COMPARATIVE STUDY ON GREEN BUILDINGS AND BINI TRADITIONAL BUILDINGS

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A PROJECT SUBMITTED TO THE DEPARTMENT OF ESTATE MANAGEMENT, FACULTY OF ENVIRONMENTAL SCIENCE, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE (B.Sc.) IN ESTATE MANAGEMENT

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DEDICATION

I dedicate this dissertation to God, the source of all wisdom and knowledge, for guiding me through this academic journey. Your unwavering love, grace, and guidance have sustained me every step of the way, and for that, i am eternally grateful. I also dedicate this work to my beloved parents, whose endless sacrifices and unwavering support have made my education possible. Your encouragement, prayers, and belief in me have been a constant source of strength and inspiration. This dissertation stands as a testament to your love and dedication, and i am profoundly thankful for everything you have done for me.

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ABSTRACT

This study aims to conduct a comparative analysis of the key architectural and construction features of green buildings and Benin traditional buildings, with a focus on their adaptability and resilience to local climate conditions and environmental factors. The research will first examine the general characteristics of green buildings and Benin traditional buildings, including their underlying design principles, material selection, and construction techniques. This will involve a review of the existing literature on the subject, as well as an assessment of the environmental performance and sustainability aspects of each building type.

The study will further look into the adaptability and resilience of these building features, such as energy efficiency, water conservation, and waste management, compare to the traditional building practices and techniques employed in Benin. The role of cultural influences, traditional knowledge, and innovative sustainable solutions in enhancing the adaptability and resilience of these buildings will also be explored. Furthermore, the research will investigate the potential for integrating green building strategies with Benin traditional building practices to create more climate-responsive and environmental-friendly structures. This will involve identifying the challenges and opportunities in bridging the gap between modern green building approaches and traditional construction methods.

The findings of this study contribute to a better understanding of the comparative advantages and limitations of green buildings and Benin traditional buildings in addressing local environmental conditions and climate change adaptation. The insights gained can inform policymakers, architects, and construction professional in developing more sustainable and resilient building practices that combine the best of both approaches.

CHAPTER ONE

INTRODUCTION

1.4 Background to the Study

The real estate industry has a significant environmental impact, contributing to resource depletion, energy consumption, and waste generation. This has led to a growing emphasis on sustainable development practices, with green buildings emerging as a response to these concerns.

Green buildings are designed and developed to minimize environmental impact throughout their life cycle. They incorporate features that: reduce energy and water consumption through efficient systems, materials, and design strategies, improve indoor air quality with proper ventilation and use of non-toxic materials, minimize waste by utilizing recycled content materials and promoting construction practices that reduce waste generation and conserve natural resources through sustainable site planning and efficient use of resources (Altieri, 2008). According to Egbu and Hari (2010) Green buildings, also known as sustainable buildings or eco-friendly buildings, are designed to minimize their environmental impact while maximizing resource efficiency and occupant comfort. They incorporate sustainable design principles, such as energy efficiency, water conservation, and use of environmentally friendly materials.

Olotuah and Adeboye (2008) postulated that Benin traditional buildings represent indigenous architectural styles and construction techniques that have evolved over centuries within the cultural context of the Benin people in Nigeria. These buildings reflect the cultural heritage, socio-economic practices, and environmental adaptation strategies of the Benin society

On the other hand, traditional building practices in Benin, with its rich architectural heritage, offers a valuable case study of traditional building practices that hold lessons for

contemporary sustainable design through climate-responsive design, this traditional Beninese architecture often incorporates features like natural ventilation, shading devices, and thermal mass to achieve thermal comfort passively, potentially aligning with some green building principles, locally sourced materials which often use locally available, renewable materials like mud, wood, and palm leaves, reducing transportation emissions and promoting resource efficiency and waste minimization techniques like using leftover materials for development or incorporating natural ventilation systems could demonstrate a traditional approach to waste minimization. (Igbinovia et al., 2012; Oludare, 2012).

There are differences between green buildings and Benin traditional buildings, according to Oludare (2012) which includes: limited focus on energy efficiency, in which traditional buildings might not have explicitly considered energy efficiency for specific appliances or electrical systems, as these technologies were not readily available, water management whereby depending on the specific context, traditional water management practices might require adaptation for contemporary usage patterns.

Despite the distinct differences, there is a growing interest in understanding their similarities, differences, and potential synergies in terms of sustainability principles, architectural features, and cultural values. A comparative study can provide valuable insights for informing sustainable architectural design practices and promoting cultural heritage preservation Gbadegesin and Akingbehin (2016).

Conversely, modern green buildings often adhere to specific building codes and certifications that aim for measurable environmental performance, which might not be present in traditional constructions Kennedy (2002).

1.5 Statement of the Problem

Green buildings are designed to minimize environmental impact, conserve natural resources, and enhance occupant health and comfort. They incorporate sustainable design principles, such as energy efficiency, water conservation, and use of renewable materials Egbu and Hari (2010).

Benin traditional buildings are characterized by indigenous architectural styles, construction techniques, and materials that reflect the cultural heritage and values of the Benin people. These buildings often exhibit unique features that contribute to their historical and cultural significance Iyamu and Igbinoba (2017).

While the green building movement offers a promising approach to sustainable development, a limited understanding exists of how these principles might be informed by and integrated with existing knowledge from traditional building practices.

Despite the growing interest in green buildings and the preservation of cultural heritage, there is limited research comparing the features and characteristics of green buildings with traditional buildings, particularly in the context of Benin traditional building development.

Understanding sustainability in traditional buildings incorporate sustainable practices and passive design strategies that would be developed over generations to respond to local climatic conditions and resource constraints. Exploring these traditional approaches could provide valuable insights for contemporary green building design. The implications for sustainable development stem from comparing the features of green buildings and Benin traditional buildings, this study seeks to identify synergies, differences, and potential areas for integration between modern sustainability principles and traditional developmental practices.

