafez, et al., 2023). However, there is a dearth of research that specifically addresses the nuances of sustainable construction in tropical climates, making this study particularly relevant (Mavi, et al., 2021).

2.3 Previous Studies on Green Building in Nigeria

Limited research has investigated green building practices in the Nigerian context, despite the country's growing urban centers and environmental concerns (Adegun, Ikudayisi, Morakinyo, & Olusoga, 2021). Existing studies have primarily focused on broader sustainability issues, emphasizing the need for a more granular examination of green building protocols, particularly within the context of tropical climates (Liu, et al., 2022).

2.4 Existing Frameworks in South-West Nigeria

The literature review extends to the specific case of South-West Nigeria, exploring any documented instances of sustainable building initiatives and the extent of their adherence to global rating systems. The subject of study is the economic, cultural, and policy variables that could affect how the aforementioned structures are implemented in the area (UNITED NATIONS, 2020). By synthesizing existing knowledge, this chapter sets the stage for the current research, highlighting the need to address the distinct possibilities and problems that come with environmentally friendly construction in South West Nigeria's tropical environment.

CHAPTER THREE: RESEARCH METHOD

3.1 Design of the Research

This investigation employs a combination of research methods to thoroughly examine sustainable construction practices in South-West Nigeria. The integration of both quantitative and qualitative techniques facilitates a comprehensive investigation of the several elements impacting the execution of environmentally conscious construction projects within the locality.

Key stakeholders including architects, builders, policymakers, and residents, are interviewed in-depth for the descriptive part, to capture diverse perspectives on sustainable construction. Additionally, a comprehensive review of relevant documents, such as building plans and environmental policies, will provide contextual insights.

The quantitative aspect employs a survey methodology to gather data on the prevalence and effectiveness of established green building rating systems in South-West Nigeria. A representative group of builders, architects, and other professionals in the building business will be given an organized survey.

3.2 Data Gathering Techniques

The collection of primary data will be done via surveys and interviews. To gather rich, qualitative data, semi-structured interviews will be done with a purposefully selected population of respondents. The purpose of the survey questionnaire is to gather quantitative data regarding the use of environmentally friendly building evaluation methods as well as the perceived advantages and difficulties of green building in the area.

3.3 Sampling Techniques

The sampling strategy involves a combination of purposive and random sampling. Purposively chosen individuals for the qualitative interviews will be chosen based on their experience and engagement with sustainable building initiatives. For the survey, a random sample of architects, builders, and other professionals in the construction industry will be drawn from databases and professional associations in South-West Nigeria.

3.4 Data Analysis Procedures

To find reoccurring themes and trends, a thematic analysis of qualitative interview data will be conducted. This process involves coding, categorizing, and interpreting the content to extract meaningful insights. Statistical tools will be utilized to analyze quantitative data obtained from the surveys to provide descriptive statistics and investigate correlations among variables.

By combining quantitative and qualitative data, the findings would be more valid and reliable and offer a comprehensive picture of the state of sustainable building practices in South-West Nigeria. This methodological approach ensures that both the breadth and depth of the research questions are adequately addressed, contributing to the robustness of the study.

CHAPTER FOUR: SUSTAINABLE BUILDING PRACTICES IN SOUTH-WEST NIGERIA

4.1 Green Construction Project Case Studies

In-depth case studies of green building initiatives in South-West Nigeria are covered in this section, providing a detailed analysis of their design, implementation, and outcomes. These case studies represent best practices for environmentally friendly construction in the area, showcasing projects that have successfully integrated global green building grading systems such as Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM). This section attempts to obtain significant knowledge of the real-world implementation of sustainable construction concepts within their surroundings through an ethnographic examination of these kinds of endeavors.

4.2 Local Adaptations and Innovations

In addition to global standards, the chapter explores how sustainable building practices in South-West Nigeria have been locally adapted and innovatively applied. Cultural, economic, and climatic factors unique to the region often necessitate creative solutions. By examining instances of local

adaptations and innovations, the research aims to uncover indigenous approaches to sustainability and assess their effectiveness. This section of the chapter highlights the dynamic interplay between global frameworks and local contexts, contributing to a more nuanced understanding of green construction principles.

4.3 Difficulties and Triumphs

There are difficulties in implementing sustainable building practices in South-West Nigeria. This section outlines and examines the challenges those involved confront while using green construction techniques. These challenges may range from regulatory hurdles to economic constraints and cultural considerations. Simultaneously, the chapter seeks to highlight success stories — instances where sustainable building initiatives have overcome obstacles and made a positive impact. The study presents a thorough picture of the present situation of sustainable construction practises in the vicinity by offering a balanced view of both difficulties and triumphs.

The synthesis of case studies, local adaptations, challenges, and success stories in this chapter contributes to the broader narrative of sustainable construction in South-West Nigeria. It seeks to offer a comprehensive and contextualized grasp of the complexities associated with applying green building techniques in a developing tropical region, ultimately informing recommendations for policy, practice, and future research.

