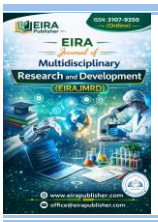

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Evaluation of Bamboo as an Eco-Friendly Construction Material for Cost-Effective Housing in Abuja, Nigeria

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Abstract **Original Research Article**

This study assesses the feasibility of bamboo as a sustainable construction material for affordable housing in Nigeria, emphasising its structural, economic, and environmental attributes. The research was motivated by the ongoing housing shortage and the escalating expenses of traditional construction materials like concrete and steel. A descriptive survey design was utilised to gather data from stakeholders in the construction sector in Abuja, comprising architects, engineers, contractors, developers, and citizens. Four hundred respondents were chosen through a stratified random sampling method to provide sufficient representation among professional and user groups. Data were collected via structured questionnaires and analysed employing descriptive and inferential statistical techniques. The results indicated that bamboo exhibits robust mechanical qualities and offers considerable benefits for cost-effectiveness, renewability, and ecological sustainability. Notwithstanding these advantages, its application in the Nigerian building sector is constrained by problems like substandard preservation procedures, insufficient technical proficiency, absence of standardisation, and low public awareness. The study indicates that bamboo possesses significant promise as an alternative material for sustainable and cost-effective housing when adequately treated and included into construction regulations. It advocates for collaboration among government agencies, professional organisations, and research institutes to formulate national standards for bamboo building, invest in treatment technologies, and implement awareness campaigns to endorse bamboo as a sustainable construction material.

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Introduction

The growing demand for affordable housing in Nigeria, particularly in rapidly urbanizing cities such as Abuja, has intensified the search for cost-effective and sustainable building materials (Suleiman et al., 2025; Akpan et al., 2025). Rapid population growth, rural–urban migration, and rising construction costs have contributed to a significant housing deficit, estimated in millions of units nationwide (Magaji et al., 2025; Abeke et al., 2025). Conventional building materials such as cement, steel, and concrete are not only expensive but also associated with high environmental impacts due to their energy-intensive production processes (Akinyemi et al., 2019; Tanko et al., 2025). Consequently, there is an increasing need to explore alternative materials that are locally available, environmentally friendly, and economically viable for sustainable housing delivery.

Bamboo has emerged globally as a promising sustainable building material due to its rapid growth rate, renewability, and strong mechanical properties. Often referred to as "green steel," bamboo possesses high tensile strength, flexibility, and durability, making it suitable for various structural and non-structural applications (Sharma et al., 2015). In many Asian and Latin American countries, bamboo has been successfully utilized in housing construction, offering both affordability and environmental sustainability. Its low carbon footprint and ability to sequester carbon further enhance its relevance in addressing climate change concerns associated with the built environment (Van der Lugt et al., 2018).

In the Nigerian context, bamboo is widely available in several regions, yet its utilization in the construction industry remains

limited and largely informal. Cultural perceptions, lack of technical knowledge, absence of standardized building codes, and limited government support have hindered its widespread adoption (Ogunsanmi et al., 2020). However, with increasing awareness of sustainable development and the need to reduce dependency on imported and high-cost materials, bamboo presents a viable alternative for affordable housing, especially in urban centers like Abuja where housing demand continues to rise.

Abuja, as Nigeria's capital city, represents a unique case study due to its rapid urban expansion, diverse population, and increasing pressure on housing infrastructure. The high cost of land and building materials in the city has made home ownership unattainable for many low- and middle-income earners. Integrating bamboo into housing construction could potentially reduce building costs while promoting environmentally responsible practices. Furthermore, the adoption of bamboo aligns with global sustainability goals, including the promotion of resource efficiency and reduction of greenhouse gas emissions in the construction sector (United Nations, 2015).

