

An Assessment of the Impact of Building Materials Recycling on Sustainable Housing Development in Ile-Ife, Osun State, Nigeria

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Abstract- *The increasing demand for environmentally sustainable housing in Nigeria, especially in urban centers like Ile-Ife, Osun State, has brought attention to the challenges posed by resource depletion, high construction costs and environmental degradation. Despite the availability and potential benefits of recycled building materials, their adoption in housing development remains limited. The central issue addressed in this study is the inadequate utilization of recycled materials in the local construction sector, largely due to a lack of awareness, insufficient policy support, and limited technical capacity. This research explores how the recycling of construction materials impacts sustainable housing development in Ile-Ife. A total of 100 questionnaires were distributed using a simple random sampling technique to ensure fair representation of stakeholders, including Builders, Estate Surveyors and Valuers, residents, Engineers, and Government Personnel. The study employs both qualitative and quantitative methods, incorporating surveys, interviews, and field observations to gather comprehensive data. Descriptive statistics and chi-square analysis were employed to assess relationships between recycling practices and sustainability outcomes. Findings reveal a high level of awareness (74.7%) but relatively low consistent usage (13.8%) of recycled materials. Recycling was found to significantly improve cost efficiency, environmental performance, and resource utilization. However, barriers such as lack of policy support, inadequate recycling infrastructure, and concerns about material quality persist. The chi-square test ($\chi^2 = 14.44$, $p < 0.05$) confirms a statistically significant relationship between recycling practices and sustainable housing development. The study concludes that promoting material recycling can enhance sustainable housing delivery and recommends policy incentives, infrastructure development, and stakeholder education to improve adoption.*

Keywords - *Building materials recycling; Sustainable housing; Construction waste; Nigeria; Ile-Ife; Circular economy.*

I. INTRODUCTION

1.1 Background of the study

Rapid urbanization has become a defining feature of developing economies, particularly in sub-Saharan Africa, where population growth and rural–urban migration continues to intensify the demand for housing and urban infrastructure. In Nigeria, this trend has placed significant pressure on the construction sector to deliver affordable housing at scale. However, the prevailing reliance on conventional construction practices—characterized by the extensive use of virgin materials—has contributed to rising construction costs, depletion of natural resources, and environmental degradation (Hossain et al., 2020; Windapo & Moghayedi, 2020). The construction industry is also a major generator of construction and demolition (C&D) waste, accounting for a significant proportion of global solid waste and posing serious environmental challenges when poorly managed (Ajayi & Oyedele, 2017; Osmani et al., 2021).

In response to these challenges, sustainable housing has emerged as a critical paradigm in contemporary urban development discourse. Sustainable housing emphasizes the integration of environmental protection, economic efficiency, and social well-being throughout the lifecycle of residential buildings. Achieving this balance requires the adoption of innovative construction practices that minimize resource consumption and environmental impact while enhancing affordability and durability.

One of the most effective strategies for achieving sustainable housing is the recycling and reuse of building materials. This approach involves the recovery, processing, and reintegration of materials such as concrete, metals, timber, and glass from construction and demolition waste into new building projects (Ajayi & Oyedele, 2018; Akinade et al., 2020).

Globally, the application of recycled materials in construction has gained significant traction as part of the transition toward a circular economy. The circular economy model promotes resource efficiency by extending the lifecycle of materials and reducing waste generation. Recent studies indicate that the use of recycled construction materials can significantly reduce greenhouse gas emissions, lower embodied energy, and enhance resource efficiency in the built environment (Ding et al., 2016; Akanbi et al., 2019; Hossain et al., 2020). Similarly, Ghaffar et al. (2020) noted that recycled and alternative materials such as fly ash, recycled aggregates, and industrial by-products can improve sustainability performance without compromising structural integrity when properly processed. In addition, recycled materials often provide cost advantages, particularly when sourced locally, thereby contributing to improved housing affordability in developing economies (Olotuah & Bobadoye, 2009; Aigbavboa et al., 2021). Despite these global advancements, the adoption of building materials recycling in developing countries such as Nigeria remains limited. Several barriers have been identified in recent literature, including inadequate recycling infrastructure, weak regulatory frameworks, lack of technical expertise, and negative perceptions regarding the quality and durability of recycled materials (Adewuyi & Odesola, 2015; Bamgbade et al. 2021; Akinradewo et al., 2022). Furthermore, institutional constraints such as poor policy implementation, lack of financial incentives, and limited stakeholder collaboration continue to hinder the mainstreaming of recycling practices in the construction sector (Ajayi et al., 2015; Bamgbade et al., 2021). Cultural resistance and risk aversion among construction professionals also contribute to the slow uptake of recycled materials, as many practitioners remain reliant on traditional construction methods (Poon et al., 2004; Ayodele et al., 2020).