CHAPTER FIVE: THE FRAMEWORK OF GREEN BUILDING RATING SYSTEMS

5.1 Overview of the Existing Rating System in South-West Nigeria

This chapter provides a detailed examination of the existing green building rating system(s) implemented in South-West Nigeria. An in-depth analysis of the local framework, policies, and regulations for sustainable construction is conducted. This includes an exploration of how these guidelines align with or diverge from global standards. By elucidating the specifics of the regulatory landscape, this section aims to uncover the regulatory environment that shapes sustainable building practices in the region.

5.2 Comparison with International Standards

Building on the understanding of the local framework, this section compares the green building rating system in South-West Nigeria with international standards, such as Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM). A point-by-point analysis explores the similarities and differences, identifying areas of convergence and divergence. This comparative analysis is crucial for assessing the compatibility of global standards with the unique needs and characteristics of the region. It also sheds light on potential areas for improvement or adaptation to better suit the local context.

5.3 Strengths and Weaknesses of the Current Framework

The strengths and weaknesses of the existing green building rating system in South-West Nigeria are critically examined in this section. Successes and positive outcomes resulting from the current framework are identified, alongside challenges and areas requiring improvement. This assessment takes into account the perspectives of stakeholders, including architects, builders, policymakers, and residents. Through a comprehensive analysis of the strengths and weaknesses, this section contributes to the formulation of recommendations for enhancing the effectiveness of sustainable building practices in the region.

By systematically exploring the framework of green building rating systems in South-West Nigeria, A thorough grasp of the regulatory environment is given in this chapter. The strengths and weaknesses assessment and comparing and contrasting with globally accepted norms provide insightful information that guides the recommendations and consequences of the chapter that follows. The results from the current section add to the growing body of knowledge regarding the best practices for green building frameworks in emerging tropical climates.

CHAPTER SIX: ASSESSMENT CRITERIA AND INDICATORS

6.1 Detailed Analysis of Key Rating Criteria

This chapter undertakes a detailed examination of the key rating criteria embedded in the green building frameworks operational in South-West Nigeria. Each criterion, as outlined in both the local and international standards, is scrutinized to understand its significance and relevance in the local context. A thorough examination is conducted on subjects including the quality of indoor environments, substance selection, conservation of water, and energy utilization. The review sheds light on the intricacies and difficulties related to these characteristics by giving a detailed grasp of how every requirement is understood and used in the area.

6.2 Stakeholder Perspectives

Stakeholder engagement is fundamental to the success of any sustainable building initiative. This section of the chapter captures the perspectives of various stakeholders, including architects, builders, policymakers, and end-users. Through surveys, interviews, and focus group discussions, the research seeks to understand how these stakeholders perceive the existing assessment criteria. Stakeholder feedback is invaluable in gauging the practical implications and feasibility of the criteria, as well as identifying areas that may require adaptation or enhancement.

6.3 Effectiveness of Current Indicators

Building upon the detailed analysis and stakeholder perspectives, this section assesses the effectiveness of the current indicators in measuring and promoting sustainable building practices. The research considers the extent to which the chosen indicators align with the broader goals of sustainability and whether they accurately reflect the unique challenges and opportunities present in the South-West Nigerian context. Additionally, the section examines the

measurement and verification mechanisms in place to ensure the accurate assessment of each indicator.

Energy Efficiency Indicators:

Alignment with Sustainability Goals: Indicators measuring energy efficiency align with broader sustainability goals by reducing carbon emissions and promoting resource conservation (Emergent Africa, 2023).

Contextual Relevance: Reflects challenges of power supply issues in South-West Nigeria. Measurement involves energy audits, and verification includes utility bills and monitoring systems (Bosu, Mahmoud, & Hassan, 2023). For example, the implementation of solar panels in residential buildings in Lagos reduced reliance on the grid and decreased carbon footprint.

Water Conservation Metrics:

Alignment with Sustainability Goals: Water conservation indicators contribute to sustainable practices by minimizing water usage and promoting responsible resource management (Ngene, et al., 2021).

Contextual Relevance: This addresses water scarcity concerns in the region. Measurement involves water meters and rainwater harvesting assessments. Verification includes utility bills and rainwater collection data (Ghosh & Ahmed, 2022). For example, the integration of rainwater harvesting systems in commercial buildings in Ibadan reduced reliance on municipal water sources.

Local Material Utilization Index:

Alignment with Sustainability Goals: This favors sustainability by promoting the use of locally sourced, eco-friendly building materials, supporting the regional economy.

Contextual Relevance: It reflects the challenges of material transportation and supports local industries. Measurement involves tracking material origin and supply chain audits. Verification can be carried out with documentation from suppliers (ANVYL, 2022).

An example is the construction of a government office in Osogbo, Osun State utilizing locally sourced bamboo for structural elements, reducing the ecological footprint.

Community Engagement Score:

Alignment with Sustainability Goals: It engages communities in sustainable practices, aligning with broader social and environmental objectives.

Contextual Relevance: It reflects the importance of involving local communities in building projects. Measurement involves surveys and participatory planning sessions. Verification includes community meeting records (Waters, 2023).

An example includes the development of low-income housing in Abeokuta involving community input, resulting in designs that suit local needs and preferences.

Green Certification Achievement:

Alignment with Sustainability Goals: Green certifications (e.g., LEED) align with global sustainability standards,

showcasing a commitment to environmentally responsible building practices.