This study therefore seeks to assess the viability of bamboo as a sustainable building material for affordable housing in Abuja, Nigeria. It aims to evaluate its structural performance, cost implications, environmental benefits, and level of acceptability among stakeholders. By examining these factors, the study contributes to the growing body of knowledge on sustainable construction materials and provides practical insights for policymakers, architects, and developers seeking innovative solutions to Nigeria's housing challenges.

Literature Review and Theoretical Framework

Conceptual Review

Bamboo

Bamboo is a fast-growing, renewable natural resource belonging to the grass family, widely recognized for its strength, flexibility, and versatility in construction. It has been used for centuries in various parts of the world for building houses, bridges, and scaffolding due to its high tensile strength and lightweight properties. Bamboo matures within 3–5 years, making it significantly more sustainable than traditional timber, which may take decades to regenerate (Sharma et al., 2015). In addition to its mechanical properties, bamboo has excellent resistance to compression and can be treated to improve durability against pests and moisture. Its environmental benefits, including carbon sequestration and low energy requirements for processing, make it an increasingly attractive material in sustainable construction practices (Van der Lugt et al., 2018).

Sustainable Building Material

Sustainable building materials are those that have minimal negative environmental impacts throughout their lifecycle, from extraction and production to use and disposal. These materials are typically renewable, energy-efficient, non-toxic, and locally sourced, thereby reducing transportation costs and environmental degradation (Al-Amin et al., 2025; Ologbonori et al., 2025; Magaji et al., 2024). The concept is rooted in sustainable development, which emphasizes meeting present needs without compromising the ability of future generations to meet their own needs (United Nations, 2015). Materials such as bamboo, recycled steel, and stabilized earth blocks are considered sustainable because they reduce carbon emissions, conserve natural resources, and enhance energy efficiency in buildings. The adoption of sustainable materials is critical in mitigating climate change and promoting environmentally responsible construction practices (Kibert, 2016).

Affordable Housing in Nigeria

Affordable housing in Nigeria refers to housing units that are accessible and financially attainable to low- and middle-income earners, who constitute a significant portion of the population (Akpan et al., 2025; Modibbo et al., 2026). However, Nigeria faces a substantial housing deficit, driven by rapid urbanization, population growth, high cost of construction materials, and limited access to housing finance. Cities like Abuja have witnessed escalating property prices, making it difficult for many residents to secure decent accommodation (Ibem & Amole, 2013). Affordable housing initiatives often focus on reducing construction costs, improving access to financing, and utilizing alternative building materials such as bamboo to lower overall expenses. Addressing the housing challenge requires integrated policies, innovative construction technologies, and the promotion of locally available materials to ensure sustainability and inclusiveness in housing delivery (Adedeji, 2018).

Theoretical Framework

Sustainable Development Theory

Sustainable Development Theory, which emphasizes the efficient use of resources to meet present needs without compromising the ability of future generations to meet their own needs (UN, 2015). This theory provides a conceptual foundation for integrating environmentally friendly, economically viable, and socially acceptable solutions in development practices (Ibrahim et al., 2025). In the context of assessing bamboo as a sustainable building material for affordable housing in Abuja, the theory supports the adoption of renewable materials like bamboo that reduce environmental degradation while lowering construction costs. It also highlights the importance of balancing ecological sustainability with socioeconomic development, particularly in addressing housing shortages among low- and middle-income populations in Nigeria. By promoting the use of locally available and rapidly renewable materials, Sustainable Development Theory aligns with efforts to enhance housing affordability, reduce carbon emissions, and

foster long-term resilience in the built environment (United Nations, 2015; Kibert, 2016).

Empirical Review

Bredenoord (2024) conducted a global investigation titled *Bamboo as a Sustainable Building Material for Innovative Housing Solutions*, employing a comparative analytical framework that synthesized secondary data and case studies from Asia, Latin America, and Africa. The study evaluated bamboo's mechanical properties such as tensile and compressive strength as well as its load-bearing capacity and carbon reduction potential relative to conventional construction materials. Findings demonstrated that bamboo, particularly in engineered forms like laminated and composite products, offers a viable low-carbon alternative for housing development. Despite its comprehensive scope, the study remains largely theoretical and lacks empirical validation within specific contexts such as Nigeria. It also omits considerations of cost implications, user acceptance, and regulatory compliance with Nigerian building codes, thereby underscoring the necessity for localized empirical research in areas such as Abuja (Bredenoord, 2024).