The implications of these challenges are particularly evident in rapidly urbanizing cities such as Ile-Ife, Osun State. As a historically significant and educational hub, Ile-Ife has experienced increasing population growth and housing demand in recent years. This growth has led to intensified construction activities, resulting in higher material consumption and increased generation of construction waste. However, waste management practices remain largely inefficient, with recyclable materials often disposed of indiscriminately. This contributes to environmental pollution, blockage of drainage systems, and increased vulnerability to flooding and public health risks (Olanrewaju & Abdul-Aziz, 2021; Akinradewo et al., 2022).

The integration of recycled building materials into housing development in Ile-Ife presents a viable pathway for addressing these challenges. By reducing dependence on virgin materials, recycling can help lower construction costs, improve resource efficiency, and minimize environmental impacts. Furthermore, the adoption of recycling practices aligns with global sustainability frameworks such as the United Nations Sustainable Development Goals (SDGs), particularly Goal 11 (Sustainable Cities and Communities) and Goal 12 (Responsible Consumption and Production). Recent studies emphasize that sustainable construction practices, including material recycling, play a critical role in achieving resilient and inclusive urban development in emerging economies (Hossain et al., 2020; Aigbavboa et al., 2021).

However, despite the recognized benefits of building materials recycling, there is limited empirical evidence on its level of awareness, adoption, and impact within the local context of Ile-Ife. Existing studies in Nigeria have largely focused on general construction waste management issues, with insufficient attention to localized assessments of recycling practices and their direct implications for sustainable housing development. This lack of context-specific data limits the ability of policymakers and stakeholders to design targeted interventions that promote sustainable construction practices.

Moreover, there is a need to understand stakeholder perceptions and behavioral factors influencing the adoption of recycled materials in construction. Construction professionals, developers, artisans, and policymakers play a critical role in shaping material selection and waste management practices. Their level of awareness, technical capacity, and willingness to adopt innovative solutions significantly influence the sustainability performance of housing projects (Akinade et al., 2020; Bamgbade et al., 2021). Addressing these factors is essential for overcoming the barriers to recycling and promoting a transition toward a circular economy in the construction sector.

Against this backdrop, this study seeks to assess the impact of building materials recycling on sustainable housing development in Ile-Ife, Osun State. Specifically, it examines the level of awareness and extent of adoption of recycling practices among stakeholders, evaluates the relationship between the use of recycled materials and key sustainability indicators such as cost efficiency, durability, and environmental performance, and identifies the major challenges hindering effective implementation. By providing empirical insights into these issues, the study contributes to the growing body of knowledge on sustainable construction in developing countries and offers practical recommendations for enhancing the adoption of recycling practices in Nigeria's housing sector.

Ultimately, this research positions building materials recycling as a critical component of sustainable housing delivery and advocates for a transition toward more resource-efficient and environmentally responsible construction practices. Such a transition is essential for addressing the dual challenges of housing shortages and environmental sustainability in rapidly urbanizing contexts like Ile-Ife and other Nigerian cities.

II. LITERATURE REVIEW

2.1 Concept of Building Materials Recycling and Sustainable Housing

Building materials recycling involves the recovery and reuse of construction and demolition (C&D) waste such as concrete, timber, metals, and glass for

new construction purposes. This practice reduces dependence on virgin materials, minimizes waste generation, and enhances resource efficiency within the construction sector (Ajayi & Oyedele, 2018; Akanbi et al., 2019). In recent years, it has gained prominence as part of the circular economy approach, which promotes sustainable resource use by extending the lifecycle of materials and reducing environmental impacts (Hossain et al., 2020; Bamgbade et al., 2021).