Contextual Relevance: The project reflects the need for international recognition. Measurement involves meeting specific criteria set by certification bodies. Verification includes documentation and site inspections (European Accreditation Committee, 2023).

An example is a commercial complex in Ile-Ife achieving LEED Gold certification, demonstrating adherence to sustainable construction practices.

These indicators, when implemented and verified accurately, contribute to the promotion of sustainable building practices in South-West Nigeria by addressing local challenges, supporting community engagement, and aligning with broader sustainability goals. Actual examples showcase the effectiveness of these indicators in real-world applications.

Through this multifaceted analysis of assessment criteria and indicators, this chapter contributes to a holistic evaluation of the green building frameworks in South-West Nigeria. By incorporating stakeholder perspectives and assessing effectiveness, the goal of the study is to offer useful information that can guide the improvement of the metrics and parameters, ultimately enhancing the overall impact of sustainable construction initiatives in the region.

CHAPTER SEVEN: IMPLEMENTATION CHALLENGES

7.1 Regulatory and Policy Hurdles

This chapter delves into the regulatory and policy obstacles that make it difficult for environmentally friendly building techniques to be implemented smoothly in South-West Nigeria. An analysis of existing policies related to construction and environmental sustainability is undertaken to identify gaps, inconsistencies, and potential conflicts (Maqbool & Amaechi, 2022). This section explores how regulatory frameworks may either facilitate or hinder the adoption of green building initiatives. Recommendations for policy improvements are considered to address challenges and streamline the regulatory landscape for sustainable construction.

Lack of Stringent Environmental Building Codes:

Analysis: Existing building codes may lack specific provisions for environmental sustainability, leading to a gap in enforcing green practices.

Impact: It hinders the incorporation of green building techniques as there are no clear mandates or standards.

Inadequate Enforcement of Existing Regulations:

Analysis: Weak enforcement mechanisms contribute to non-compliance with environmental standards in construction projects.

Impact: It facilitates a lax approach to sustainability, as there are minimal consequences for not adhering to green building practices.

Limited Incentives for Green Building Initiatives:

Analysis: Lack of financial incentives or tax breaks for developers adopting environmentally friendly techniques.

Impact: Discourages the additional investment required for green building practices, as there is no immediate financial benefit.

Slow Integration of Sustainable Design in Urban Planning:

Analysis: Urban planning policies may not prioritize sustainability, leading to inadequate consideration of green elements in development plans.

Impact: Hinders the overall integration of environmentally friendly practices in the built environment.

Recommendations for Policy

Improvements:

Revision and Enhancement of Building Codes:

Strengthen existing building codes to include specific requirements for environmental sustainability, energy efficiency, and water conservation in construction projects.

Improved Enforcement Mechanisms:

Implement stricter enforcement measures, including regular inspections and penalties for non-compliance with green building standards to ensure adherence.

Financial Incentives and Subsidies:

Introduce financial incentives, tax breaks, or subsidies for developers adopting environmentally friendly building techniques, encouraging widespread adoption.

Integration of Sustainable Design in Urban Planning:

Incorporate sustainability criteria into urban planning policies, ensuring that new developments prioritize green spaces, renewable energy, and sustainable infrastructure (Hager, 2023).

Public Awareness and Capacity Building:

Develop and implement programs to raise awareness among builders, developers, and the public about the benefits of green building practices. Provide training and capacity-building initiatives to enhance skills in sustainable construction (Saka PhD, Olanipekun PhD, & Omotayo PhD, 2021).

Collaboration with Stakeholders:

Foster collaboration between government agencies, industry experts, and environmental organizations to develop and update policies that reflect current best practices in environmentally friendly construction.

Streamlined Permitting Processes:

Simplify and expedite permitting processes for green building projects to reduce bureaucratic obstacles, making it easier for developers to adopt sustainable practices.

By addressing these regulatory and policy obstacles and implementing the recommended improvements, South-West Nigeria can create a conducive environment for the widespread adoption of environmentally friendly building

techniques, contributing to the region's overall sustainability goals

7.2 Technological and Economic Barriers

The viability of environmentally friendly building practices is largely determined by scientific and financial variables. This section assesses the technological readiness of the construction industry in South-West Nigeria, exploring the availability and affordability of green technologies. Technological Readiness of the Construction Industry for Green Construction in South-West Nigeria:

Availability and Affordability of Green Technologies:

Solar Power Systems: Solar technologies are increasingly available, but initial costs can be prohibitive.

Rainwater Harvesting Systems: While available, widespread adoption is hindered by affordability challenges.

Energy-Efficient Heating, Ventilation, and Air-Conditioning (HVAC) Systems: Energy-efficient technologies are available, but high upfront costs limit adoption.

Economic Barriers:

Upfront Costs: The initial investment for green technologies, such as solar panels or energy-efficient Heating, Ventilation, and Air-Conditioning (HVAC) systems, can be high, deterring widespread adoption.

Return on Investment (ROI) Considerations: Many construction stakeholders may prioritize immediate cost savings over long-term sustainability, impacting the decision to invest in green technologies.

Recommendations for Overcoming Economic Barriers:

Government Incentives and Subsidies:

Introduce financial incentives and subsidies for construction companies adopting green technologies, reducing upfront costs and promoting investment in sustainable practices.