Thus, exploring how traditional Beninese architecture might align with green building principles, particularly regarding climate-responsive design, use of local materials, and potentially, waste minimization practices (Oludare, 2012; Igbinovia et al., 2012), analyze how traditional practices can be reinterpreted and adapted for contemporary green building design within the context of Benin's specific climate and environmental concerns, would contribute to the development of sustainable building practices in Africa by drawing inspiration from the rich architectural heritage of Benin and its potential synergy with green building principles (Altieri, 2008; Kennedy, 2002).

In Order to do this the study will try to address the following research questions:

This study aims to provide answers to the following questions.

1. What are the environmental impacts of Green Buildings compared to Bini Traditional Buildings?
2. What are the key architectural and construction features of green buildings and Benin traditional buildings.
3. How should materials and construction techniques be used in green buildings and Benin traditional buildings be analyzed.
4. What are the potential opportunities available in integrating sustainable practices inspired by Bini traditional architecture into modern green buildings designs?

1.6 Aims and Objectives of the Study

The aim of the study is to examine how green building technologies and practices can be applied to Bini Traditional Buildings with a view to explore stakeholder perspectives on the integration of green building features into Bini traditional buildings and identify potential challenges and opportunities for collaboration.

The specific objectives are:

1. To identify the key architectural development features of green buildings and Benin Traditional Buildings.
2. To analyze the materials and development techniques used in green building and Benin traditional buildings.
3. To identify potential opportunities for integrating sustainable practices inspired by Bini traditional architecture into modern green buildings designs.

1.4 Significance of Study

By comparing materials and development techniques, the research can identify:

Potential overlaps in sustainable approaches between green buildings and traditional practices. Opportunities to adapt traditional techniques for use in contemporary green building projects in Benin. This analysis can inform architects, designers, and construction professionals on selecting sustainable materials and implementing environmentally conscious construction methods.

The research can explore the potential trade-offs between traditional and green building materials, considering factors like durability, embodied energy, and maintenance requirements. It can analyze how traditional development techniques might require adaptation to meet contemporary building codes and safety standards. By undertaking this analysis, the research can contribute to a more informed and holistic approach to sustainable building practices in Benin. By understanding the strengths of both traditional and green building approaches, the construction industry can move towards a future that is both environmentally responsible and respectful of cultural heritage.

1.5 Scope of the Study

The scope of the study on the research topic "comparative study on the features of green buildings and Benin traditional buildings" encompasses several key aspects that need to be considered to conduct a comprehensive analysis. Here's an outline of the scope of the study:

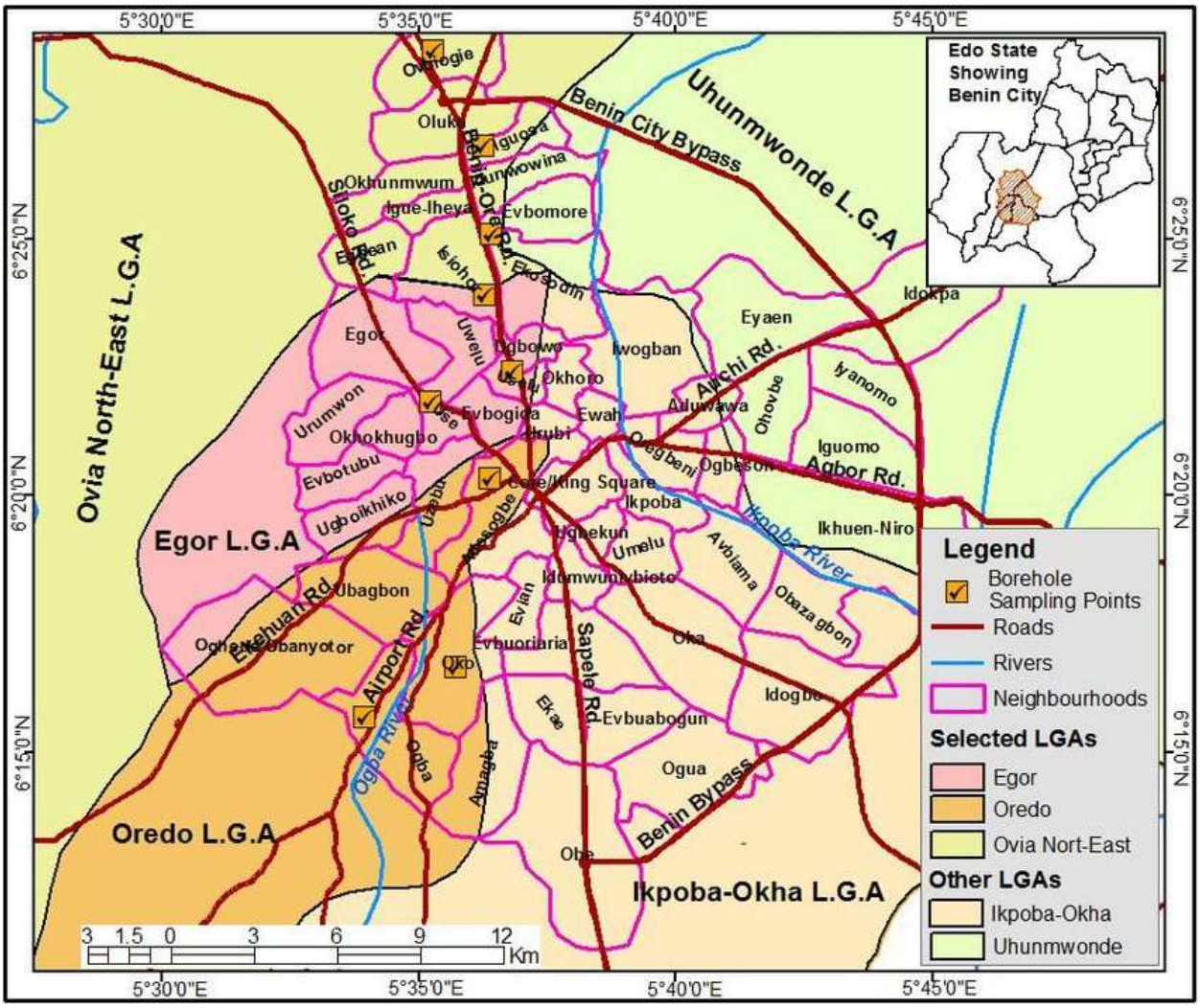
The study will primarily compare the environmental features of green buildings and Benin traditional buildings. The comparison will consider features that contribute to: Reduced energy consumption, improved water efficiency, Sustainable material use, Waste minimization, Indoor environmental quality (thermal comfort, air quality), Climate-responsive design.

