A COMPARATIVE STUDY OF TRADITIONAL AND MODERN BUILDING MATERIALS IN NIGERIA: ADDRESSSING THE ISSUE OF SUSBSTAINABILITY AND ENVIRONMENTAL IMPACTS.

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BENIN CITY.

MAY 2025.

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MAY 2025

DECLARATION

I, **EIGBE EDOSE SOPHIA**, hereby declare that this project work titled **"A COMPARATIVE STUDY OF TRADITIONAL AND MODERN BUILDING MATERIALS IN NIGERIA: ADDRESSSING THE ISSUE OF SUSBSTAINABILITY AND ENVIRONMENTAL IMPACTS".**

Is a record of an original work done by me, as a result of my research effort carried out in the department of architecture, faculty of Environmental Science, university of Benin, under the supervision of Arc. Bello Oluwatoyin. All academic material used in this work and their sources has been duly acknowledge.

…….. …….

EIGBE EDOSE SOPHIA **DATE**

CERTIFICATION

This is to certify that this study entitled **A COMPARATIVE STUDY OF TRADITIONAL AND MODERN BUILDING MATERIALS IN NIGERIA: ADDRESSSING THE ISSUE OF SUSBSTAINABILITY AND ENVIRONMENTAL IMPACTS.** Was carried out by EIGBE EDOSE SOPHIA with Matriculation Number ENV2103337 in the department of Architecture, Faculty of Environmental Science, University of Benin, Benin city under the supervision of Arc. Bello Oluwatoyin.

I certify that it has not been submitted for Bachelor Degree in this or any other University and is approved for its contribution to knowledge and literary presentation.

..... **.....**

Arc. Bello Oluwatoyin **Date**

(Project supervisor)

..... **.....**

Arc. Henry Omorogbe **Date**

(Head of Department)

..... **.....**

EXTERNAL EXAMINER **Date**

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ABSTRACT

The construction industry in Nigeria faces significant challenges in balancing economic growth with environmental sustainability. This study compares traditional and modern building materials in Nigeria, focusing on their sustainability and environmental impact. Traditional material (mud, thatch, bamboo). Are evaluated alongside modern materials (e.g., concrete, steel, glass) using Life cycle Assessment (LCA) and case studies. The research investigates the environmental implication of materiSal extraction, processing, construction, and disposal. Factors such as energy consumption, greenhouse gas emission, and indoor air quality are assessed. The study reveal that traditional materials exhibits superior sustainability characteristics, including lower carbon footprints, reduced waste generation, and enhanced thermal performance. However modern materials offer improved durability and structural integrity. Policy and regulatory frameworks analyzed to identify barriers to sustainable building practices.

CHAPTER ONE

1.1 INTRODUCTION

The choice of building materials plays a critical role in the sustainability and environmental impact of the built environment. In Nigeria, the evolution of construction materials has transitioned from traditional materials such as adobe, bamboo, thatch, and laterite to modern materials like concrete, steel, and glass. While modern materials offer structural efficiency and durability, their production and usage often contribute significantly to environmental degradation, carbon emissions, and resource depletion. Conversely, traditional materials, though often considered outdated, are typically more environmentally friendly and sustainable.

This study focuses on comparing traditional and modern building materials in Nigeria, with an emphasis on sustainability and environmental impact. By evaluating the life cycle assessment (LCA) of these materials, assessing their ecological footprint, and understanding their performance in local climatic conditions, this research aims to provide insights into how Nigeria's construction industry can adopt more sustainable building practices. The study area, Ugbowo in Benin City, Edo state Nigeria, represents a growing urban environment where both traditional and modern materials are in use, making it an ideal case study for this comparative analysis.

1.2 BACKGROUND OF THE STUDY

The construction industry is one of the largest contributors to environmental degradation, accounting for about 39% of global carbon emissions (UNEP, 2021). This is due to high energy consumption, waste generation, and resource exploitation in the production of modern building materials like cement, steel, and glass. In Nigeria, rapid urbanization has led to increased dependence on these modern materials, often at the expense of traditional, locally sourced materials.

Historically, Nigerian Architecture relied on materials like adobe (mud bricks), bamboo, raffia palm, and thatch, which were readily available, cost-effective, and environmentally friendly. However, with modernization, these materials have been largely replaced by cement blocks, reinforced concrete, and aluminum roofing sheets due to perceived durability, aesthetics, and structural integrity**.**

Despite these advantages, modern materials pose sustainability challenges, including high embodied energy, increased carbon footprint, and poor thermal performance in tropical climates. On the other hand, traditional materials, though less favored due to maintenance concerns and social perception, have a lower environmental impact and better adaptability to local climate conditions.

This study explores how Nigeria's construction sector can integrate traditional materials with modern innovations to enhance sustainability while minimizing environmental harm. The construction industry is a significant contributor to Nigeria's economic growth, but it also poses environmental challenges. The industry's reliance on nonrenewal resources, energy consumption, waste generation has severe impact on the environment. Traditional building materials used for centuries, offer suitable alternative. However, modern materials have become increasingly popular due to their study aims to compare traditional and modern building materials in Nigeria, focusing on sustainability and environmental impacts. *(*Akinmoladun, O., & Omotosho, E. (2019).

It has become increasingly glaring that most of the urban population live in dehumanizing housing environment while those that have access to average housing do so at abnormal cost *(Olugbenga, 2001*). In developing countries like Nigeria, a home of one's own represents a precious refuge. Literature on housing in developing countries often show that housing ranks

above education and health services as a priority. Thus, households in developing countries value homeownership more than households in advanced industrialized countries.

1.3 STATEMENT OF THE PROBLEM

Several challenges arise from the shift from traditional to modern building materials in Nigeria, including**:**

1. **Environmental Impact:** The production of modern materials such as cement and steel contribute significantly to greenhouse gas emissions, whereas traditional materials tend to be more sustainable.
2. **Sustainability Concerns:** Modern materials have high embodied energy, and their disposal contributes to waste accumulation, while traditional materials are often biodegradable and eco-friendly.
3. **Thermal Performance:** Many modern materials perform poorly in Nigeria's hot climate, leading to increased reliance on air conditioning and higher energy consumption**.**
4. **Cost Implications:** Modern materials are often more expensive due to manufacturing and transportation costs, whereas traditional materials are usually locally available and affordable.
5. **Social Perception and Acceptance:** Traditional materials are often viewed as inferior or outdated, limiting their adoption despite their sustainability benefits.
6. **Durability and Maintenance**: Traditional materials require regular maintenance, which discourages their use in favor of modern alternatives that demand less frequent repairs.

These issues underscore the need for a comparative study to evaluate the viability of integrating traditional materials into contemporary building practices to promote sustainability.