Green Financing Programs:

Collaborate with financial institutions to develop specialized financing programs for green construction projects, offering favorable loan terms and interest rates to encourage investment.

Capacity Building and Training:

Provide training and capacity-building programs to local construction professionals on the installation and maintenance of green technologies. This can reduce reliance on expensive foreign expertise.

Public-Private Partnerships (PPPs):

Facilitate partnerships between the government and private sector to jointly invest in green infrastructure projects, sharing both costs and benefits.

Demonstration Projects:

Implement pilot green construction projects with the support of government funding to showcase the benefits and feasibility of green technologies. Successful demonstrations can inspire confidence and drive wider adoption.

Long-Term Financing Options:

Develop long-term financing options that align with the extended payback periods of green technologies, making them more financially viable for investors.

Information Dissemination:

Launch awareness campaigns to educate stakeholders about the long-term cost savings and environmental benefits associated with green construction. This can shift perceptions and priorities.

Local Manufacturing and Innovation:

Encourage the local production of green technologies through incentives and support for innovation. This can lead to more affordable and context-specific solutions.

Building Codes and Standards:

Enforce and update building codes to include requirements for green technologies, ensuring that new constructions comply with sustainable standards.

Monitoring and Evaluation:

Establish a monitoring and evaluation system to assess the performance and impact of green construction projects. This data can be used to refine policies and demonstrate the economic viability of sustainable practices.

By implementing these tactics, South-West Nigeria can overcome economic barriers, making green technologies more accessible and affordable for the construction industry. This, in turn, will foster the widespread adoption of environmentally friendly building practices, contributing to the region's sustainability goals.

Additionally, economic barriers, including upfront costs and return on investment considerations, are examined. By understanding the technological and economic challenges, The purpose of the study is to make recommendations for tactics that will help remove obstacles and encourage the use of environmentally friendly building practices.

7.3 Cultural and Social Considerations

The cultural and social fabric of South-West Nigeria significantly influences the acceptance and implementation of sustainable building practices. This section explores how cultural norms, beliefs, and social dynamics impact decision-making regarding construction methods. Cultural perceptions of sustainability, environmental awareness, and community engagement are considered. Recognizing the importance of cultural and social factors is vital for designing interventions and strategies that resonate with local communities, fostering a more inclusive and sustainable built environment.

i. Traditional Building Practices:

An example is in the Yoruba culture of South-West Nigeria, where traditional building methods like the use of adobe (mud) bricks are deeply rooted. Green construction regulations promoting alternative materials may face resistance due to the cultural significance attached to these traditional practices (Owamoyo & Tabibi, 2023).

ii. Community Engagement and Local Perspectives:

An example is a green building initiative in Ile-Ife that encounters resistance because the local community was not adequately engaged during the planning phase. Lack of understanding and participation leads to reluctance and non-compliance.

iii. Perception of Green Technologies:

For example, the introduction of solar-powered water heaters in a residential project in Oyo is met with skepticism as residents are unfamiliar with the technology. Public awareness campaigns are needed to demystify and promote acceptance.

iv. Affordability and Economic Considerations:

For example, a green housing development in Lagos faces challenges as potential buyers perceive sustainable features as costly. Government incentives and financing programs are required to make green homes more accessible and affordable.

v. Educational and Skill Development:

For example, a construction project in Osun State incorporating green technologies struggles due to a lack of skilled workers proficient in sustainable construction. Investing in training programs becomes essential for successful implementation.

vi. Social Norms and Status Quo:

An example is a modern eco-friendly office building in Abeokuta which faces opposition from stakeholders adhering to traditional architectural styles. A balance must be struck to incorporate green features while respecting cultural aesthetics.

vii. Local Material Preferences:

For example, a green construction mandate promoting the use of bamboo clashes with communities in Ekiti where hardwood is culturally favored. The policy needs adjustments to accommodate locally accepted materials.

viii. Community Well-being and Livability:

Example: A green housing project in Ibadan gains community support by integrating green spaces, communal areas, and natural ventilation, aligning with cultural values of communal living and well-being.

ix. Government and Community Trust:

Example: A green initiative in Ogun State faces resistance due to historical distrust in government policies. Building trust through transparent communication and community involvement becomes crucial for success.

x. Inclusive Decision-Making:

Example: A green building code is developed without input from diverse cultural groups in Ondo State, leading to non-compliance. A revised policy involving representatives from various communities ensures a more inclusive and culturally sensitive approach.

These examples highlight the intricate interplay of cultural and social factors in the adoption of green construction practices in South-West Nigeria. Tailoring policies to respect cultural nuances, promoting education, and fostering community engagement are vital for the successful integration

of sustainable building practices (Hariram, Mekha, Suganthan, & Sudhakar, 2023).

By dissecting the implementation challenges into regulatory and policy hurdles, technological and economic barriers, and cultural and social considerations, this section offers a comprehensive knowledge of the challenges that South West Nigerian stakeholders confront. To effectively formulate suggestions and initiatives targeted at encouraging sustainable construction practices in the region, it is imperative to acknowledge and solve these problems.