1.6 Study Area

Benin City the capital and largest city of Edo state, southern Nigeria. Benin City is situated on a branch of the Benin River and lies along the main highways from Lagos to the eastern states. The city is also linked by roads to Sapele, Siluko, Okene, and Ubiaja and is served by air and the Niger River delta ports of Koko and Sapele. Benin City was the principal city of the Edo (Bini) kingdom of Benin (flourished 13th-19th century). It was destroyed in 1897 by the British, who attacked after the Edo assaulted an earlier British expedition, which had been told not to enter the city during a religious festival but nonetheless attempted to do so. Before burning the city down, the British pillaged it, taking many of its famous bronzes, ivory, and other treasures. Traces of the old wall and moat remain, but the new city is a close-packed pattern of houses and streets converging on the palace and compound of the Oba (sacred king) and the government offices. In the main square is a statue of Emotan, a woman honored for assisting a 15th-century prince attempting to regain power and who later became Oba Ewuare. The present Oba retains traditional and advisory roles in government.

Benin City has long been famous for its "bronzes casting "actually brass work, some of which is said to date from the 13th century and for its ivory and wood carvings. Its museum (1960)

has a notable collection of some of the kingdom's early pieces. The city's present artisans still practice the ancient method of cire perdue ("lost-wax") casting, and its wood- carvers are organized into a cooperative craft society. The traditional export of palm oil and palm kernels remains important. The Nigerian Institute for Oil Palm Research (1939) is here.



MAP OF BENIN CITY

CHAPTER TWO

LITERATURE REVIEW

2.1 Concept of Green Building

Green buildings are characterized by their sustainable design principles, which encompass various architectural features aimed at reducing environmental impact and improving occupant well-being. These features may include passive design strategies, energy-efficient systems, use of renewable materials, and integration of green spaces Kibert (2008). According to Yudelson (2009), the development process of green buildings involves several stages, from site selection and planning to design, construction, operation, and maintenance. Key development features of green buildings may include sustainable site development, water efficiency measures, energy-efficient building systems, indoor environmental quality, and post-occupancy evaluation. Also, green buildings prioritize features that minimize environmental impact throughout their life cycle. Key architectural and development features include; Energy Efficiency, Water Efficiency, Waste Minimization, (Altieri, 2008; Kennedy, 2002)

2.2 Benin Traditional Buildings

Benin traditional buildings exhibit distinctive architectural characteristics rooted in indigenous building traditions, cultural practices, and environmental adaptation strategies. These buildings typically feature earth construction techniques, thatched roofs, courtyard layouts, and decorative elements reflecting local craftsmanship and cultural symbolism Olotuah and Adeboye (2008).

Igbinosa and Iyamu (2018) posited that the development of Benin traditional buildings involves a holistic approach that integrates architectural design, construction methods, and community participation. Development aspects may include site selection based on

environmental considerations, use of locally available materials, communal labor practices, and cultural rituals associated with building construction.

Benin's architectural heritage offers a wealth of knowledge about sustainable design practices adapted to the local climate and resources. Key features to consider includes; Climate-Responsive Design, Locally Sourced Materials, Waste Minimization, (Oludare, 2012; Igbinovia et al., 2012):

A comparative analysis of green buildings and Benin traditional buildings highlight similarities, differences, and potential synergies in their architectural and development features. Such analysis may focus on building form, spatial organization, material selection, construction techniques, environmental performance, cultural significance, and socio-economic implications Gbadegesin and Akingbehin (2016). The features identify potential overlaps and divergences like - Alignments: Both green buildings and traditional buildings might share principles like climate-responsive design, use of local materials, and potentially, waste minimization practices. Differences: Green buildings might focus more on quantifiable energy and water efficiency metrics, while traditional buildings might prioritize passive strategies.

2.5 Analyzing Materials and Development Techniques in Green Buildings vs. Benin Traditional Buildings

This objective focuses on a comparative analysis of materials and development techniques used in green buildings and Benin traditional buildings. Here's a breakdown of its significance with relevant academic references:

Understanding Material Choices:

Green buildings prioritize materials with low environmental impact, such as recycled content, rapidly renewable resources, and locally sourced options (Asif et al., 2013). Analyzing these choices can offer insights into sustainable material selection.

Traditional Beninese buildings often utilize readily available, local materials like mud, wood, and palm leaves (Oludare, 2012). Studying these choices can reveal a historical approach to sustainable material usage.

Development Techniques and Sustainability:

Green buildings often employ techniques like prefabrication and modular construction to minimize waste and improve efficiency (Wong & Yang, 2015). Analyzing these methods can highlight approaches to reducing construction's environmental footprint.

Traditional Beninese construction techniques might involve skilled craftsmanship and minimal reliance on heavy machinery, potentially reducing energy consumption during construction

(Igbinovia et al., 2012). Studying these techniques can reveal alternative, potentially sustainable construction approaches.

2.6 Analyzing Materials and Construction Techniques

Green Buildings vs. Benin Traditional Buildings

This objective delves into the heart of the comparative study, focusing on the materials and construction techniques employed in both green buildings and Benin traditional buildings.

Here's a breakdown with relevant academic references:

Construction Techniques in Green Buildings:

Green buildings employ construction techniques that minimize energy consumption, reduce waste, and optimize building performance. Techniques may include prefabrication, modular construction, passive design strategies, and integrated building systems.