Sustainable housing refers to residential development that integrates environmental sustainability, economic affordability, and social well-being throughout the building lifecycle. The incorporation of recycled materials contributes to these goals by reducing construction costs, conserving natural resources, and lowering carbon emissions (Tam & Tam, 2006; Aigbavboa et al., 2021). In developing countries like Nigeria, where housing demand is high and resources are limited, recycling presents a practical strategy for achieving cost-effective and environmentally responsible housing delivery (Benachio et al., 2020).

2.2 Awareness and Adoption of Building Materials Recycling

Awareness and adoption of building materials recycling are critical factors influencing its effectiveness in promoting sustainable construction. While developed countries have made significant progress due to strong policies and advanced technologies, adoption in developing countries remains limited (Ding et al., 2016). Studies indicate that although many construction professionals are aware of recycling practices, this awareness does not always translate into consistent implementation due to knowledge gaps and limited technical capacity (Akinade et al., 2020; Ayodele et al., 2020).

In Nigeria, low adoption is further influenced by negative perceptions regarding the quality and durability of recycled materials, as well as limited access to recycling facilities (Ayodele et al., 2020). The absence of structured training programs and weak institutional support also hinder widespread implementation (Olanrewaju & Abdul-Aziz, 2021). Consequently, despite growing awareness, the practical use of recycled materials in construction remains relatively low.

2.3 Influence of Recycled Materials on Sustainable Housing Delivery

The use of recycled building materials has significant benefits for sustainable housing development, particularly in terms of cost reduction, environmental performance, and resource efficiency. Recycled materials are often more affordable than conventional materials, especially when sourced locally, thereby improving housing affordability (Olotuah & Bobadaye, 2009; Aigbavboa et al., 2021). This is particularly important in developing countries where high construction costs limit access to adequate housing.

Environmentally, recycling reduces construction waste, conserves natural resources, and lowers greenhouse gas emissions associated with material production (Ding et al., 2016; Hossain et al., 2020). In terms of performance, studies show that properly processed recycled materials can achieve comparable durability to traditional materials, although concerns about quality consistency still exist among stakeholders (Ajayi et al., 2015; Akanbi et al., 2019).

2.4 Challenges of Implementing Building Materials Recycling

Despite its benefits, the implementation of building materials recycling faces several challenges. A major barrier is the lack of supportive government policies and incentives, which limits stakeholder motivation to adopt recycling practices (Adewuyi & Odesola, 2015; Bamgbade et al., 2021). In addition, inadequate recycling infrastructure and limited access to processing facilities make it difficult to effectively reuse construction waste ((Ogunseye, Ogunseye and Olarenwajo, (2023).

Economic and behavioral factors also contribute to low adoption. High initial costs of recycling technologies and lack of financial incentives discourage investment, particularly among small-scale developers (Ajayi et al., 2015). Furthermore, resistance to change and negative perceptions about recycled materials continue to hinder their acceptance, highlighting the need for awareness campaigns, training, and stronger policy support (Poon et al., 2004; Ayodele et al., 2020;)

2.5 Types and Applications of Recycled Building Materials

Recycled building materials commonly used in construction include recycled concrete aggregates, reclaimed timber, recycled metals, glass, plastics, and industrial by-products such as fly ash and slag. Recycled concrete is widely applied as aggregate in road bases, foundations, and structural components, while recycled steel is frequently reused due to its high durability and recyclability without loss of strength (Akanbi et al., 2019; Hossain et al., 2020). Similarly, reclaimed timber is utilized for structural framing and finishes, and recycled glass is incorporated into concrete mixes and decorative elements. These materials contribute to reducing construction waste and lowering dependence on virgin resources, thereby supporting sustainable construction practices (Ajayi & Oyedele, 2018).

In addition to traditional recycled materials, recent advancements have introduced innovative materials such as recycled plastics, compressed earth blocks with recycled content, and composite materials derived from construction waste. These materials have shown promising performance in terms of strength, durability, and environmental efficiency when properly processed and tested (Akinade et al., 2020; Aigbavboa et al., 2021). However, their application in developing countries like Nigeria remains limited due to challenges such as inconsistent material quality, lack of standardization, and limited technical knowledge. Expanding the use of these materials in housing development requires improved quality control systems, supportive policies, and increased awareness among construction stakeholders (Bamgbade et al., 2021; Ayodele et al., 2020)

Despite increasing attention to building materials recycling, most studies remain focused on environmental benefits such as waste reduction and emissions control, with limited emphasis on how recycling directly influences sustainable housing delivery outcomes. Empirical evidence linking recycled materials to housing affordability, supply efficiency, and housing quality remains weak, particularly in developing countries like Nigeria, where research is still largely conceptual rather than performance-based (Akinade et al., 2020; Tam et al.,

2021). As a result, the practical contribution of recycling to addressing housing deficits is not well established in existing literature.