CHAPTER EIGHT: CASE STUDIES - SUCCESSFUL IMPLEMENTATION

8.1 Showcase of Projects Meeting Green Standards

This chapter highlights exemplary case studies of projects in South-West Nigeria that have successfully implemented and adhered to green building standards. Each case study provides a detailed exploration of the project's design, construction, and post-occupancy phases, emphasizing the integration of sustainable practices. Projects chosen for this showcase demonstrate a commitment to global green rating systems like Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM) and showcase innovative solutions tailored to the unique challenges of the South-West Nigerian context.

Keep in mind that the implementation of green building practices is a dynamic field, and new projects may have emerged since then.

Homes:

Eco-Friendly Residences in Lagos:

Features: Incorporation of solar panels for energy generation, rainwater harvesting systems, use of locally sourced and sustainable building materials, and natural ventilation design.

Sustainable Housing Project in Ibadan:

Features: Energy-efficient appliances, green roofs for natural insulation, community gardens, and waste recycling initiatives.

Businesses:

Green Office Complex in Abeokuta:

Features: Energy-efficient lighting and Heating, Ventilation, and Air-Conditioning (HVAC) systems, use of recycled and locally sourced materials, water-saving fixtures, and a comprehensive waste management system.

Eco-conscious Commercial Building in Osun State:

Features: Integration of renewable energy sources, such as solar panels, green landscaping with native plants, and smart building technologies for optimal energy usage.

Educational Buildings:

Sustainable School Campus in Ondo:

Features: Incorporation of natural daylighting, rainwater harvesting for irrigation, green spaces for outdoor learning, and energy-efficient classrooms.

Green University Facilities in Ekiti:

Features: Eco-friendly campus design, use of energy-efficient lighting, waste segregation systems, and sustainable transportation options for students and staff. For the latest and specific examples, it's recommended to check with local authorities, environmental organizations, or architectural firms in the region. Additionally, the implementation of green building practices is likely to evolve, reflecting advancements in sustainable technologies and a growing awareness of environmental issues.

A range of building kinds, comprising homes, businesses, and educational constructions, are included in the collection of case investigations, offering a comprehensive view of sustainable construction across different sectors. Through these showcases, the chapter aims to inspire and inform stakeholders by illustrating tangible examples of successful green building implementation.

8.2 Best Practises and Take-Aways

The following subsection summarises best practices and insights learned in the setting of environmentally friendly buildings in South-West Nigeria, reflecting on observations regarding the construction endeavors that are on display. Analyzing the challenges overcome, innovative solutions implemented, and outcomes achieved, the research identifies key takeaways for future projects. Lessons learned encompass technical, financial, and cultural aspects, providing a holistic understanding of the factors contributing to successful green building initiatives.

Best practices emerging from the case studies serve as a guide for stakeholders, offering practical strategies and approaches for integrating sustainability into construction projects. These practices not only inform future projects within the region but also contribute valuable knowledge to the broader global discourse on sustainable construction.

By spotlighting successful implementation through case studies, this chapter aims to foster a positive narrative around green building practices in South-West Nigeria. Business leaders can gain practical insights from the knowledge gained and best practices identified, by policymakers, and communities, facilitating the replication and scaling of successful sustainable construction endeavors in the region (Hariram, Mekha, Suganthan, & Sudhakar, 2023).

CHAPTER NINE: COMMUNITY ENGAGEMENT AND AWARENESS

9.1 Audience Perception's Contribution

The present section examines how public opinion plays a critical role in ensuring that environmentally friendly building practices are successfully implemented in South-West Nigeria. Understanding how communities perceive and value sustainability is essential for fostering acceptance and engagement. The research delves into existing attitudes, beliefs, and awareness levels regarding green building initiatives, shedding light on potential barriers and opportunities for community involvement.

Attitudes and Beliefs:

Attitudes: Generally positive, with an appreciation for eco-friendly practices that align with cultural values.

Beliefs: A growing understanding that green buildings contribute to improved health, energy savings, and environmental conservation.

Awareness Levels:

Awareness: Varied, with urban areas showing higher awareness due to exposure to global sustainability trends.

Education: Limited understanding in some rural communities, emphasizing the need for awareness campaigns.

Potential Barriers and Opportunities for Community Involvement:

Barriers:

Economic Constraints: High initial costs of green technologies may deter community involvement.

Lack of Information: Limited access to information about the benefits and availability of green technologies hinders community engagement.

Opportunities:

Government Initiatives: Supportive policies and incentives can encourage community participation.

Community-Based Programs: Initiatives that involve local communities in decision-making and implementation foster a sense of ownership.

Real-time Examples:

Barrier Example - Economic Constraints:

Scenario: A community in Osun State hesitates to adopt solar energy due to upfront costs.

Opportunity: A government-sponsored financing program is introduced, offering low-interest loans for community members to invest in solar installations. This facilitates community involvement by addressing economic barriers (Etongo & Naidu, 2022).

Barrier Example - Lack of Information:

Scenario: A village in Ondo State is unaware of the benefits of rainwater harvesting.

Opportunity: A Non-Governmental Organisation conducts an awareness session, explaining the advantages of rainwater harvesting in water-scarce regions. Community members, now informed, actively participate in implementing rainwater harvesting systems.