Green Building Materials and Techniques:

Focus on Sustainability: Green buildings prioritize materials with low environmental impact, such as recycled content, rapidly renewable resources, and locally sourced materials (Lechner, 2015).

Energy Efficiency: Building envelopes utilize high-performance insulation, efficient windows, and passive design strategies to minimize energy consumption (Asif et al., 2014).

Water Conservation: Plumbing fixtures are low-flow, and rainwater harvesting systems might be employed (Gerrard, 2009).

Construction Techniques: Techniques that minimize waste and promote efficient material use are preferred (Achim et al., 2013).

2.5 Benin Traditional Building Materials and Techniques

Climate-Responsive Design: Buildings often incorporate natural ventilation, shading devices, and thermal mass materials like earth to achieve thermal comfort passively (Oludare, 2012).

Locally Sourced Materials: Mud, wood, palm leaves, and other locally available, renewable resources are commonly used (Igbinovia et al., 2012).

Simple Construction Techniques: Techniques often rely on traditional skills and local knowledge, minimizing reliance on complex machinery (Oludare, 2012).

Potential for Waste Minimization: Techniques like using leftover materials for construction or incorporating natural ventilation systems might demonstrate a traditional approach to waste minimization.

Comparative Analysis:

This research will compare and contrast the materials and construction techniques used in both approaches, considering:

Similarities: Explore potential overlaps in the use of locally-sourced materials, climate-responsive design principles, and potential waste minimization practices.

Differences: Analyze differences in material selection (e.g., focus on recycled content in green buildings), construction techniques (e.g., higher reliance on advanced technologies in green buildings), and potential limitations of traditional approaches regarding water management and building code compliance.

By analyzing these aspects, the research can identify valuable lessons from traditional practices and explore the potential for adaptation in the context of contemporary green building design in Benin.

Analyzing the materials and development techniques used in green buildings and Benin traditional buildings requires a comprehensive examination of construction practices, materials selection, and building technologies employed in both contexts. Here's a discussion with relevant academic references.

Materials in Green Buildings:

Green buildings prioritize the use of environmentally friendly materials with low environmental impact, high durability, and recyclability. Common materials include recycled

materials, sustainable timber, low-emission paints, energy-efficient glazing, and non-toxic insulation.

Construction Techniques in Green Buildings:

Green buildings employ construction techniques that minimize energy consumption, reduce waste, and optimize building performance. Techniques may include prefabrication, modular construction, passive design strategies, and integrated building systems.

Materials in Benin Traditional Buildings:

Benin traditional buildings typically utilize locally available materials such as mud bricks, timber, thatch, and palm leaves. These materials are chosen for their sustainability, affordability, and thermal performance, reflecting indigenous building traditions and environmental adaptation strategies

Construction Techniques in Benin Traditional Buildings:

Construction techniques in Benin traditional buildings are characterized by indigenous building methods that have been passed down through generations. Techniques may include earth construction, timber framing, woven matting, and palm thatching, demonstrating adaptation to local climatic conditions and cultural preferences.

Comparative Analysis:

A comparative analysis of materials and construction techniques in green buildings and Benin traditional buildings involves identifying similarities, differences, and potential synergies between the two approaches. Factors such as resource efficiency, environmental impact, thermal performance, and cultural significance should be considered.

2.6 Innovation and Adaptation:

Both green buildings and Benin traditional buildings demonstrate innovation and adaptation in materials and construction techniques. Examining innovative solutions and traditional wisdom can inform the development of sustainable building practices that integrate modern technologies with indigenous knowledge.

By analyzing the materials and development techniques used in green buildings and Benin traditional buildings, researchers can gain insights into sustainable construction practices, cultural heritage preservation, and opportunities for integrating traditional wisdom with modern innovations in architectural design and construction.

1. **Examining Adaptability and Resilience**: Green Buildings vs. Benin Traditional Buildings

This objective delves into the core concept of sustainability in the built environment by analyzing how both green buildings and Benin traditional buildings adapt to and withstand local climatic conditions and environmental factors. Here's a breakdown of the significance, supported by academic references:

Significance of Adaptability and Resilience:

Climate change and environmental degradation necessitate buildings to be adaptable and resilient to ensure occupant comfort, minimize energy consumption, and withstand extreme weather events (Akbari, 2002). Examining both green buildings and traditional approaches through this lens offers valuable insights.

2. Green Buildings and Climate Adaptation:

Green building principles like passive design strategies (natural ventilation, shading devices) and energy-efficient systems can significantly reduce a building's reliance on mechanical heating and cooling, enhancing resilience to climate change impacts (Artmann et al., 2018).

However, the effectiveness of green building features in adapting to local conditions needs to be assessed. For example, ventilation strategies might need adjustments for regions with high humidity (Fillioudis et al., 2017).

3. Resilience of Traditional Buildings in Benin:

Traditional Beninese architecture often incorporates features that passively address local climatic conditions.

Oludare (2012) highlights the use of thermal mass materials like mud brick to regulate indoor temperatures and strategically placed ventilation openings for natural air circulation, demonstrating inherent resilience to Benin's hot and humid climate.

However, the resilience of traditional buildings might be challenged by factors like increased precipitation due to climate change, necessitating adaptation strategies.

Comparative Analysis:

The research can compare the effectiveness of green building technologies (e.g., cool roofs, high-performance windows) with traditional techniques (e.g., overhanging eaves, strategically placed windows) in mitigating solar heat gain in Benin's climate.

Similarly, water management strategies in both approaches can be compared, considering traditional rainwater harvesting techniques and contemporary grey water reuse systems.

By examining the adaptability and resilience of both green buildings and Benin traditional buildings, the research can contribute to the development of more sustainable and climate-

responsive building practices in Benin and beyond. The analysis can identify strengths and weaknesses of each approach, paving the way for a future where modern green building principles can be integrated with the valuable knowledge embedded in traditional architecture to create buildings that are not only environmentally friendly but also well-adapted to the specific climatic conditions of a region.