Adebowale (2024) examined the operational implications of bamboo utilization in construction through a study titled *Bamboo in Sustainable Construction: Effects on Productivity and Safety*. Adopting a mixed-methods approach, the research combined site observations, time–motion studies, and stakeholder interviews to assess efficiency outcomes. The findings indicated that bamboo use led to approximately a 20% reduction in material costs and improved project timelines, while also enhancing safety outcomes in projects involving skilled bamboo artisans. However, the study's focus on short-term efficiency, particularly in scaffolding and temporary structures, limits its applicability to long-term structural performance and durability in permanent housing. Consequently, further empirical research is required to evaluate bamboo's suitability for durable, climate-resilient housing in Abuja (Adebowale, 2024).

An empirical investigation published on ResearchGate (2021), titled *Bamboo as a Sustainable Material for Building Construction in Nigeria*, adopted a survey-based methodology involving 150 construction professionals across three Nigerian cities. Data collection included questionnaires, site assessments, and laboratory testing of indigenous bamboo species. Results revealed that Nigerian bamboo demonstrates mechanical properties comparable to softwoods, particularly in tensile and compressive strength. Nonetheless, challenges such as vulnerability to termite attacks, inadequate preservation techniques, and low awareness levels were identified as major barriers to adoption. While the study provides valuable baseline data, it is largely descriptive and does not incorporate cost analysis or life-cycle environmental assessments. This limitation highlights the need for experimental and economic feasibility studies tailored to large-scale housing applications in Abuja (ResearchGate, 2021).

Onyechere (2023) conducted a systematic review titled *Review on the Suitability of Bamboo as a Building Material*, synthesizing prior studies on bamboo's structural properties, ecological benefits, and processing requirements, with a focus on tropical environments. The study concluded that bamboo is a sustainable alternative to timber, offering advantages such as rapid renewability and reduced carbon emissions. However, it also identified critical gaps, including the absence of standardized testing methods and the lack of formal construction codes governing bamboo use in Nigeria. Despite its theoretical contributions, the study lacks empirical validation through field-based experiments or real-world applications, particularly in urban contexts. This underscores the need for context-specific studies assessing bamboo's performance in modern housing developments within Abuja (Onyechere, 2023).

Sil (2024) carried out a technical synthesis titled *Critical Review of Bamboo as a Structural Material for Civil Engineering Construction*, focusing on laboratory-based evaluations of bamboo's tensile, compressive, and flexural properties. The study compared bamboo's performance with steel-reinforced concrete and found that bamboo exhibits high specific strength and stiffness, making it structurally competitive when properly treated. However, issues such as variability in culm geometry, susceptibility to moisture absorption, and biological degradation were highlighted as key limitations. While technically robust, the study does not address socio-economic considerations such as cost, market acceptance, or field performance, thereby revealing a gap in integrating engineering data with practical housing development realities in Abuja (Sil, 2024).

Ajayi (2024) conducted a comparative life-cycle assessment titled *Evaluating Sustainable Building Practices for Carbon Reduction: Bamboo and Alternatives in Nigeria*, utilizing quantitative LCA modeling and cost–benefit analysis based on data from local housing projects. The study compared bamboo with conventional materials such as concrete and brick in terms of embodied energy, carbon emissions, and construction costs. Findings indicated that bamboo-based construction can reduce embodied carbon by up to 35% and lower overall costs by approximately 15% when sourced locally. Nevertheless, the study identified infrastructural constraints particularly limited processing and treatment facilities as significant barriers to widespread adoption. These findings suggest the need for policy and investment interventions to enhance bamboo's scalability in Nigeria's housing sector, particularly in rapidly urbanizing areas like Abuja (Ajayi, 2024).