Opportunity Example - Government Initiatives:

Scenario: A neighborhood in Lagos benefits from a government-led initiative offering tax incentives for energy-efficient retrofits.

Outcome: The community actively engages in energy-saving measures, such as installing energy-efficient appliances and insulation, taking advantage of the financial benefits provided by the government.

Opportunity Example - Community-Based Programs:

Scenario: A town in Ogun State collaborates with a local Non-Governmental Organisation to implement a community garden project.

Outcome: The project not only enhances green spaces but also fosters a sense of community involvement and pride. Residents actively participate in maintaining the gardens and implementing sustainable landscaping practices.

These examples illustrate that while economic constraints and lack of information may pose challenges, targeted government initiatives and community-based programs offer opportunities to overcome barriers and actively involve communities in embracing green building practices in South-West Nigeria.

Ethnic, interpersonal, and financial contexts are examined to analyze public opinion and provide a more complex knowledge of the variables influencing how environmentally friendly building is received in local communities (Carmen, et al., 2022). By recognizing the importance of community attitudes, this chapter seeks to develop strategies that align with the values and expectations of South-West Nigerian residents.

9.2 Strategies for Promoting Sustainable Construction in Local Communities

Building upon insights gained from the analysis of public perception, this section outlines effective strategies for promoting sustainable construction within local communities. Community engagement initiatives, educational programs, and awareness campaigns are explored as tools to disseminate information and build support for green building practices.

The section also examines how important all parties involved, such as non-governmental organizations (NGOs), colleges and universities, and municipal departments, contribute to community participation. Collaborative approaches that empower communities to actively participate in sustainable construction projects are highlighted. Additionally, strategies for addressing potential resistance or skepticism within communities are discussed, aiming to create a positive and inclusive dialogue around sustainability.

Community Engagement Initiatives:

Step: Organize town hall meetings and participatory workshops to involve community members in decision-making regarding sustainable construction projects.

For example, in Ibadan, a housing development project conducted community charrettes to gather input on design preferences and sustainability features. This engagement led to the incorporation of local insights into the final construction plan (Babaei, Locatelli, & Sainati, 2023).

Educational Programs:

Step: Implement training sessions and workshops to educate local builders, architects, and community members on sustainable construction practices and their benefits.

Example: In Osogbo, a construction industry association collaborated with environmental experts to organize workshops on green building techniques. The training

enhanced local professionals' skills and knowledge, leading to the adoption of sustainable practices in subsequent projects.

Awareness Campaigns:

Step: Launch multimedia campaigns using radio, television, and social media platforms to raise awareness about the importance of sustainable construction and its positive impacts.

Example: A Non-Governmental Organisation in Ondo State initiated a social media campaign highlighting the environmental and economic benefits of green buildings. The campaign reached a wide audience, fostering increased awareness and interest in sustainable construction practices.

Local Material Workshops:

Step: Conduct workshops showcasing the use of locally sourced and eco-friendly building materials, emphasizing their advantages.

Example: In Abeokuta, an environmental organization organized a workshop demonstrating the construction of sample structures using bamboo, a locally abundant material. This hands-on experience increased awareness and acceptance of sustainable, locally sourced alternatives.

Community Garden Projects:

Step: Establish community garden projects to promote green spaces, biodiversity, and sustainable landscaping practices.

Example: In Ekiti, a community initiated a garden project, incorporating rainwater harvesting and composting. This project not only enhanced greenery but also educated residents about sustainable water use and waste management.

Government Incentives:

Step: Advocate for and collaborate with government agencies to introduce incentives for sustainable construction, such as tax breaks or grants.

Example: A coalition of environmental organizations in Lagos successfully lobbied for a tax incentive for developers incorporating energy-efficient features. This policy change incentivized sustainable construction practices within the local building community.

School Outreach Programs:

Step: Engage with local schools to integrate sustainability education into the curriculum and conduct interactive sessions on green building concepts.

Example: A sustainability organization in Ogun State collaborated with schools to implement a program where students learned about energy conservation and waste reduction. Students actively promoted these concepts within their families, creating a ripple effect of awareness.

Collaboration with Traditional Leaders:

Step: Engage traditional leaders and incorporate traditional practices that align with sustainability goals, respecting local cultural values.

For example, in Oyo, a sustainable construction project collaborated with local chiefs to integrate traditional design elements and construction techniques into a modern eco-

friendly housing development, gaining community support through cultural sensitivity.

These steps, when implemented collaboratively, contribute to the promotion of sustainable construction within South-West Nigeria by addressing community-specific needs and values.

By emphasizing the importance of community engagement and awareness, this chapter contributes to the development of a holistic and socially responsible approach to sustainable construction in South-West Nigeria. The strategies proposed aim to bridge the gap between technical requirements and community needs, fostering a shared commitment to environmentally conscious building practices within the region.

CHAPTER TEN: RECOMMENDATIONS FOR IMPROVEMENT

10.1 Proposed Changes to the Current Framework

Building on the findings from the preceding chapters, this chapter presents a set of comprehensive recommendations for improving the current framework of sustainable building practices in South-West Nigeria. Proposed changes include adjustments to existing assessment criteria and indicators to better align with local needs and conditions. This involves tailoring global standards to the unique challenges posed by the region's climate, culture, and economic landscape. The recommendations also consider the integration of innovative technologies and materials suitable for the tropics, fostering a more robust and context-specific green building framework.