2.7 Adaptability to Local Climatic Conditions:

The objective of examining the adaptability and resilience of green buildings and Benin traditional buildings to local climatic conditions and environmental factors involves evaluating how well each building type responds to the specific challenges posed by the surrounding environment. Here's a discussion supported by relevant academic references: Green buildings and Benin traditional buildings may exhibit different degrees of adaptability to local climatic conditions, such as temperature variations, humidity levels, precipitation patterns, and solar exposure. For instance, green buildings often incorporate passive design strategies, such as natural ventilation, day lighting, and thermal insulation, to optimize indoor comfort and minimize energy consumption in response to climatic variations.

Resilience to Environmental Factors:

Resilience refers to the ability of buildings to withstand and recover from environmental stresses, such as extreme weather events, natural disasters, and environmental degradation. Both green buildings and Benin traditional buildings may incorporate resilient design features, such as durable construction materials, structural stability, and adaptive design elements, to enhance their resilience to environmental factors.

Case Studies and Comparative Analysis:

Comparative case studies can be conducted to assess the adaptability and resilience of green buildings and Benin traditional buildings in specific climatic regions. These studies may

involve field surveys, building performance evaluations, occupant surveys, and data analysis to identify design strategies that enhance adaptability and resilience in each context.

Cultural and Technological Adaptations:

Benin traditional buildings often incorporate cultural and technological adaptations that have evolved over generations to respond to local climatic conditions and environmental factors. These adaptations may include natural building materials, vernacular construction techniques, and indigenous knowledge systems that contribute to the resilience of traditional building forms.

2.8 Innovations in Green Building Design:

Green buildings utilize innovative design strategies and technologies to enhance their adaptability and resilience to environmental factors. These may include green roofs, rainwater harvesting systems, solar photovoltaic panels, and passive solar design principles that optimize building performance and reduce environmental impact.

By examining the adaptability and resilience of green buildings and Benin traditional buildings to local climatic conditions and environmental factors, researchers can identify design principles and strategies that optimize building performance, promote environmental sustainability, and enhance community resilience in diverse geographic contexts.

Identifying Integration Opportunities: Sustainable Practices from Benin to Green Buildings

The objective of identifying potential opportunities for integrating sustainable practices inspired by Benin traditional architecture into modern green building designs holds significant value. Here's a breakdown of its importance, supported by academic references:

Significance:

With the construction industry's environmental impact a growing concern, exploring alternative approaches is crucial. This objective aligns with the ongoing discourse on integrating traditional knowledge with contemporary sustainable design practices (Oludare, 2012; Igbinovia et al., 2012).

Potential Benefits:

Enhanced Sustainability: Traditional Beninese architecture often incorporates passive cooling strategies through natural ventilation, shading devices, and thermal mass materials (Oludare, 2012). These practices can inspire modern green buildings to reduce reliance on energy-intensive mechanical cooling systems.

Reduced Environmental Impact: Traditional buildings frequently utilize locally sourced, renewable materials like mud, wood, and palm leaves, minimizing transportation emissions and promoting resource efficiency (Igbinovia et al., 2012). This aligns with green building principles of minimizing embodied energy in building materials.

Climate-Responsive Design: By learning from the traditional approach to adapting buildings to the local climate in Benin, modern green buildings can be designed to better suit specific climatic conditions, improving occupant comfort and reducing energy consumption (Kennedy, 2002).

Passive Cooling Techniques: Modern architects can adapt traditional ventilation strategies like strategically placed windows and windcatchers to enhance natural ventilation in contemporary buildings (Altieri, 2008).

Bioclimatic Design Principles: Studying how traditional buildings in Benin respond to solar radiation and prevailing winds can inform the design of modern buildings for optimal solar control and natural ventilation (Oludare, 2012).

Locally Sourced and Sustainable Materials: Modern green building projects can explore the use of locally available, renewable materials like those traditionally used in Benin, minimizing transportation emissions and promoting resource efficiency (Igbinovia et al., 2012).

Research and Innovation:

Research can explore how traditional construction techniques like earthen construction can be adapted for use in modern green buildings, considering factors like structural integrity and building codes. Innovation can focus on developing new materials inspired by traditional practices that offer improved durability and environmental performance for use in contemporary green buildings. By identifying opportunities to integrate sustainable practices from Benin's traditional architecture into modern green building design, this objective has the potential to contribute significantly to the construction of more environmentally friendly and regionally responsive buildings. By fostering a dialogue between traditional knowledge and contemporary green building practices, this research can lead to a more sustainable and culturally sensitive built environment.

Cultural Heritage Preservation: The objective to identify potential opportunities for integrating sustainable practices inspired by Benin traditional architecture into modern green building designs is significant in promoting cultural heritage preservation and enhancing the environmental sustainability of contemporary architecture. Here's a discussion supported by academic references. Benin traditional architecture embodies indigenous knowledge, construction techniques, and sustainable practices that have evolved over centuries. By

identifying opportunities to integrate these practices into modern green building designs, architects can contribute to the preservation and promotion of cultural heritage.

Passive Design Strategies:

Benin traditional buildings often incorporate passive design strategies, such as natural ventilation, shading, and thermal mass, to respond to local climatic conditions and enhance occupant comfort. These strategies can be adapted and integrated into modern green building designs to improve energy efficiency and reduce reliance on mechanical systems.

Use of Local Materials:

Benin traditional architecture utilizes locally sourced and sustainable materials, such as clay, timber, and thatch, which have low embodied energy and minimal environmental impact. Incorporating similar materials into modern green building designs can reduce carbon footprint and promote resource efficiency.

Community Engagement and Social Cohesion:

Benin traditional architecture often reflects communal values and social cohesion, with buildings designed to accommodate multi-generational families and community gatherings. By incorporating similar principles of community engagement and social interaction into modern green building designs, architects can create more inclusive and sustainable built environments.

Resilience to Climate Change:

Benin traditional buildings demonstrate resilience to climate change through their adaptive design strategies and use of natural materials. By studying and integrating these resilient features into modern green building designs, architects can enhance the resilience of buildings and communities to climate-related risks.