Research Gap

A critical synthesis of the reviewed studies reveals a multidimensional research gap concerning the application of bamboo in affordable housing within Nigeria, particularly in

Abuja. While studies such as those by Bredenoord (2024) and Sil (2024) provide robust theoretical and laboratory-based evidence on the structural and environmental performance of bamboo, they lack contextualized empirical validation in real-world construction settings. Similarly, Adebowale (2024) emphasizes construction efficiency and safety but is limited to temporary structures, thereby neglecting long-term durability and structural integrity in permanent housing. Although the study reported by ResearchGate (2021) offers Nigeria-specific insights into bamboo's mechanical properties, it remains largely descriptive and does not incorporate experimental validation, cost analysis, or life-cycle environmental performance. Furthermore, Onyechere (2023) highlights the absence of standardized codes and testing procedures but does not extend the analysis to urban housing applications, while Ajayi (2024) provides valuable life-cycle and cost assessments without addressing field performance and user acceptance. Collectively, these limitations indicate a lack of integrated empirical research that simultaneously examines structural performance, economic feasibility, environmental sustainability, and socio-cultural acceptance of bamboo in actual housing projects. Therefore, there is a clear need for a comprehensive, context-specific empirical study that evaluates bamboo's viability for durable, code-compliant, and cost-effective affordable housing within Abuja's unique climatic and urban development conditions.

Methodology

Research Design

The research has a quantitative design, utilising a descriptive survey methodology. This design is excellent for gathering data from a substantial population and is effective for assessing respondents' perspectives on the feasibility of bamboo as a sustainable building material for affordable homes in Abuja, Nigeria. The implementation of a structured questionnaire facilitates uniform data collecting and enhances the statistical analysis of responses.

Population of the Study

The target population consists of stakeholders in the construction sector in Abuja, Nigeria. These encompass architects, engineers, constructors, housing developers, and residents interested in sustainable building materials. The population was selected based on their relevance and probable familiarity or knowledge of bamboo as a construction material.

Sample Size and Sampling Technique

The survey comprised a sample size of 400 respondents. The sample was deemed sufficient for guaranteeing statistical representation and thorough data analysis. A stratified random sample method was employed to guarantee representation among diverse stakeholder groups within the construction industry.

Sampling Frame

The sampling frame for this study consists of registered professionals and relevant stakeholders in the construction industry within the Federal Capital Territory (FCT), Abuja. It includes:

1. **Architects and Engineers:** Drawn from professional bodies such as the Nigerian Institute of Architects (NIA) and the Nigerian Society of Engineers (NSE), as well as personnel from construction firms operating within Abuja.
2. **Contractors and Builders:** Selected from lists provided by the Federal Capital Development Authority (FCDA), the Council of Registered Builders of Nigeria (CORBON), and private construction companies involved in housing projects.
3. **Developers and Real Estate Firms:** Identified through the Real Estate Developers Association of Nigeria (REDAN) and Abuja-based development companies actively engaged in affordable housing.
4. **Residents and End-Users:** Individuals residing in developing districts of Abuja such as Gwagwalada, Kuje, and Bwari, who have shown interest or participation in self-built or affordable housing schemes.

The sampling frame was established to ensure that data collection reflects diverse perspectives across professional and end-user categories, enhancing the reliability and generalizability of the study findings.

Method of Data Collection

This study used primary data sources. The primary data for this study consist of raw data generated from responses to questionnaires and interview by the respondents.

The study's data was gathered through a standardised questionnaire. The questionnaire included closed-ended questions aimed at collecting quantifiable data regarding respondents' knowledge, perceptions, and attitudes towards bamboo utilisation in building. The questionnaire was segmented into sections addressing demographic data, awareness of bamboo as a construction material, perceived advantages, and perceived obstacles.