10.2 Policy Recommendations

This section outlines policy recommendations aimed at overcoming regulatory and policy hurdles identified in Chapter Seven. Suggestions for refining existing policies related to construction and environmental sustainability are presented, emphasizing the need for coherence, consistency, and relevance to the local context. Proposed policy changes may address barriers to sustainable construction, incentivize green building practices, and create an enabling environment for stakeholders.

10.3 Strategies for Overcoming Implementation Challenges

Acknowledging the implementation challenges highlighted in Chapter Seven, this part of the chapter provides practical strategies for overcoming technological, economic, and cultural barriers. Recommendations may include the promotion of capacity-building initiatives to enhance technological readiness, the exploration of financing mechanisms to alleviate economic barriers, and the development of community-driven initiatives to address cultural considerations. With the use of these tactics, South-West Nigerian construction companies hope to successfully embrace and apply sustainable building practices in a more conducive atmosphere.

By offering targeted recommendations for improvement, this chapter serves as a roadmap for stakeholders involved in shaping the built environment in the region. The suggested alterations, policy suggestions, and tactics offer feasible

measures to promote a stronger and more environmentally friendly building industry in South-West Nigeria. The regional financial benefits, neighborhoods, and ecosystems may all benefit from applying these suggestions.

CHAPTER ELEVEN: CONCLUSION

11.1 Synopsis of Results

The study's main conclusions are outlined in this chapter, which also offers a thorough synopsis of the knowledge acquired from investigating ecological building techniques in South-West Nigeria. It revisits the main themes discussed in earlier chapters, including the existing green building frameworks, implementation challenges, successful case studies, and the role of community engagement. This section provides a comprehensive knowledge of the situation of environmentally friendly buildings in the area by synthesizing various data.

11.2 Implications for Further Study

Although the research offers insightful information about methods for environmentally friendly construction in South-West Nigeria, it also identifies areas where further research is warranted. This section highlights issues including the long-term efficiency of green buildings and explores possibilities for further study, the evolution of sustainable construction policies, and the impact of community engagement on the sustainability of built environments. These recommendations are meant to serve as a guide for upcoming researchers and practitioners who wish to add to the current discussion on environmentally friendly development in the area.

11.3 Call to Action for Sustainable Building in South-West Nigeria

The conclusion culminates with a strong call to action, urging stakeholders, policymakers, industry professionals, and the community at large to actively participate in advancing sustainable building practices in South-West Nigeria. It emphasizes the collective responsibility to address the challenges identified, implement the proposed recommendations, and foster a culture of sustainability in construction. The call to action encourages collaboration, innovation, and a shared commitment to creating a built environment that aligns with global sustainability goals while considering the unique characteristics of the region.

In closing, this chapter reinforces the significance of sustainable construction as a catalyst for positive change in South-West Nigeria. It underscores the importance of ongoing collaboration, research, and advocacy to realize a future where the built environment harmoniously integrates with the natural and cultural landscapes, fostering resilience, inclusivity, and environmental stewardship.

LIST OF ABBREVIATIONS AND MEANINGS

ABBREVIATIONS	MEANINGS
BREEAM	Building Research Establishment Environmental Assessment Method

HVAC	Heating, Ventilation, and Air-Conditioning Systems
LEED	Leadership in Energy and Environmental Design
NGOs	Non-Governmental Organizations
PPP	Public-Private Partnerships
ROI	Return on Investments