In addition, there is limited integration of environmental, economic, and social dimensions in assessing the impact of recycling on housing delivery. Most studies overlook key factors such as lifecycle cost savings, stakeholder adoption behavior, policy enforcement, and end-user satisfaction (Ajayi & Oyedele, 2021; Liu et al., 2022). Furthermore, context-specific and spatial analyses that connect recycling practices to urban housing planning are scarce, especially in African cities, leaving a gap in understanding how recycling can be effectively embedded into sustainable housing systems (Aigbavboa & Thwala, 2021).

III. METHODOLOGY

3.1 Research Design, Population and sampling, Data Sources and Research Instruments.

This study adopts a descriptive survey research design. This approach is appropriate because it allows for the collection of both quantitative and qualitative data that reflect the current state of building materials recycling and its impact on sustainable housing development in Ile-Ife. The design enables the researcher to assess relationships, perceptions, and patterns among builders, developers, residents, and relevant stakeholders.

The study was conducted in Ile-Ife, located in Osun State, South-West Nigeria. Ile-Ife is a historically significant urban area with increasing urbanization and construction activities, making it an ideal location to explore the implications of recycling in housing development.

The target population includes: Construction professionals (e.g., Architects, Builders, Estate Surveyors and Valuers, Civil Engineers), Housing developers and site supervisors, Artisans (e.g., masons, carpenters), Officials in the Ministry of Works and Housing and Residents in housing areas where recycled materials are used.

A total of 100 respondents were sampled using purposive and stratified random sampling techniques.

Each stakeholder group formed a stratum, and respondents were randomly selected within each category to ensure balanced representation.

Both primary and secondary data were utilized in this study. While primary data were gathered via questionnaire, secondary data were sourced from academic publications, government housing policies, urban planning reports and environmental impact assessments. The questionnaire was designed to capture both demographic and research-specific data, using a mix of Likert-scale, multiple-choice, and open-ended questions. Interview was used for in-depth discussions with professionals and policy makers. Descriptive statistics and chi-square technique analysis were employed to assess relationships between recycling practices and sustainability outcomes

To ensure reliability and validity, the questionnaire and interview guide were reviewed by experts in housing, environmental science, and research methods. A pilot study with 10 respondents in the study area was conducted for refinement. Data was presented in tables

3.2 Ethical Considerations:

Participants were briefed on the study aim and assured of confidentiality. Participation was voluntary and anonymous, and no sensitive data was collected. Ethical approval was obtained from the appropriate research ethics committee.

IV. PRESENTATION AND ANALYSIS OF DATA.

4.1 Preamble

This section presents the data distribution and collection process for the research on the impact of building materials recycling on sustainable housing development in Ile-Ife Osun State.

4.2 Questionnaire Distribution and Retrieval

A total of 100 questionnaires were distributed among five key respondent categories involved in or affected by building materials recycling and housing development in Ile-Ife, Osun State. The distribution was as follows:

Table 1 Questionnaire distribution and retrieval summary

Category	Number Distributed	Number Retrieved	Not Retrieved	% Retrieved	% Not Retrieved
Construction Professionals	30	27	3	90%	10%
Housing Developers/Supervisors	20	17	3	85%	15%
Artisans (e.g., Masons)	20	18	2	90%	10%
Government Officials	10	8	2	80%	20%
Residents	20	17	3	85%	15%
Total	100	87	13	87%	13%

Source; Field survey, 2025

4.2.1 Validity of Retrieved Questionnaires:

The questionnaires were administered in person and retrieved over a period of two weeks. Follow-up visits and reminder calls were made during the second week to increase the response rate. Out of the 100 questionnaires distributed, 87 were successfully retrieved, resulting in an 87% response rate, while 13 were not retrieved, representing a 13% non-response rate. Only fully completed questionnaires were included in the data analysis.