1.4 RESEARCH QUESTIONS

This study seeks to answer the following questions:

1. What are the environmental impacts of traditional and modern building materials in Nigeria?
2. How do traditional and modern building materials compare in terms of sustainability and life cycle assessment?
3. What are the economic implications of using traditional versus modern materials?
4. How do these materials perform in relation to Nigeria's climate and thermal comfort?
5. What strategies can be adopted to improve the sustainability of building materials in Nigeria?

1.5 RESEARCH OBJECTIVES

1. To evaluate the environmental impacts of traditional and modern building materials in Nigeria.
2. To assess the sustainability of these materials using life cycle assessment (LCA) methodologies.
3. To compare the cost-effectiveness of traditional and modern building materials.
4. To examine the thermal performance and energy efficiency of both material types.
5. To propose strategies for integrating sustainable materials into Nigeria's construction industry.

1.6 JUSTIFICATION OF THE STUDY

The growing concern over environmental degradation, climate change, and resource depletion necessitates a shift towards sustainable building practices. This study is justified on the following grounds:

1. Environmental Conservation: The findings will provide insights into how Nigeria's construction industry can reduce its environmental footprint.
2. Sustainable Development: This study aligns with the United Nations Sustainable Development Goal (SDG) 11, which advocates for sustainable cities and communities.
3. Economic Benefits: Understanding the cost-effectiveness of traditional and modern materials can help reduce housing costs in Nigeria.
4. Cultural Preservation: The study will highlight the importance of traditional materials and how they can be modernized for contemporary use.
5. Policy Recommendations: The research will provide recommendations that can inform policies on sustainable building practices in Nigeria.

1.7 SCOPE OF THE STUDY

This study focuses on the comparative analysis of traditional and modern building materials in Nigeria, specifically evaluating their sustainability and environmental impact. The research will be limited to:

1. Study Area: Ugbowo, Benin City, Edo State, Nigeria.
2. Materials Considered: Traditional materials (mud bricks, bamboo, raffia palm, thatch, rammed earth, timber) and modern materials (concrete, steel, glass, aluminum).

3. Parameters Assessed: Environmental impact, life cycle assessment, cost-effectiveness, and thermal performance.

1.8 STUDY AREA

Ugbowo, Egor LGA, Benin City, Edo State, Nigeria.

1.8.1 OVERVIEW OF THE STUDY AREA

The study is focused on Egor Local Government in Benin City, Edo State, Nigeria. This area was selected due to its diverse urbanization patterns, which include both traditional and modern building practices. The comparison of building materials in this area provides a clearer understanding of how sustainability and environmental impacts vary between traditional and modern construction methods in Nigeria.

1.8.2 LOCATION AND GEOGRAPHIC CHARACTERISTICS

Egor Local Government located in Benin City, which lies within the coordinates of latitude 6.34°N and longitude 5.63°E. Benin City, has a tropical climate, with distinct wet and dry seasons that influence building materials choices.

The climatic conditions of the study area play a critical role in determining the suitability of building materials.

Climate factor	Description
Average temperature	26°C
Rainfall	1500mm – 2000mm
Humidity	High, especially during the wet season
Dry season	November – march
Wet season	April - October

Table 1.: Climate Characteristics of Benin City

The climate conditions of the study area play a critical role in determining the suitability of building materials. Traditional materials such as mud bricks and thatch provide better thermal regulation in hot climates, while modern materials like concrete and steel often require additional cooling mechanisms such as air conditioning, increasing energy consumption.

1.8.3 ENVIRONMENTAL AND SUSTAINABILITY CONSIDERATIONS IN THE STUDY AREA

Due to rapid urbanization and modernization in Egor Local Government Area, the environmental impact of construction activities is a growing concern. Some key issues include:

1. Deforestation: The use of timber and thatch in traditional buildings leads to deforestation, though at a lower scale compared to large-scale production of modern materials.
2. Carbon Emissions: The manufacturing of cement and steel used in modern buildings significantly contributes to carbon emissions, affecting air quality in urban areas.
3. Waste Generation: Construction waste from modern materials such as concrete and plastic-based finishes contribute to environmental pollution.
4. Thermal Performance: Traditional materials such as mud bricks have better insulation properties, reducing the need for artificial cooling, whereas concrete and steel structures absorb and retain heat, increasing energy consumption.

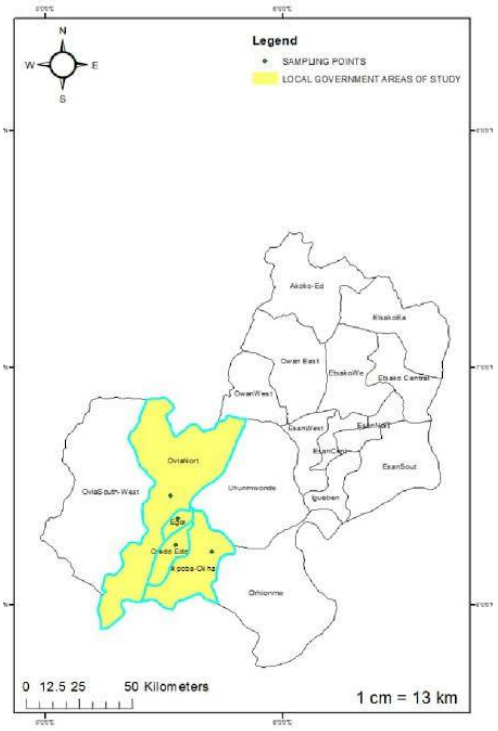

Figure 1. Showing map of Edo state

1.8.4 JUSTIFICATION FOR SELECTING EGOR LOCAL GOVERNMENT AREA, BENIN CITY, EDO STATE, NIGERIA AS STUDY AREAS

The selection of Egor for this study is justified due to the following reasons:

1. Presence of Both Traditional and Modern Buildings: These areas offer a diverse range of buildings constructed with both traditional and modern materials, allowing for an in-depth comparative study.
2. Rapid Urbanization: Egor is experiencing fast urban growth, making it crucial to assess the sustainability of current construction trends.
3. Environmental Impact Concerns: The environmental consequences of building materials, such as carbon emissions and waste generation, are becoming more prominent in these areas, making them ideal for this research.

1.8.5 EXPECTED CONTRIBUTION OF THE STUDY IN THE SELECTED AREA

This study aims to provide valuable insights that will:

1 Help urban planners and policymakers develop sustainable building regulations.

2 Guide architects and builders in selecting environmentally friendly materials.

3 Promote the adoption of eco-friendly materials in both urban and rural housing.

4 Raise awareness about the benefits of traditional materials and how they can be integrated with modern construction techniques.

1.9 SIGNIFICANCE OF THE STUDY

Ugbowo is a strategic area in Egor Local Government Area in Benin-City, Edo State, known for its mix of residential, commercial, and institutional buildings. The presence of the University of Benin and a growing population has driven rapid urbanization, increasing the demand for modern construction materials. However, traditional buildings still exist in some parts, making it an ideal case study for this research.