By identifying and integrating sustainable practices inspired by Benin traditional architecture into modern green building designs, architects can create more culturally responsive, environmentally sustainable, and socially inclusive built environments. This objective aligns with the broader goals of promoting sustainable development, cultural heritage preservation, and resilience to climate change in the built environment.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Preamble

The study of the concepts, processes, and methods used to gather data and knowledge for the purpose of conducting independent research in order to arrive at a set of results that efficiently and satisfactorily address the research questions and contribute to the achievement of the research goals is referred to as research methodology.

According to Allan and Randy (2005), research methodology covers the process used in gathering and analyzing data as well as the logic behind the methods so that the results can be evaluated not only by the researcher; but also by other parties.

3.2 Research Design

The research design is a defined strategy or a step by step plan on how the study will be executed. According to Okoko (2002), research design is a framework that guides researcher(s) in realizing the aim of the research. Research design is the validation, analysis and interpretation of data. For the purpose of this study, the research design that will be adopted will be adopted is mixed method design.

Johnson, Onwuegbuzie & Turner in 2007 opined that mixed methods research design is a kind of design where a researcher or group of researchers combine essential ingredients of qualitative and quantitative research approaches – ―for example, use of qualitative and quantitative viewpoints, data collection, analysis, and inference techniques‖ to get a wide understanding and corroboration with breadth and depth. A significant advantage of mixed-method research is that outcome can be revealed (quantitatively) and explained why it was obtained (qualitatively).

3.3 Sources of Data

The research will apply the use of the two main sources of data in obtaining necessary information for the research; which include primary and secondary sources of data.

3.3.1 Primary Sources of Data

Primary data is the data obtained from direct content with the respondents serving as the sample for a particular research like questionnaire and oral interview. The primary data required for this research will be sourced through.

Questionnaire

The questionnaire instrument is a method of extracting data from respondents in basic questioning. It is designed in order to get responses that help in achieving the aim and objective of the research work. The questionnaire for this research contains questions and statements directed primarily towards obtaining information in respect of the study at hand which is to be administered to the professionals in the built environment (Estate Developers, Architects, and Quantity Surveyors) within the study area.

A questionnaire survey will be adopted because it can be used to gather information from large samples. A well-structured questionnaire containing closed ended questions with suggested answers measured on a 4- Likert Scale is to be used.

a. By Observation

The observation method of primary data collection includes the use of sense organs in recognizing and recording data by surveillance without interviewing the subjects of study considering the present facts and not the past or future events. Though not suitable where large samples are present because it can wear the observer down and increase fatigue, it was also employed in this study because dilapidated buildings can easily be spotted.

3.3.2 Secondary Source of Data

In order to obtain the secondary data for this research, the review on literature aspect of this presentation will be on the basis of intensive reading and studying of published textbooks, lecture notes, journal, magazines, workshop papers, articles in academic and professional journals on the subject matter with the aim of acquiring an in-depth knowledge of the subject of discussion. The analysis of the data will be interpreted by the use of methods adopted by different researchers in similar research topics.

3.4 Study Population

Population is the number of people, objects or occurrences that have similar observable features (Mugenda & Mugenda, 2003). In other word, it is the totality of the objects, individuals, and/or events; that meet the set criteria for inclusion in a research for the aim to be met (Oladun, 2012). Inferences are drawn from the characteristics of the population. For this study, the relevant population are construction professionals both in public and private organisations in Benin metropolis. Also, the property management experts (owners and managers) who are possess requisite knowledge on construction matters and understand the green process will be considered.

3.5 Sample Frame

Sampling frame refers to the list of sampling units in the survey population and also include the non-theoretical population and size from which sample are drawn i.e. the accessible population which may not include the entirety of population (Trochim, 2006). A sample frame is a population the researcher can use in determining the sample size and is a result of the target population. For the purpose of this research, list of construction professionals was gotten from the catalogue of the following professional associations in Benin; Nigerian Institute of Estate Surveyors and Valuers (NIESV), Nigerian Institute of Architects (NIA),

Real Estate Developers of Nigeria (REDAN). The populations of property owners/landlords were determined through a preliminary study.

3.6 Sampling Technique

Sampling technique is the strategy used to select respondents for the study (Oladun, 2012). It allows for studying a certain proportion of the population. According to Morenikeji (2006), the categories of quota sampling techniques include simple sampling, systematic, clustering random and stratified sampling. This study employed a simple random sampling technique in the questionnaire administration of the and data collection. This method was employed so as to give the samples equal likelihoods of being chosen. Primary data used for the analysis were collected by means of well-structured questionnaires.

3.7 Method of Data Analysis

The method used to analyze data collected was descriptive statistics. Descriptive statistics such as percentages, means item score, relative important index; were all used to present, analyse and rank the variables. Respondents' general information was analysed through percentage. Tables as well as charts were used to present the result of the analysis. Mean item score and percentages with correlation were used to analyse and rank variables in objectives 1 to check if the awareness level and adoption of green materials within the Nigerian construction industry is adequate.

Mean item score formula used for this study is written thus

Mean Item score (MIS) = $5n5+ 4n4 + 3n4 + 2n2 + 1n1$ (3.2)

$n5 + n4 + n3 + n2 + n1$

Objective two (2) which is to determine the drivers of GBM adoption; Objective three (3) which is to examine the barriers to the adoption of GBM, and objective four (4) which is to propose strategies for improving the uptake of GBM were analysed by means of relative importance index (RII) find out if the afore mentioned objectives were achieved.

Zbigniew, (1990) posit that once the score gotten by the target respondents are added up, the relative importance index (RII) can be calculated using the Relative Important Index formula; written thus

Relative Important Index (RII) =

$$\frac{\sum Pi\ Ui}{A \times N}$$

Where;

A = highest weighting (i.e. 5 used in this study)

N = Sample size

Pi = respondent rating of variables,

Ui = Number of respondents placing identical weighting/rating on variables

This study adopted the following limit point for establishing the level of importance, satisfaction, significance and / or severity of factors using relative frequency (or percentage) index:

1) (0-20%) - Very Low

2) (21-40%) – Low

3) (41-60%) - Average

4) (61-80%) – High, and

5) (81-100%) - Very High

Agresti A. (2016).