4.3 Sample characteristics:

The sample for this study consists of 87 valid respondents whose completed questionnaires were retrieved and analyzed. The breakdown of the sample by category, gender, age, and occupation is presented below:

Table 2: Category of Respondents

Category	Frequency (n)	Percentage (%)
Construction Professionals	27	31.0%
Housing Developers/Supervisors	17	19.5%
Artisans (e.g., Masons)	18	20.7%
Government Officials	8	9.2%
Residents	17	19.5%
Total	87	100%

Source: Field Survey, 2025

Table 2 above shows that 31% of the respondents are construction professionals (Architects, Builders, Civil Engineers, Estate Surveyors and Valuers, etc.), 20%, Artisans; 19.5%, Housing developers and Supervisors, 19.5% residents while 9.2% Government Officials. This implies that the data gathered for the purpose of this were from reliable sources and considered authentic for drawing conclusions

Table 3: Gender Distribution of Respondents

Gender	Frequency (n)	Percentage (%)
Male	61	70.1%
Female	26	29.9%
Total	87	100%

Source: Field Survey, 2025

The information contained in table 3 above indicates that males (62.1%) dominated the sample, reflecting the male dominance in the building industry.

Table 4: Age Distribution of Respondents

Age Range (Years)	Frequency (n)	Percentage (%)
18-30	15	17.2%
31-40	32	36.8%
41-50	25	28.7%
51 and above	15	17.2%
Total	87	100%

Source: Field Survey, 2025

The age Distribution of the respondents as shown in table 4 above reveals that majority of the respondents (44.8%) are between 31-40 years, implying a youthful and active workforce.

Table 5: Occupation of Respondents

Occupation	Frequency (n)	Percentage (%)
Architect/Estate Surveyors and Valuers/Engineer/Builder	30	27.6%
Developer/Site Supervisor	20	19.5%
Artisans (Masons, Carpenter)	20	20.7%
Government Official	10	9.2%
Others	20	23.0%
Total	87	100%

Source: Field Survey, 2025

This table profiles the occupational distribution of the respondents. 27.6% are professionals in built environment; 23% others; 20.7% are artisans, 19.5%

are developers/site supervisors while 9.2% are government officials, implying the diversity of respondents and establish the representativeness of the data collected for analyzing the impact of building materials recycling on sustainable housing development in Ile-Ife.

4.4: Analysis of Survey Responses and Interpretation
 This section presents the analysis of the 87 valid survey responses collected from stakeholders in the building industry and housing sector in Ile-Ife. The data were analyzed using descriptive statistics. The key areas of focus include awareness of building materials recycling, extent of usage, perceived benefits, challenges and its impact on sustainable housing development.

Table 6: Awareness of Building Materials Recycling

Response	Frequency (n)	Percentage (%)
Highly aware	35	40.2%
Moderately aware	30	34.5%
Slightly aware	15	17.2%
Not aware	7	8.0%
Total	87	100%

Source: Field Survey, 2025

Interpretation: A total of 74.7% of respondents are either highly or moderately aware of building materials recycling. This shows a good level of awareness among professionals and developers, likely due to increased advocacy and education on sustainable practices.

Table 7: Extent of Use of Recycled Materials in Construction

Extent of Use	Frequency (n)	Percentage (%)
Always	12	13.8%
Often	18	20.7%
Occasionally	28	32.2%
Rarely	20	23.0%
Never	9	10.3%
Total	87	100%

Source: Field Survey, 2025

Interpretation: While awareness is relatively high, only 13.8% of respondents reported always using recycled materials. A significant proportion of the respondents (32.2%) use them occasionally. This suggests that usage is constrained by factors such as

availability, trust in quality and regulatory frameworks.

Table 8: Perceived Benefits of Using Recycled Materials

Respondents were asked to rate their agreement on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) regarding benefits of recycled materials.

Benefit	Mean Score	Interpretation
Reduces construction Cost	4.22	Strongly Agree
Minimizes environmental impacts	4.10	Strongly Agree
Promotes efficient resources utilization	4.03	Agree
Improves affordability of housing	3.92	Agree
Enhances waste management in urban areas	4.15	Strongly Agree

Source: Field Survey, 2025

Interpretation: Respondents widely agreed that recycling building materials contributes to cost reduction, environmental protection, and improved urban waste management. These benefits are key to sustainable housing development, particularly in urbanizing areas like Ile-Ife.