The significance of this study lies in its potential contributions to sustainable architecture and environmental management in Nigeria.

The study will:

1. Provide empirical data on the sustainability of traditional vs. modern materials.
2. Support architects, builders, and policymakers in making informed decisions on material selection.
3. Encourage the adoption of eco-friendly construction practices in Nigeria.
4. Contribute to academic literature on sustainable building materials.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The construction industry plays a vital role in Nigeria's economic development, but its environmental impact has become a significant concern. The industry's reliance on non-renewable resources, energy consumption, and waste generation has severe implication for the environment.

The choice of building materials plays a crucial role in the construction industry, influencing the sustainability, durability, and environmental impact of buildings. In Nigeria, the shift from traditional to modern building materials has raised concerns about ecological sustainability and environmental degradation. This chapter reviews relevant literature on traditional and modern building materials in Nigeria, their sustainability, and their environmental impacts. The chapter also examines the concepts of sustainability and environmental impact in the context of building materials.

2.2 DEFINITION AND CONCEPT OF BUILDING MATERIALS

Building materials are substances used in construction to create structures such as residential, commercial, and industrial buildings. They can be categorized based on their composition, function, and environmental impact. Traditional building materials are those that have been used historically, often sourced locally and naturally, whereas modern building materials are industrially produced for enhanced strength, aesthetics, and efficiency Olotuah, A. O. (2015)

2.2.1 TRADITIONAL BUILDING MATERIALS IN NIGERIA

HISTORICAL CONTEXT

Traditional building materials have been used in Nigeria for centuries. Studies have shown that these materials offer several benefits, including;

1. ENERGY EFFICIENT: Environmental protective measures ensure reduction of operational energy in construction. Studies according to Davis, M. L., & Cornwell, D. A. (2008). Reveals that the building sectors consume more than one third of the world's energy, and contribute to global warming. A typical traditional building of earth emits fewer greenhouse gases, consumes less energy, and maintains a high level of internal thermal comfort, regardless of prevailing solar radiation outside *(Iwuagwu and Azubuine, 2015).*

2. OZONE FRIENDLY: The built environment contributes ultimately to global warming by its high rates of greenhouse gases emission through energy use (for cooling, heating, and lighting) and construction. Local building materials projects a possibility of total reduction to a near zero carbon emission of buildings. Local building materials are eco-friendly, climate responsive and organic protective measures to safeguard and as well minimize environmental impact. The thermal insulation, energy saving, etcetera of local building materials reduces negative environmental impact. The proximity of materials saves cost and reduces pollution by fuel burning through transportation.

3. REUSABILITY: Reusability is a function of the age and durability of a material. Very durable materials may have many useful years of service left when the building in which they are installed is decommissioned, and may be easily extracted and
4. reinstalled in a new site. Windows and doors, even brick can be successfully reused. Timber from old barns
   has become fashionable as a reclaimed material for new construction.

5. BIODEGRADABILITY: The biodegradability of a material refers to its potential to naturally decompose when discarded. Organic materials can return to the earth rapidly, while

others, like steel, take a long time. An important consideration is whether the material in question will produce hazardous materials as it decomposes, either alone or in combination with other substances. Traditional African building materials exhibit this characteristic, example include, earth, thatch, bamboo, timber etcetera

2.3.2 CHARACTERISTICS AND ADVANTAGES

ACCEPTABILITY**:** The future of any Architecture depends on the extent to which it is acceptable to the people for whom it is intended. The notion that buildings of traditional materials

are substandard is the main obstacle to the development of an authentic African Architecture that is truly indigenous to the people. Perhaps issue of acceptability has brought destruction

of traditional values and their replacement with alien ones.

DURABILITY/ LOW STRENGTH: The highest problem of houses built with traditional African building materials was the low strength of the houses, implying that the locally available materials have strength that is below expectation when compared with strength of the houses built with conventional materials such as cement, concrete, steel, among others. The strength of every house is important because it determines the durability and security of the house. This is consistent with the view of *Venkatarama and Prasanna (2009)* that one of the drawbacks for using earth alone as a material for construction is its durability which is strongly related to its compressive strength. *Riza et al. (2011*) further explained that most soil in their natural condition lack the strength, stability and durability required for building construction. The above indicates that the local materials for building houses lack the desired strength and improvement of their strength properties would be beneficial to the users.

Building Tall: The nature and strength of these traditional building materials make it impossible for building tall. They encourage low rise buildings leading to over use of land. Millions of acres of land in Africa have buildings constructed on them. For instance, spread of buildings require the construction of new roads, drainage, utility poles, and other infrastructure, which lead to, habitat destruction, land disturbance and erosion, environmental pollution, global warming among other.

Deforestation: the building materials sources in Africa contribute to prevailing problem of deforestation on the continent. When timber for construction is harvested, in many cases, replacement trees are not planted, if replanted, the rate of replacement is far lower than the rate of consumption.

Civilization: Local and indigenous cultures have practiced sustainable resource use due to their practical experience and human dependency on earth's life support systems. Traditional communities integrated buildings into the natural environment in terms of adequate use of cost effective and easily assessable local building material for construction and maintenance. However, importation and the use of imported building materials has put the African traditional and sustainable way of building and construction processes in danger, thus relegating our architecture.

Frequent Maintenance: Frequent maintenance of houses built with local materials especially earth, is another challenge facing African architecture. According to Rumana (2007) there is high maintenance requirement of earthen plinth and walls which are often plastered, especially during the wet season. This is due to the low strength of the materials that make it a requirement for the frequent maintenance in order to keep the building is good condition for use. If the houses built

with local materials are not maintained regularly, they will deteriorate in some few years after their construction due to their vulnerability to weather such as rain and storm.

Traditional building materials in Nigeria are derived from natural sources and have been used for centuries due to their availability and adaptability to the local climate. These materials include:

a) Mud and Clay

Mud and clay are among the oldest building materials in Nigeria, commonly used for constructing walls and floors. They offer excellent thermal insulation, reducing the need for artificial cooling in hot climates. However, they are susceptible to erosion and require maintenance (Olotuah & Bobadoye, 2009).

Figure 2. Showing Adobe Bricks. Source: Robert O (2018)

b) Thatched Roofs (Palm Fronds and Grass)

Thatched roofs, made from palm fronds or grass, are lightweight and provide good ventilation. However, they have a short lifespan and are highly flammable (Adekunle, 2015).

c) Timber and Bamboo

Timber and bamboo are renewable resources widely used for structural frameworks, roofing, and furniture. However**,** deforestation due to excessive timber use has raised environmental concerns (Adebayo, 2017).

d) Stone

Stone is used for constructing walls and foundations in some regions of Nigeria. It is durable but requires skilled labor and is labor-intensive to process (Agboola, 2011).

e) Laterite

Laterite, a soil rich in iron and aluminum, is used in traditional construction for making bricks and walls. It is durable, cost-effective, and has good thermal insulation properties (Eboh, 2018).