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

4.1 Preamble

This chapter discusses data presentation and interpretation. The study had three research questions. The researcher would be able to draw conclusions on the comparative study of green building features and Bini traditional features. The study questions were answered by thoroughly analysing the data. The item responses were counted and percentages determined. Since 105 questionnaires were administered, however 100 retrieved, and used to sample respondents' opinions. Respondents were drawn from stakeholders in the built environment ; property developers, architects, estate surveyors and valuers, and landlords in Nigeria.

4.2 Administration of Questionnaire

In this study, a total of 105 copies of questionnaires were administered to the above mentioned personnel's in the built environment. 100 copies (95%) were retrieved and analyzed using Statistical Package for Social Sciences (SPSS V23).

Table 4.1: Administration of Questionnaires

CLASSIFICATION	FREQUENCY	PERCENTAGE
Retrieved	100	95%
Un-retrieved	5	5%
Total	105	100%

4.3 Demographic Information

This shows details and information about the respondents with respect to their gender and professional qualification.

Table 4.2: Demographics of Respondents

Demographics	**Frequency**	**Percentage**
GENDER		
Male	55	55%
Female	45	45%
TOTAL	**100**	**100%**
Construction Industry Respondents		
Property Developers	10	10%
Architects	21	21%
Estate Surveyors	26	26%
Landlords	4	4%
TOTAL	**100**	**100%**

Source: Researcher's fieldwork 2024

Table 4.2 presents the demographics profile of the respondents. It was observed that 55 (55%) of the respondents are male while females were 45 in numbers making up 45% of the total respondents. Hence, majority of the respondents in the study area are male respondents.

The distribution of experts in the construction industry, it shows that 10 of the respondent are Property Developers representing 10%, while 21 of the respondent are architects representing 21%. 26 of the respondent are Estate Surveyors representing 26% of the respondent. Lastly, 4 (4%) of the respondents are landlords. This shows that majority of the respondents are Estate Surveyors and Valuers.

4.4 Analysis of Results

Research Question 1: What are the key architectural and construction features of green buildings and Benin traditional buildings.

Green Buildings

S/N	ITEMS	SA	A	D	SD	Mean	S.Dev
1	Green Building are built with renewable energy systems	52 (52%)	44 (44%)	4 (4%)	0	3.06	600
2	Green buildings provides indoor environmental quality	60 (60%)	40 (30%)	0	0	2.92	7.34
3	Green Buildings employ use of sustainable materials	26 (26%)	61 (61%)	12 (12%)	1 (1%)	2.89	.715
	Bini Traditional Buildings						
4	Bini Traditional Buildings are mostly built with locally obtained materials	44 (37%)	52 (35%)	4 (4%)	0	2.77	.600
5	Bini Traditional Buildings are designed to provide spaces for communal living	69 (69%)	31 31%)	0	0	3.06	.603
6	Bini traditional buildings are designed to integrate with nature.	38 (38%)	32 (32%)	11 (11%)	19 (19%)	2.51	.521

From table above, item 1 was accepted with a mean of 3.06, which implies that green buildings are built renewable energy systems. Item 2 was accepted with a mean of 2.92, which implies that the aspect of providing indoor environmental quality is fostered in green buildings. Item 3 was accepted with a mean of 2.89, which indicates that the use of sustainable materials in construction of green buildings is paramount. Item 4 was also accepted with a mean of 2.77, which implies that the design and construction of Bini traditional buildings are mostly built from locally sourced materials. Item 5 was accepted with a mean of 3.06, which shows that Bini traditional architecture emphasizes the importance of communal living and social interaction. Many buildings include shared spaces such as courtyards or gathering areas where community members can come together for various activities and ceremonies. Item 6 was accepted that the Bini traditional buildings are designed to blend harmoniously with their natural surroundings. They often feature large windows and open spaces that provide views of the surrounding landscape and allow for natural light and ventilation. With a mean of 2.51.

Research Question 2: How should materials and construction techniques can be used in green buildings and Benin traditional buildings be analyzed.

Table 4.4

S/N	ITEM	SA	A	D	SD	Mean	S.Dev
7	Benin traditional building materials and techniques address energy efficiency, water conservation, and waste reduction?	0	0	3 (3%)	97 (97%)	3.21	.795
8	Green buildings incorporate energy-efficient materials and techniques to reduce energy consumption?	74 (74%)	26 (26%)	0	0	3.10	.873
9	Adoption of green building materials and techniques could be improved in Benin traditional buildings?	44 (37%)	52 (35%)	4 (4%)	0	2.93	.792
10	Bini Traditional Buildings outperform Green Buildings in terms of environmental performance	12 (12%)	1 (1%)	26 (26%)	61 (61%)	2.26	.330

Source: Researcher's fieldwork 2024

Scale: Mean > 2.5 = Accepted

Mean < 2.5 = Rejected

From table above, item 7 was not accepted with a mean of 3.21, which show implies that Bini traditional building do not really address the need for energy efficiency, water conservation, and waste reduction. Item 8 was accepted with a mean of 3.10, which implies that green buildings are designed to incorporate energy-efficient materials and techniques to reduce energy consumption. Item 9 was accepted with a mean of 2.93, which indicates that the adoption of green building materials and techniques could be improved in Bini traditional buildings. Item 10 was not accepted that Bini traditional buildings outperform green buildings in terms of environmental performance, with a mean of 2.26.

Research Question 3: What are the potential opportunities available in integrating sustainable practices inspired by Bini traditional architecture into modern green buildings designs?