Table 9: Perceived Challenges Hindering the Use of Recycled Materials

Challenge	Mean Score	Interpretation
Lack of government support/incentives	4.25	Strongly Agree
Limited access to recycling facilities/materials	4.05	Agree
Concerns over material quality and durability	3.98	Agree
Lack of public awareness	3.76	Agree
Resistance to change in construction practices	3.62	Agree

Source: Field Survey, 2025

Interpretation: The major challenges identified include lack of government incentives and limited recycling infrastructure. Quality concerns and resistance to new construction practices also hinder

adoption. These suggest a need for policy support and professional training.

Table 10: Overall Impact on Sustainable Housing Development

Response	Mean Score	Interpretation
Very significant impact	33	37.9%
Moderate impact	29	33.3%
Minor impact	15	17.2%
No impact	10	11.5%
Total	87	100%

Source: Field Survey, 2025

Formula:

$$C = \sqrt{\frac{\chi^2}{\chi^2 + n}}$$

Where:

- χ^2 = Chi-square value
- n = Total number of observations (respondents)

Using the earlier calculated Chi-square value:

- $\chi^2 = 14.44$
- $n = 87$

$$C = \sqrt{\frac{14.44}{14.44 + 87}} = \sqrt{\frac{14.44}{101.44}} = \sqrt{0.1423} \approx 0.377$$

P-value Approach for Decision Rule

Instead of comparing the calculated Chi-square value to a critical value, I determine the p-value associated with the Chi-square statistics.

Given:

- Chi-square statistic (X^2) = 14.44
- Degrees of Freedom (df) = $(r - 1)(c - 1) = (3 - 1)(3 - 1) = 4$
- Sample size (n) = 87

Using a chi-square distribution table or statistical software:

- P-value $X^2 = 14.44$ at $df = 4$ is approximately 0.006

Decision Rule (P-value Method)

- If $p\text{-value} \leq 0.05$, reject the null hypothesis

Interpretation: A combined 71.2% of respondents agreed that building materials recycling has a moderate to very significant impact on sustainable housing development in Ile-Ife. This confirms that stakeholders recognize its relevance, even if implementation is still limited.

4.5 Statistical Method Used: To assess the strength of association between the use of recycled building materials and perceived impact on sustainable housing, the contingency coefficient (c) was applied.

Interpretation of the contingency coefficient

The contingency coefficient ranges from 0 to 1, where values closer to indicate a stronger association.

A result of 0.377 suggests a moderate association between the extent of use of recycled materials and perceived impact on sustainable housing development.

This supports the conclusion that increased use of recycled materials correlates with positive perceptions of their benefits for sustainability

- If $p\text{-value} > 0.05$, fail to reject the null hypothesis

Conclusion: Since $p = 0.006 < 0.05$, we reject the null hypothesis. This means that there is a statistically significant relationship between the extent of use of recycled building materials and the perceived impact on sustainable housing development.

4.6 Discussion of Results

The findings of this study reveal that awareness of building materials recycling among stakeholders is relatively high, with a large proportion of respondents indicating moderate to high levels of awareness. This suggests that knowledge of sustainable construction practices is not entirely lacking within the study area. However, despite this awareness, the actual use of recycled materials remains low, with most respondents indicating only

occasional application. This gap between awareness and practice supports existing studies which argue that knowledge alone does not guarantee adoption without enabling conditions such as policy support and technical capacity (Akinade et al., 2020; Ayodele et al., 2020).

The study further shows that the use of recycled materials in construction is not yet a regular practice. This limited adoption can be linked to structural issues within the construction sector, including weak supply systems and lack of accessible recycling facilities. This finding is consistent with previous research which highlights that inadequate infrastructure and poor waste management systems significantly hinder recycling efforts in developing countries (Ogunseye, Ogunseye and Olarenwajo, (2023); Bamgbade et al., 2021). It implies that improving access to recycling facilities is essential for increasing adoption levels.

In terms of perceived benefits, the study reveals strong agreement among respondents that recycled materials help to reduce construction costs, improve waste management, and minimize environmental impact. This aligns with the principles of the circular economy, which emphasize efficient use of resources and reduction of waste in construction activities (Hossain et al., 2020; Benachio et al., 2020). The cost-saving advantage is particularly important in the Nigerian context, where high construction costs limit access to housing. This suggests that recycling can play a key role in improving housing affordability. Despite these benefits, the study identifies major challenges that limit the adoption of recycled materials. These include lack of government incentives, inadequate recycling infrastructure, and negative perceptions about the quality and durability of recycled materials. These challenges reflect broader institutional and behavioral barriers identified in previous studies, which emphasize the importance of policy support, standardization, and stakeholder confidence in promoting sustainable construction practices (Ayodele et al., 2020; Bamgbade et al., 2021). The findings indicate that without addressing these barriers, the adoption of recycling will remain limited.