Figure 3. Shows laterite soil used in Nigeria.
Source: Oyenuga, V. A. (2019).

2.2.2 MODERN BUILDING MATERIALS IN NIGERIA

Modern building materials have emerged due to advancements in construction technology and industrialization. These materials are designed for durability, efficiency, and aesthetics.

a) Cement and Concrete

Cement is one of the most widely used modern building materials in Nigeria, primarily for producing concrete. While concrete is strong and durable, cement production is a major contributor to CO_2 emissions (Bamgbose, 2020).

b) Steel and Aluminum

Steel and aluminum are used in modern construction for structural frameworks, reinforcement, and roofing. These materials offer high strength and durability but require significant energy for production, leading to environmental concerns (Ogunsemi, 2019).

c) Glass

Glass is used for aesthetics, natural lighting, and energy efficiency in modern buildings. However, its production process is energy-intensive (Ayodele, 2021).

d) Plastics and Synthetic Materials

Plastics and synthetic materials such as PVC are increasingly used in construction for pipes, window frames, and interior finishes. While they offer durability and affordability, their non-biodegradable nature contributes to environmental pollution (Akinyemi, 2018).

e) Ceramic and Porcelain Tiles

Ceramic and porcelain tiles are widely used for flooring and wall finishes due to their aesthetic appeal and longevity. However, their production consumes large amounts of energy and water (Okonkwo, 2022).

Critic	**Tradition Materials**	**Modern Materials**
Sustainability	More sustainable, locally available	Less suitable, resource-intensive
Environmental Impact	Low carbon footprint, biodegradable	High carbon footprint, non-biodegradable
Energy consumption	Low energy for production	High energy consumption
Durability	Requires frequent maintenance	Long-lasting but may require chemical treatments
Cost	Generally cheaper	More expensive due to production and importation
Aesthetic appeal	Traditional appearance, cultural significant	Modern aesthetics, high flexibility

Table 2. provides a comparison between traditional and modern building materials based on selected characteristics.

Brown, G., & Ed. (2010)

2.3 SUSTAINABILITY OF BUILDING MATERIALS

Sustainability in construction involves minimizing environmental impact while ensuring economic and social benefits. Sustainable building materials should be energy-efficient, durable, and environmentally friendly (UNEP, 2020).

2.3.1 RESOURCE AVAILABILITY AND RENEWABILITY

Materials like timber and bamboo are renewable, whereas materials such as cement and steel require extensive resource extraction (Olabode, 2017).

2.3.2 ENERGY CONSUMPTION IN PRODUCTION

Modern materials require more energy for production than traditional materials. For example, cement production is highly energy-intensive (UNEP, 2020).

2.3.3 WASTE GENERATION AND RECYCLING

Traditional materials are biodegradable, while modern materials like plastics contribute to long-term waste problems (Bamgbose, 2020).

2.3.4 DURABILITY AND MAINTENANCE

Modern materials generally last longer but require intensive maintenance, while traditional materials need frequent repairs but have a lower environmental footprint (Ogunsemi, 2019).

2.4 ENVIRONMENTAL IMPACT OF BUILDING MATERIALS

1. **Carbon Footprint and Greenhouse Gas Emissions**

   Cement and steel production are major contributors to CO_2 emissions (Olabode, 2017).

2. **Deforestation and Biodiversity Loss**

   The excessive use of timber for construction has led to deforestation, soil degradation, and biodiversity loss (Adebayo, 2017).

3. **Waste Management and Pollution**

   Non-biodegradable materials like plastics cause pollution, while biodegradable materials decompose naturally (Ayodele, 2021).

2.4.1 ENERGY CONSUMPTION AND CLIMATE CHANGE

The production of modern materials requires large amounts of energy, contributing to climate change (UNEP, 2020).

2.5 SUMMARY

This chapter reviewed the concepts of traditional and modern building materials in Nigeria, their sustainability, and their environmental impacts. Traditional materials are generally more environmentally friendly but require frequent maintenance. Modern materials offer durability and improved aesthetics but often have a high carbon footprint. Sustainable construction practices must balance the use of both traditional and modern materials to minimize environmental impact while maintaining efficiency and cost-effectiveness.

CHAPTER THREE

RESERCH METHODOLOGY

3.1 INTRODUCTION

This chapter outlines the methodology used to compare traditional and modern building materials in Nigeria. focusing on sustainability and environmental impact. It includes research design, sampling techniques, study area details, data collection methods, data analysis techniques, Life Cycle Assessment (LCA), Environmental Impact Assessment (EIA), and ethical considerations.

3.2 RESEARCH DESIGN

This study adopts a mixed-method research design, combining quantitative and qualitative approaches. The quantitative aspect involves numerical data collection on the durability, cost, energy efficiency, and carbon footprint of selected building materials.

3.2.1 QUALITATIVE RESEARCH:

The qualitative aspect includes expert opinions, interviews, and case studies on sustainability in material selection

3.2.2 QUANTITATIVE RESEARCH:

Quantitative methods were employed to gather structured data regarding preferences and opinions regarding buildings made with traditional building materials and buildings made with modern building materials in Nigeria. This consist of survey distributed to specialist and community members of Egor Local Government Area, Benin City, Edo State.

3.2.3 CASE STUDIES

The case study approach was used to analyze specific buildings constructed with either traditional or modern materials in Nigeria. The purpose of the case studies was to assess the performance, durability, sustainability, and environmental impact of these materials in real-life applications. Selected case studies included buildings in different regions to reflect varying climatic conditions and construction practices.

Selection Criteria for Case Studies:

1. Buildings constructed with predominantly traditional materials (e.g., mud, thatch, timber, and laterite).
2. Buildings constructed with modern materials (e.g., concrete, steel, glass, and synthetic materials).
3. Structures that have existed for a long period to assess durability and maintenance requirements.
4. Consideration of geographic diversity, including urban and rural areas.

Data Collected from Case Studies:

- Type of materials used in construction.
- Longevity and durability of the buildings.
- Maintenance practices and costs.
- Environmental effects (e.g., energy consumption, waste generation, carbon footprint).

3.2.4 SURVEYS

Surveys were conducted to gather quantitative and qualitative data from stakeholders in the construction industry, including architects, builders, engineers, environmentalists, and homeowners. The survey method was chosen to obtain broad perspectives on the sustainability and environmental impact of different building materials.

SURVEY DESIGN AND DISTRIBUTION:

Structured questionnaires were distributed to professionals and residents in different regions of Nigeria.