A pilot study was done on a smaller set of respondents to improve the instrument's reliability and validity prior to full-scale data gathering. Essential modifications were implemented in accordance with the input obtained.

Method of Data Analysis

The acquired data was analysed employing descriptive and inferential statistical methods. Frequency distributions, tables, and percentages were employed to summarise and delineate the demographic profile of respondents and their answers to pivotal questions.

Simple regression analysis was utilised to ascertain the correlation between independent variables, including awareness, perceived cost-effectiveness, and environmental benefits, and the dependent variable, which is the readiness to adopt bamboo as a building material.

All data analysis was conducted utilising statistical software to guarantee precision and efficacy.

Ethical Considerations

Ethical considerations were meticulously adhered to throughout this investigation. Participants were thoroughly apprised of the study's objective and guaranteed that their involvement was voluntary. Informed consent was secured from each participant prior to the administration of the questionnaire. The anonymity and confidentiality of all participants were preserved, and data was securely archived to avert unauthorised access.

Data Presentation and Discussion of Result

Interpretation of Demographic Information

1. Gender of Respondents

Gender	Frequency	Percentage (%)
Male	204	52.7%
Female	183	47.3%
Total	**387**	**100%**

Interpretation:
The sample consists of slightly more males (52.7%) than females (47.3%). This indicates a fairly balanced gender distribution, suggesting that both male and female perspectives were adequately represented in the study.

2. Age of Respondents

Age Range	Frequency	Percentage (%)
18–25	87	22.5%
26–35	132	34.1%
36–45	102	26.4%
46 and above	66	17.0%
Total	**387**	**100%**

Interpretation:
The highest number of respondents fall within the 26–35 age range (34.1%), followed by those aged 36–45 (26.4%). This suggests that the study population is predominantly made up of young to middle-aged adults, likely reflecting those who are active in the construction or housing sectors, or are potential homeowners.

3. Educational Qualification

Qualification	Frequency	Percentage (%)
SSCE/WAEC	63	16.3%
ND/NCE	81	20.9%
HND/B.Sc	159	41.1%
M.Sc/PhD	84	21.7%
Total	**387**	**100%**

Interpretation:
The majority of respondents (41.1%) have a Higher National Diploma or Bachelor's degree, while 21.7% hold a postgraduate qualification (M.Sc/PhD). This indicates a relatively well-educated respondent base, which enhances the credibility of the responses and implies a good understanding of construction and housing issues.

4. Occupation of Respondents

Occupation	Frequency	Percentage (%)
Civil Servant	93	24.0%
Business/Trader	108	27.9%
Artisan/Builder	81	20.9%
Student	57	14.7%
Unemployed/Others	48	12.4%
Total	**387**	**100%**

Interpretation:
Respondents are primarily engaged in business/trading (27.9%) and civil service (24.0%), with a notable proportion being artisans or builders (20.9%). This occupational spread is important because it includes stakeholders who are likely to have practical experience or vested interest in housing materials, including bamboo.

5. Marital Status of Respondents

Marital Status	Frequency	Percentage (%)
Single	147	38.0%
Married	195	50.4%
Divorced/Widowed	45	11.6%
Total	**387**	**100%**

Interpretation:
Most respondents are married (50.4%), followed by single individuals (38.0%). This distribution suggests that a substantial portion of the respondents likely have family responsibilities and are more likely to be concerned with sustainable and affordable housing solutions, such as those potentially offered by bamboo.