Furthermore, the results show that stakeholders generally perceive building materials recycling as having a significant impact on sustainable housing development. This perception is supported by the statistical analysis, which reveals a significant relationship between the use of recycled materials and sustainable housing development ($p < 0.05$). This confirms the study's conceptual assumption that recycling contributes to sustainability through improved affordability, environmental performance, and efficient resource use. Similar conclusions have been reported in previous studies on circular construction and sustainable housing systems (Hossain et al., 2020; Ghaffar et al., 2020).

Overall, the discussion shows that while awareness and perceived benefits of recycling are high, actual implementation is constrained by institutional, infrastructural, and perception-related factors. This highlights the need for a more integrated approach that combines policy support, infrastructure development, and stakeholder engagement to promote the use of recycled materials in housing development.

V. SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of findings:

The key findings of the study include:

- 1) High awareness of building materials recycling among stakeholders: The study found that most respondents are aware of building materials recycling and understand its importance. This shows that knowledge about sustainable construction already exists within the study area. However, awareness alone has not led to full adoption in practice.
- 2) Low level of practical adoption of recycled materials: Despite the high level of awareness, the actual use of recycled materials in construction is still low. Many respondents only use them occasionally rather than regularly. This indicates a gap between what people know and what they practice.
- 3) Recycling significantly reduces construction cost and improves environmental sustainability: The findings show that recycled materials help to lower the cost of construction. This makes

housing more affordable, especially in developing areas where high building costs are a major problem. The use of recycled materials helps to reduce construction waste and environmental pollution. It also supports better use of natural resources, which is important for long-term environmental sustainability.

- 4) The challenges identified include, absence of strong government policies and incentives. Inadequate recycling infrastructure, negative perceptions and quality concerns. Without support such as regulations or financial encouragement, stakeholders are less motivated to adopt recycling practices. Inadequate recycling facilities makes it difficult to collect, process, and reuse construction waste, thereby reducing the use of recycled materials. Some stakeholders believe that recycled materials are not as strong or reliable as new materials. These concerns reduce their willingness to use recycled materials in construction.
- 5) There is a significant relationship between recycling and sustainable housing: Statistical analysis shows that the use of recycled materials has a meaningful impact on sustainable housing development (Chi-square = 14.44, df = 4, $p < 0.05$). This confirms that increasing recycling practices can improve housing outcomes.

5.2 Conclusion

The findings affirm that recycling of building materials has a positive impact on sustainable housing development in Ile-Ife. It aids in reducing construction costs, minimizing environmental degradation, and promoting affordable housing. However, adoption remains limited due to infrastructural, institutional and perceptual barriers.

To maximize the benefits of recycling in the building sector, a coordinated effort involving stakeholders, government, construction professionals, and the public is essential. The study concludes that enhanced policy support, technical education, and access to materials will facilitate greater integration of recycling practices into the housing sector.

5.3 Recommendations

Based on the findings, the following recommendations are made:

1. Government Policy and Incentives: The government should create clear rules that support the use of recycled building materials. They can also encourage builders by giving benefits such as tax reductions, grants or financial support. This will make more people willing to use recycled materials in construction projects.
2. Public Awareness and Professional Training: There should be more awareness campaigns to educate people about the benefits of recycling building materials. In addition, construction professionals and artisans should be trained on how to properly use recycled materials in building projects.
3. Development of Recycling Infrastructure: More recycling plants and facilities should be built so that construction waste can be properly collected, processed and reused. When these facilities are available, it will be easier for builders to access recycled materials.
4. Quality Control and Standardization: Government and professional bodies should set clear standards to ensure that recycled materials are safe and durable. Testing and certification should be done to improve trust in these materials.
5. Stakeholder Collaboration: Different groups such as government agencies, construction companies, researchers, and communities should work together. This collaboration will help in sharing knowledge, improving practices, and promoting the use of recycled materials.

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