1. The questions focused on material preference, environmental considerations, cost implications, and sustainability awareness.
2. Both open-ended and closed-ended questions were included to allow for diverse responses.
3. The surveys were conducted through online forms distribution to ensure wider participation.

3.3 DATA ANALYSIS TECHNIQUES

Data analysis techniques were applied to evaluate and interpret the information gathered from case studies and surveys. The analysis methods included qualitative data analysis, quantitative data analysis, and cross-data analysis to ensure a comprehensive understanding of the findings.

3.3.1 QUALITATIVE DATA ANALYSIS

Qualitative data analysis was used to interpret non-numerical data obtained from case studies and open-ended survey responses. The analysis focused on identifying patterns, themes, and trends in respondents' views on sustainability and environmental impact. Content analysis was employed to examine responses from professionals regarding the effectiveness of traditional and modern materials.

Quantitative analysis was conducted using statistical tools to evaluate numerical data obtained from surveys. Descriptive statistics, such as percentages, means, and standard deviations, were used to summarize the responses. Graphs, tables, and charts were employed to illustrate key findings.

3.3.2 QUANTITATIVE DATA ANALYSIS

Quantitative analysis was conducted using statistical tools to evaluate numerical data obtained from surveys. Descriptive statistics, such as percentages, means, and standard deviations, were used to summarize the responses. Graphs, tables, and charts were employed to illustrate key findings.

Examples of Quantitative Data Analysis:

1. Percentage of respondents who prefer traditional vs. modern materials.
2. Cost comparison of maintenance between traditional and modern materials.
3. Carbon footprint comparison of different materials.
4. Durability ratings of selected materials based on survey responses.

3.4 SAMPLING TECHNIQUES:

A purposive sampling technique is used to select professionals in the building industry within Egor LGA, including Architects, Builders, And Urban Planners etc. This ensures that participants have relevant expertise.

Additionally, stratified random sampling is used to collect data from residential, commercial, and institutional buildings in Ugbowo to capture the diversity in building material usage.

3.4 DATA ANALYSIS TECHNIQUES

The collected data is analyzed using descriptive and inferential statistics:

Descriptive statistics: Frequency distribution, mean, and percentage analysis.

Comparative analysis: Examining the performance of traditional vs. modern materials.

Data Analysis techniques and Applications

Analysis technique	**Purpose**
Descriptive statistics	Summarize trends and patterns in materials use
Comparative Analysis	Identify difference between traditional and modern materials

Table 3. Showing data analysis technique

3.5 ETHICAL CONSIDERATIONS

Informed consent: Participants are informed about the research objectives.

Confidentiality: All responses remain confidential

Non-bias policy: The study remains neutral in comparing traditional and modern materials.

Data accuracy: Findings are transparently analyzed and presented.

CHAPTER FOUR

RESULTS AND DISCUSSION OF FINDINGS

4.1 INTRODUCTION:

This chapter presents the analysis and interpretation of data is analyzed to examine the sustainability characteristics and environmental impact of traditional and modern building materials. The analysis includes descriptive statistics, comparative analysis, environmental assessment, and an evaluation of policy and regulatory framework governing the use of these materials in Nigeria.

The data is analyzed based on the study's objectives:

- To compare the sustainability characteristics of traditional and modern building materials.
- To assess their environmental impact.
- To examine existing policies and regulations on building materials in Nigeria.

The results are presented in tables, charts, and graphs for clarity.

4.2 DEMOGRAPHIC INFORMATION OF RESPONDENTS

Out of 61 respondents, 19.7% were between the age of 16 and 18 years, 62.3% were between the age of 21 and 25 years, 14. 8% were between the age of 26 and 30 years.

59% of the respondents were Architects in profession, 8.2% were Estate managers, 6.6% of the respondent were Quantity Surveyor, Urban planners, Civil Engineers, while 26.2% other professions.

Age bracket (years)	Percentage %
16 – 20	19.7%
21 – 25	62.3%
26 – 30	14.8%
Total	100%

Table 4. Age Distribution of Respondents

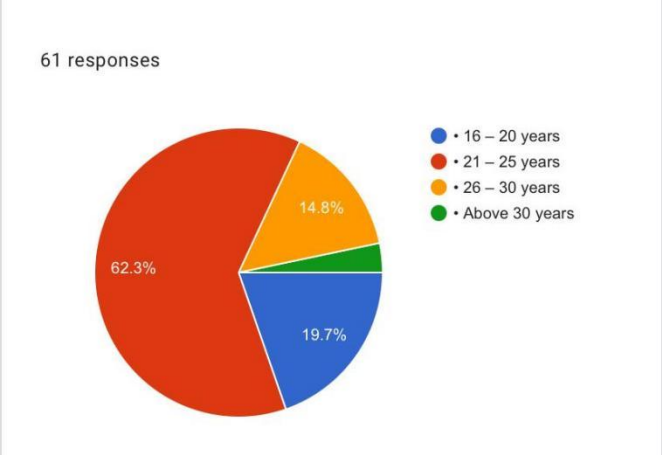

Figure 4.1 pie chart showing the age range of respondents

Profession	Percentage%
Architecture	59%
QSV	2.2%
URP	2.2%
ESM	8.2%
Civil engineering	2.2%
others	26.2%

Table 5: Occupation of Respondents

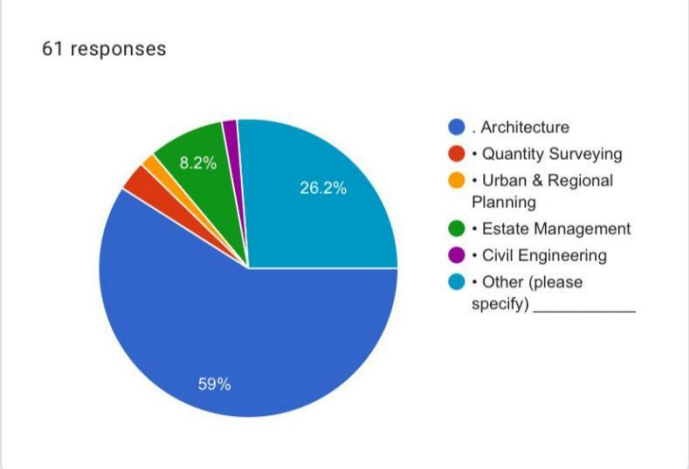

Figure 4.2 showing the profession of respondent

Response	**Percentage %**
Yes	70.5%
No	29.5%

Table 6: knowledge on different building materials

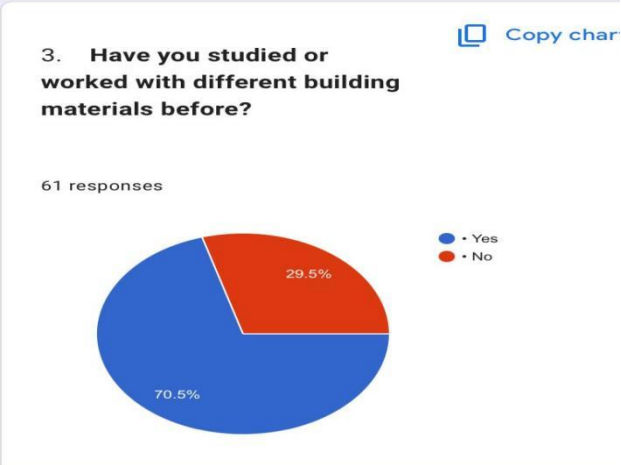

Figure 4.3 showing respondents knowledge on types of building materials

4.4 COMPARATIVE ANALYSIS OFSUSTAINABILTY CHARACTERISTICS

This section present data on how respondent perceive the sustainability attributes of traditional vs. modern materials.