Table 4.5: Potential Opportunity available in Integrating Sustainability Practices

S/N	ITEM	SA	A	D	SD	Mean	S.Dev
11	Specific passive strategies used in bini traditional architecture, such as natural ventilation, thermal mass, and shading, can be incorporated into modern green building designs to improve energy efficiency and comfort	37 (37%)	41 (41%)	20 (20%)	2 (2%)	2.98	.834
12	Locally sourced materials, a common practice in bini traditional buildings, can be adopted in modern green building designs to reduce environmental impact and promote circular economy principles	9 (9%)	5 (5%)	41 (41%)	45 (45%)	2.40	.545
13	Innovative approaches inspired by bini traditional architecture, such as rainwater harvesting systems, courtyard designs, and passive cooling techniques, can be implemented in modern green building designs to enhance sustainability and resilience	31 (31%)	29 (29%)	25 (23%)	15 (15%)	2.51	.530
14	Lessons learned from the historical context and cultural significance of bini traditional architecture be leveraged to inspire	82 (82%)	11 (11%)	0	7 (7%)	3.10	.893

	creativity, innovation, and sustainability in the development of modern green building projects						
15	The traditional building layout and orientation of bini architecture be adapted in modern green buildings to optimize natural light, airflow, and overall environmental performance	66 (66%)	13 (13%)	11 (11%)	10 (10%)	2.53	.483

Source: Researcher's fieldwork 2024

Scale: Mean > 2.5 = Accepted

Mean < 2.5 = Rejected

From the table on the potential opportunities available in integrating sustainable practices inspired by Bini traditional architecture into modern green buildings designs, it was discovered that item 11 was also accepted with a mean of 2.98, which implies that specific passive strategies used in bini traditional architecture, such as natural ventilation, thermal mass, and shading, can be incorporated into modern green building designs to improve energy efficiency and comfort. Item 12 was not accepted with a mean of 2.40, which shows that locally sourced materials, may not be adopted into green buildings to reduce environmental impact. Item 13 was also accepted with a mean of 2.52, which implies that the innovative approaches inspired by Bini traditional architecture, such as rainwater harvesting systems, courtyard designs, and passive cooling techniques, can be implemented in modern green building designs to enhance sustainability and resilience. Item 14 was accepted with a mean of 3.10, which show that historical context and cultural significance of Bini traditional architecture be leveraged to inspire creativity, innovation, and sustainability in the development of modern green building projects. Item 15 was accepted with a mean of 2.52,

which implies that the traditional building layout and orientation of Bini architecture be adapted in modern green buildings to optimize natural light, airflow, and overall environmental performance.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The summary of findings for the study is presented in this section, conclusion reached with recommendation made as regarding the comparative study of green buildings features and Bini traditional buildings.

5.3 Summary of Findings

This study investigated the features of both building types and how they can be incorporated into each other. Three (3) objectives were raised for the study which are: To identify the key architectural development features of green buildings and Benin Traditional Buildings ; To analyze the materials and development techniques used in green building and Benin traditional buildings; To identify potential opportunities for integrating sustainable practices inspired by Bini traditional architecture into modern green buildings designs. The study adopted survey research design. The instrument for data collection was a questionnaire; it was built around the research question by the researcher and validated by the researcher's supervisor. Data collected were analysed using descriptive statistics by means of frequency, percentage and Mean and Standard deviation. The following findings from the study:

1. Green buildings are built with renewable energy systems while Bini traditional buildings are mostly built with locally sourced materials.
2. Incorporating sustainable practices inspired by traditional architecture, such as bini architecture, into modern green building designs can contribute to reducing the environmental impact of the construction sector, enhancing sustainability and resilience, and promoting eco-friendly innovation in the industry

3. Bini traditional techniques, such as using local materials, natural cooling systems, and innovative construction methods, can significantly reduce energy consumption and greenhouse gas emissions in modern buildings

5.3 Conclusion

Based on the findings, the research underscores the valuable insights that traditional building practices, particularly those exemplified by Bini traditional architecture, offer to the realm of modern sustainable construction. By examining the sustainable practices embedded in bini architecture, such as the use of local materials, passive design strategies, and climate-responsive techniques, we can glean essential lessons for creating environmentally responsible and resilient structures.

The findings highlight the potential for integrating these traditional sustainable practices into modern green building designs to enhance energy efficiency, reduce environmental impact, and promote cultural heritage preservation. By embracing the principles of adaptability, resourcefulness, and community engagement inherent in Bini traditional architecture, we can pave the way for innovative and sustainable solutions in contemporary construction.

Ultimately, the research underscores the importance of bridging the gap between traditional wisdom and modern innovation to address the pressing challenges of climate change, resource depletion, and sustainable development in the built environment. By drawing inspiration from the past and embracing sustainable practices, we can create a more harmonious and sustainable future for generations to come.

5.4 Recommendations

Based on the analysis and interpretation of the data obtained during this study, the following recommendations are made:

1. **Incentivize Sustainable Design:** Implement policies and regulations that incentivize the adoption of sustainable practices in modern green building designs, such as tax breaks, subsidies, and streamlined permitting processes.
2. **Support Research and Development:** Invest in research and development initiatives to explore innovative ways of integrating traditional sustainable practices into modern green building designs.
3. **Preserve Cultural Heritage:** Implement measures to preserve traditional building techniques and materials, ensuring their continued availability and relevance for future generations.
4. **Promote Education and Awareness:** Encourage educational programs and awareness campaigns to promote the benefits of traditional sustainable practices and their relevance to modern green building designs.
5. **Monitor and Evaluate:** Establish monitoring and evaluation systems to assess the performance of traditional sustainable practices in modern green building designs, ensuring continuous improvement and learning.

Suggesting for Further Studies

Further studies should be carried out on:

1. **Comparative Analysis**: Conduct a comparative analysis between bini traditional architecture and other traditional architectural styles in Africa to identify common sustainable practices and unique characteristics that can be integrated into modern green building designs.

2. **Policy Analysis:** Investigate the policy implications of integrating traditional sustainable practices into modern green building designs, examining how regulatory frameworks can support or hinder the adoption of these practices.
3. **Technological Innovations**: Investigate how technological innovations can be integrated with traditional sustainable practices to enhance the performance and efficiency of modern green buildings while preserving cultural heritage.

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