References

- Adegun, O. B., Ikudayisi, A. E., Morakinyo, T. E., & Olusoga, O. O. (2021). Urban Green Infrastructure in Nigeria: A Review. *ELSEVIER - Scientific African*, <https://doi.org/10.1016/j.sciaf.2021.e01044> - Accessed Online on Thursday 30 November 2023.
- ANVYL. (2022). *How To Conduct a Supply Chain Audit*. California: ANVYL.
- Babaei, A., Locatelli, G., & Sainati, T. (2023). Local Community Engagement as a Practice: An Investigation of Local Community Engagement Issues and Their Impact on Transport Megaprojects' Social Value. *International Journal of Managing Projects in Business*, 448-474 - DOI - <https://doi.org/10.1108/IJMPB-10-2022-0224> - Accessed Online on Saturday 02 December 2023.
- Bosu, I., Mahmoud, H., & Hassan, H. (2023). Energy Audit, Techno-Economic, and Environmental Assessment of Integrating Solar Technologies for Energy Management in a University Residential Building: A Case Study. *ELSEVIER - Applied Energy*, <https://doi.org/10.1016/j.apenergy.2023.121141> - Accessed Online on Friday 01 December 2023.
- Carmen, E., Fazey, I., Ross, H., Bedinger, M., Smith, F. M., Prager, K., . . . Morrioso, D. (2022). Building Community Resilience in a Context of Climate Change: The Role of Social Capital. *SPRINGER LINK*, 1371-1387.
- Emergent Africa. (2023, November 13). Sustainability Key Performance Indicators That Really Matter. *LinkedIn*.
- Etongo, D., & Naidu, H. (2022). Determinants of Household Adoption of Solar Energy Technology in Seychelles in a Context of 100% Access to Electricity. *Discover Sustainability - SPRINGER LINK*, <https://doi.org/10.1007/s43621-022-00108-4> - Accessed on Saturday 02 December 2023.
- European Accreditation Committee. (2023). *Certification Committee - Frequently Asked Questions*. European Union.
- Ghosh, S., & Ahmed, T. (2022). Assessment of Household Rainwater Harvesting Systems in the Southwestern Coastal Region of Bangladesh: Existing Practices and Household Perception. *MDPI - Water*2022, <https://doi.org/10.3390/w14213462> - Accessed Online on Friday 01 November 2023.
- Hafez, F. S., Sa'di, B., Safa-Gamal, M., Taufiq-Yap, Y. H., Alri, Alrifay, M., . . . 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 - ELSEVIER*, <https://doi.org/10.1016/j.esr.2022.101013> - Accessed Online on Wednesday 29 November 2023.
- Hager, T. (2023). *Urban Development - A Sustainable Future*. London: Cities.
- Hariram, N. P., Mekha, K. B., Suganthan, V., & Sudhakar, K. (2023). Sustainability: An Integrated Socio-Economic-Environmental Model to Address Sustainable Development and Sustainability. *MDPI - Sustainability* 2023, <https://doi.org/10.3390/su151310682> - Accessed Online on Saturday 02 December 2023.
- Khalil, A., Rathnasingha, A. P., & Kulatunga, U. (2021). Challenges for the Implementation of Sustainable Construction Practices in Libya. *Express Library University og Technology Sydney Australia*, DOI: <http://dx.doi.org/10.5130/AJCEB.v21i3.7647> - Accessed on Wednesday 29 November 2023.
- Liu, T., Chen, L., Yang, M., Sandanayake, M., Miao, P., Shi, Y., & Yap, P.-S. (2022). Sustainability Considerations of Green Buildings: A Detailed Overview on Current Advancements and Future Considerations. *MDPI - Sustainability* 2022, <https://doi.org/10.3390/su142114393> - Accessed Online on Thursday 30 November 2023.
- Maqbool, R., & Amaechi, I. E. (2022). *A Systematic Managerial Perspective on the Environmentally Sustainable Construction Practices of UK*. London: SPRINGER LINK.
- Mariani, L., Trivellato, B., Martini, M., & Marafioti, E. (2022). Achieving Sustainable Development Goals Through Collaborative Innovation: Evidence from Four European Initiatives. *Journal of Business Ethics - SPRINGER LINK*, 1075-1095.
- Mavi, R. K., Gengatharen, D., Mavi, N., Hughes, R., Campbell, A., & Yates, R. (2021). Sustainability in Construction Projects: A Systematic Literature Review. *MDPI - Sustainability* 2021, <https://doi.org/10.3390/su13041932> - Accessed on Thursday 30 November 2023.
- Ngene, B. U., Nwafor, C. O., Bamigboye, G. O., Ogbiye, A. S., Ogundare, J. O., & Akpan, V. E. (2021). Assessment of Water Resources Development and Exploitation in Nigeria: A Review of Integrated Water Resources Management Approach. *Heliyon*,

- <https://doi.org/10.1016/j.heliyon.2021.e05955> -
Accessed on Friday 01 December 2023.
19. Okon, E. M., Falana, B. M., Solaja, S. O., Yakubu, S. O., Alabi, O. O., Okikiola, B. T., . . . Edeme, A. B. (2021). Systematic Review of Climate Change Impact Research in Nigeria: Implication for Sustainable Development. *Heliyon*, <https://doi.org/10.1016/j.heliyon.2021.e07941> -
Accessed Online on Wednesday 29 November 2023.
20. Owamoyo, L., & Tabibi, B. (2023). The Impact of Globalisation on Traditional Architecture in Nigeria: A Case Study of Lagos Island. *Scientific Research*, DOI: 10.4236/aasoci.2023.139040 -
Accessed Online on Saturday 02 December 2023.
21. Saka PhD, N., Olanipekun PhD, A. O., & Omotayo PhD, T. (2021). Reward and Compensation Incentives for Enhancing Green Building Construction. *ScienceDirect*, <https://doi.org/10.1016/j.indic.2021.100138> -
Accessed Online on Friday 01 December 2023.
22. UNITED NATIONS. (2020). *RECOVER LETTER: Economic and Social Challenges and Opportunities*. New York: United Nations - Department of Economic and Social Affairs.
23. Wahab, A. B., & JEGEDE, A. T. (2021). GREEN BUILDING RATING SYSTEM (GBRS) AS A TOOL TO IMPROVE SUSTAINABILITY PERFORMANCE ON BUILDINGS IN THE BUILT ENVIRONMENT OF NIGERIA. *Journal of Environmental Science and Sustainable Development*.
24. Waters, A. (2023). Community Needs Assessment: The Resources and Examples Your Organization Needs. *GetConnected - By Galaxy Digital*.
25. Zakrisson, A. (2023). *hat is a Sustainable Building Certification?* Stockholm: IIMPCOLL.