4.4.1 BUILDING MATERIALS AND SUSTAINABILITY

Out of 61 respondents, 55.7% said modern materials are commonly used in Nigeria, 42.6% said a combination of modern and traditional materials are commonly used in Nigeria.

The analysis carried out showed that 55.7% of the respondent agreed that the type of building material used depends on the location and project, 16.4% agreed with traditional materials are more cost-effective for construction, 27.9% of the respondent said modern materials are more cost-effective for construction.

According to the analysis, 80.3% of the respondents thinks higher durability is the reason modern materials are preferred in construction today.

Table 4.4: commonly used materials in Nigeria

Materials	**Percentage**
Traditional building materials	1.7%
Modern building materials	55.7%
Combination of both	42.6%

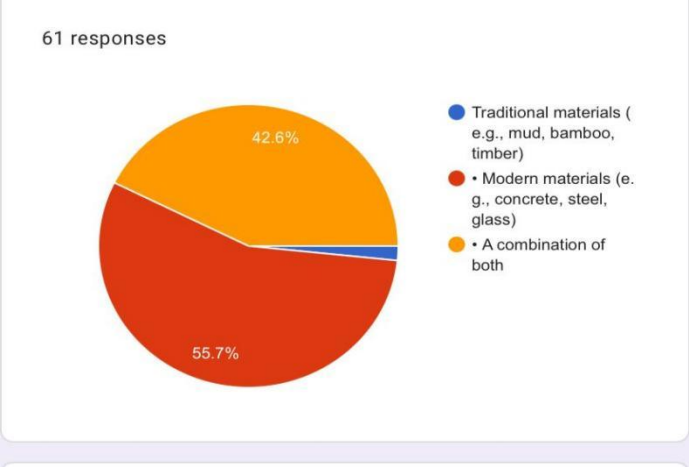

Figure 4.4 pie chart showing the building materials commonly used in Nigeria

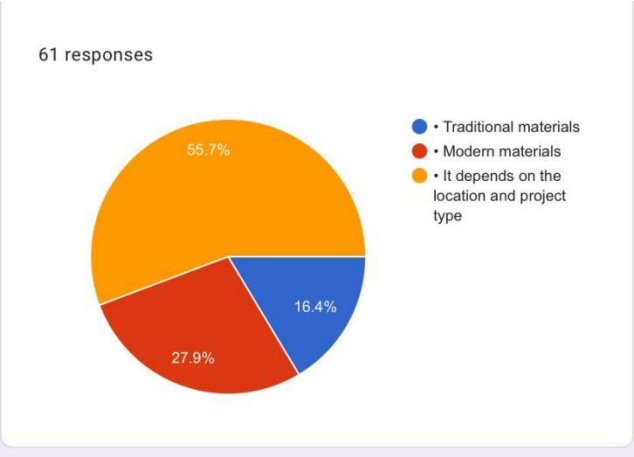

Figure 4.5 pie chart showing the material that is cost-effective for construction

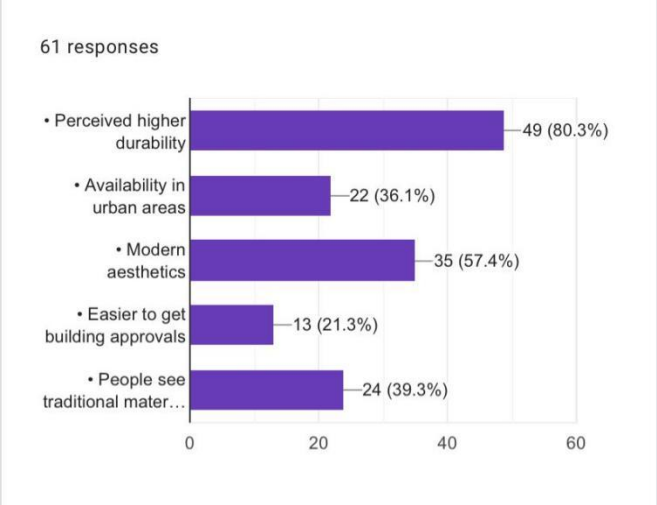

Figure 4.6 bar chart showing why modern building materials are preferred in the construction.

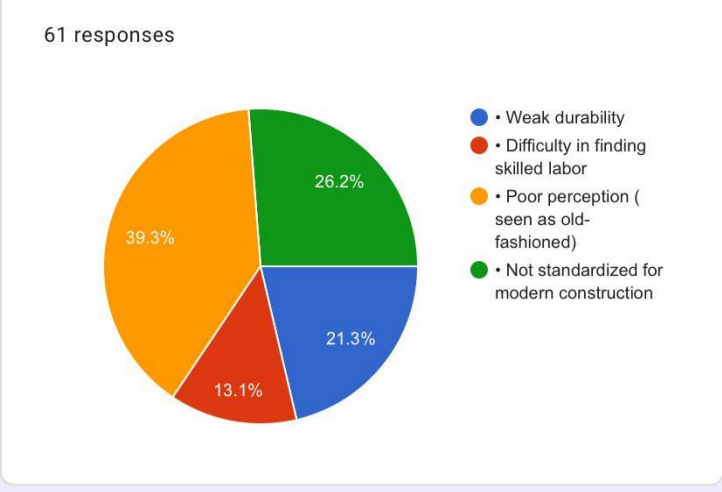

Figure 4.7 pie chart showing the biggest challenge with traditional building materials in Nigeria.

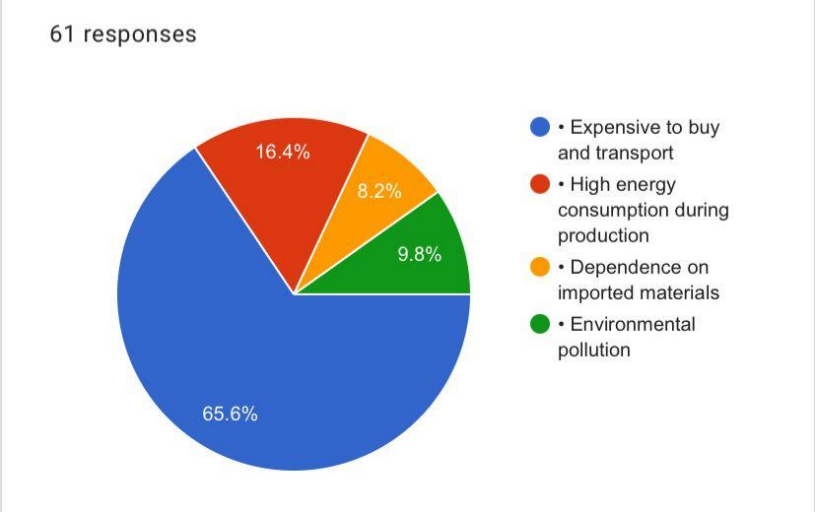

Figure 4.8 showing the possible problem with modern building materials

4.5 ENVIRONMENTAL IMPACT OF BUILDING MATERIAL

This section present responses on how traditional and modern materials affect the environment.

Out of the 61 responses, 59% agreed that traditional building materials has lower negative impact on the environment, while 21.3% thinks modern materials has lower negative impact on the environment, 19.7% were not sure of which building materials has lower negative impact on the environment.

From the analysis carried out, respondent agreed that major environmental concerns caused by modern materials are generated from manufacturing of cement, steel, others could be from waste generation from constructions, not to exclude high energy consumption in productions.

82% of the respondent said one of the reasons that makes traditional materials more sustainable is because they are locally available and requires less energy, other responses is that they adapt well to Nigeria climates condition, others said it is because they decompose naturally.

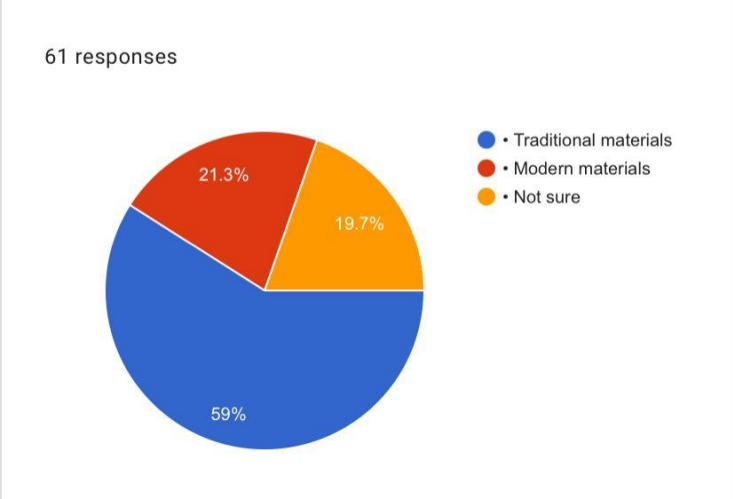

Figure 4.9 pie chart showing the building material that have a lower negative impact on the environment.

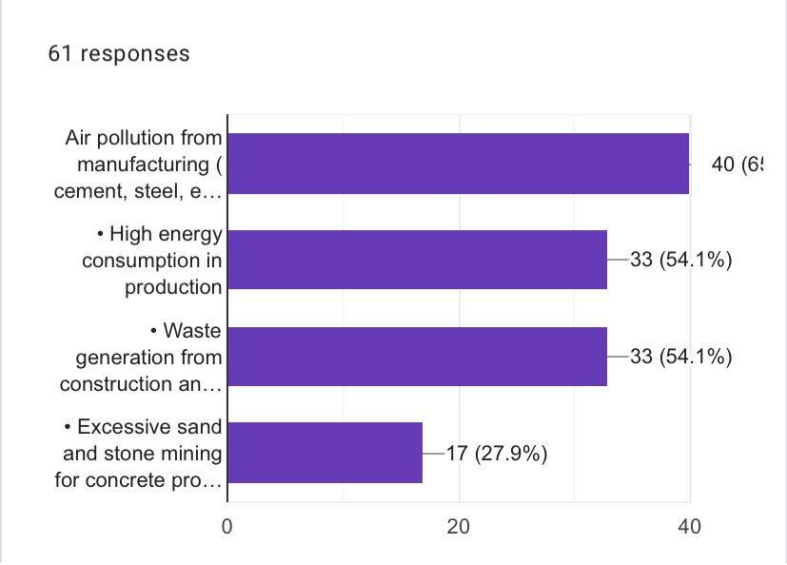

Figure 4.10 bar chart showing the major environmental concerns caused by modern materials

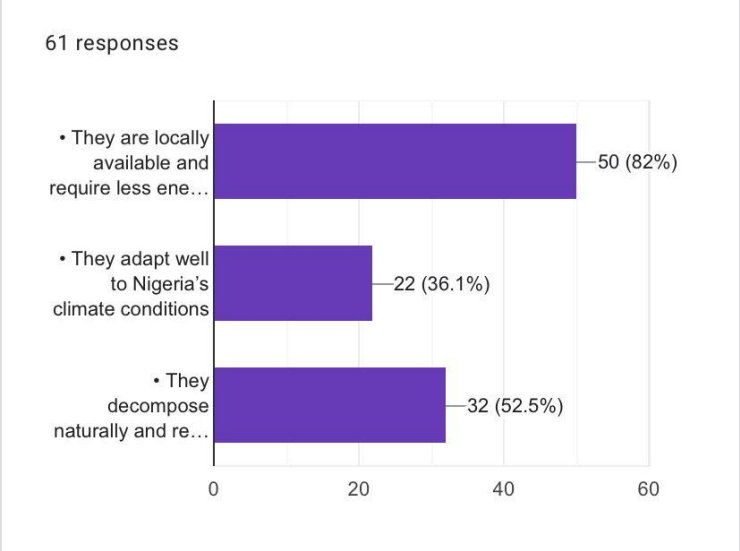

Figure 4.11 bar chart showing what makes traditional materials more suitable.

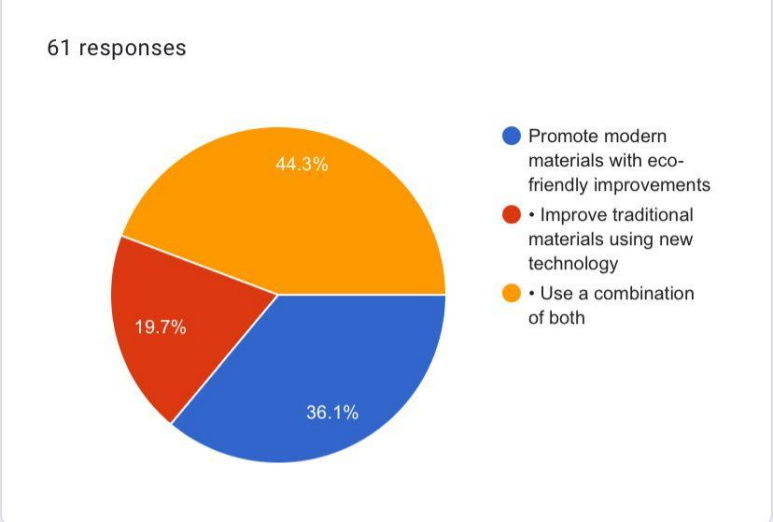

Figure 4.12 pie chart showing how modern materials should be modified to be more eco-friendly.

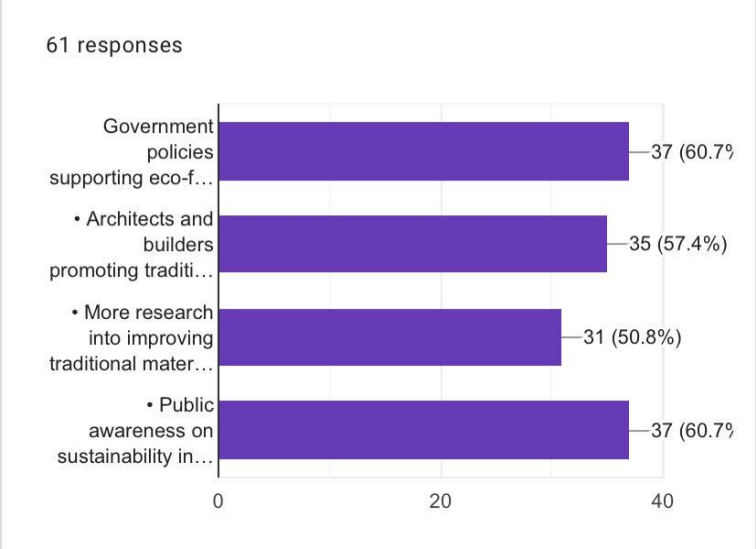

Figure 4.13 bar chart showing what can be done to encourage the use of more suitable building materials.

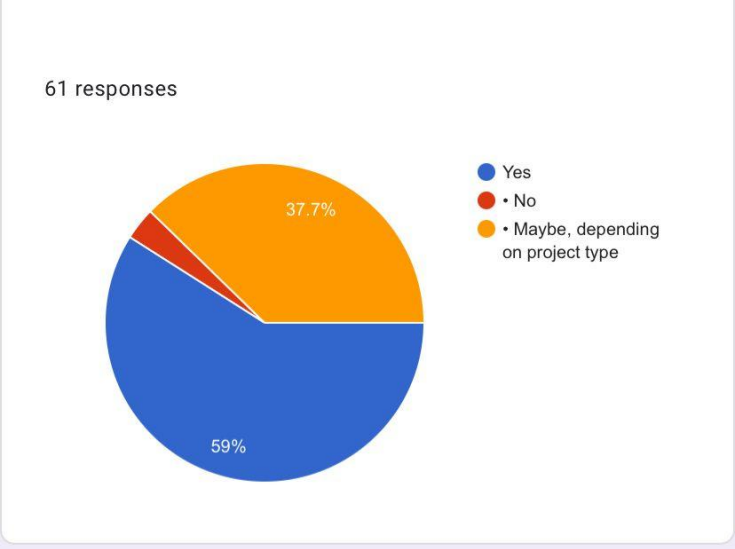

Figure 4.14 pie chart showing consideration of use if traditional building material is to be improved.

4.6 SUMMARY OF FINDINGS

The analysis revealed that:

- Traditional materials are more sustainable but require frequent maintenance.
- Modern materials offer durability but contribute significantly to environmental degradation.
- There is a need for policy improvements to promote eco-friendly building materials.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents a summary of findings, discusses their implications, and provides recommendations based on the study of traditional and modern building materials in Nigeria, focusing on sustainability and environmental impact.

The study focused on comparing traditional and modern building materials in Nigeria, examining their sustainability and environmental impact, with Egor LGA and Ovia North-East LGA (particularly Ugbowo) as case study areas to provide localized insights in the national trends.

5.2 SUMMARY OF FINDINGS

The research compared traditional (e.g., mud bricks, bamboo, timber, thatch, laterite) and modern materials (e.g., concrete, steel, aluminum, glass) based on their sustainability, cost, durability, and environmental impact.

5.2.1 SUSTAINABILITY AND ENVIRONMENTAL IMPACT

The study revealed that traditional materials generally have a lower environmental footprint compared to modern materials, which require extensive industrial processing. Life Cycle Assessment (LCA) results showed that modern materials contribute significantly to CO_2 emissions and energy consumption, while traditional materials decompose naturally with minimal pollution.

5.3 IMPLICATIONS OF THE STUDY

For Architects and Builders:

Encourage hybrid construction, combining traditional and modern materials for better sustainability and durability.

Integrate passive cooling strategies using traditional materials to reduce energy consumption in buildings.

For Policymakers and Government:

Introduce policies that promote sustainable material usage and reduce over-reliance on high-energy-consuming materials.

Encourage local production of eco-friendly building materials to cut costs and emissions**.**

For Environmental Conservation:

Advocate for recycling of modern materials such as steel and glass to minimize environmental degradation.

Implement sustainable forestry practices for timber usage in construction.

5.4 CONCLUSION

This study has provided valuable insights into the sustainability and environmental impact of traditional and modern building materials in Nigeria. The findings suggest that while modern materials offer better durability and strength, they also contribute significantly to carbon emissions and energy consumption. On the other hand, traditional materials are more sustainable but often lack the structural strength needed for large-scale projects. The future of sustainable

architecture in Nigeria lies in hybrid construction techniques that integrate the strengths of both material types.

5.5 LIMITATIONS OF THE STUDY

1. Limited Geographic Scope:

The study focused on Egor LGA and Ovia North-East LGA (Ugbowo) Benin City, Edo State, meaning findings may not fully apply to other regions in Nigeria.

2. Data Constraints:

Some environmental impact data on local materials were unavailable due to limited studies in Nigeria.

3. Time Limitations:

More time would have allowed for experimental durability tests on selected materials.

5.6 RECOMMENDATIONS

1. Encouraging Sustainable Construction Techniques:

   Adopt compressed stabilized earth blocks (CSEB) as a more sustainable alternative to concrete blocks.

2. Research into Improved Traditional Materials:

   Invest in research to improve the durability of mud bricks and bamboo.

3. Implementation of Green Building Policies:

   Nigerian building codes should incentivize the use of local, low-carbon materials.

4. Public Awareness on Sustainable Construction:

   Conduct workshops and training for architects and builders on eco-friendly materials.

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