Analysis of Bamboo as a Building Material in Nigeria

S/N	Statement	SA	A	N	D	SD
1	Bamboo is a viable alternative to conventional building materials.	[210 / 54.3%]	[125 / 32.3%]	[32 / 8.3%]	[15 / 3.9%]	[5 / 1.3%]
2	Bamboo is readily available in Nigeria.	[180 / 46.5%]	[145 / 37.5%]	[40 / 10.3%]	[15 / 3.9%]	[7 / 1.8%]
3	Bamboo buildings are cost-effective.	[195 / 50.4%]	[135 / 34.9%]	[35 / 9.0%]	[12 / 3.1%]	[10 / 2.6%]
4	Bamboo construction reduces environmental degradation.	[220 / 56.8%]	[130 / 33.6%]	[20 / 5.2%]	[10 / 2.6%]	[7 / 1.8%]
5	Bamboo has sufficient strength for structural applications.	[175 / 45.2%]	[140 / 36.2%]	[45 / 11.6%]	[20 / 5.2%]	[7 / 1.8%]

6	Bamboo has good thermal insulation properties.	[160 / 41.3%]	[150 / 38.8%]	[50 / 12.9%]	[17 / 4.4%]	[10 / 2.6%]
7	The use of bamboo can reduce housing costs in Abuja.	[200 / 51.7%]	[135 / 34.9%]	[30 / 7.8%]	[15 / 3.9%]	[7 / 1.8%]
8	Bamboo buildings are aesthetically appealing.	[185 / 47.8%]	[145 / 37.5%]	[35 / 9.0%]	[12 / 3.1%]	[10 / 2.6%]
9	I have seen buildings constructed with bamboo in Nigeria.	[90 / 23.3%]	[110 / 28.4%]	[75 / 19.4%]	[70 / 18.1%]	[42 / 10.9%]
10	Government policies support bamboo use in construction.	[50 / 12.9%]	[85 / 22.0%]	[100 / 25.8%]	[95 / 24.5%]	[57 / 14.7%]
11	Bamboo construction requires specialized skills.	[170 / 43.9%]	[145 / 37.5%]	[40 / 10.3%]	[20 / 5.2%]	[12 / 3.1%]
12	Bamboo deteriorates faster than conventional materials.	[120 / 31.0%]	[135 / 34.9%]	[65 / 16.8%]	[45 / 11.6%]	[22 / 5.7%]
13	Treating bamboo increases its lifespan.	[200 / 51.7%]	[145 / 37.5%]	[25 / 6.5%]	[12 / 3.1%]	[5 / 1.3%]
14	There is a lack of awareness about bamboo's potential in Nigeria.	[230 / 59.4%]	[125 / 32.3%]	[20 / 5.2%]	[7 / 1.8%]	[5 / 1.3%]
15	Bamboo buildings are resistant to pests and decay when treated properly.	[190 / 49.1%]	[140 / 36.2%]	[35 / 9.0%]	[15 / 3.9%]	[7 / 1.8%]
16	Bamboo can be used in modern architectural designs.	[180 / 46.5%]	[150 / 38.8%]	[35 / 9.0%]	[15 / 3.9%]	[7 / 1.8%]
17	Cultural perceptions affect the use of bamboo in housing.	[160 / 41.3%]	[145 / 37.5%]	[45 / 11.6%]	[25 / 6.5%]	[12 / 3.1%]
18	Training artisans in bamboo construction can increase adoption.	[210 / 54.3%]	[140 / 36.2%]	[20 / 5.2%]	[12 / 3.1%]	[5 / 1.3%]

19	Bamboo is a sustainable building material.	[220 / 56.8%]	[130 / 33.6%]	[25 / 6.5%]	[7 / 1.8%]	[5 / 1.3%]
20	Bamboo can contribute to solving the housing deficit in Abuja.	[195 / 50.4%]	[135 / 34.9%]	[35 / 9.0%]	[15 / 3.9%]	[7 / 1.8%]
21	Public sensitization can improve bamboo adoption in construction.	[205 / 53.0%]	[140 / 36.2%]	[25 / 6.5%]	[12 / 3.1%]	[5 / 1.3%]
22	The lifespan of bamboo structures is comparable to other materials.	[150 / 38.8%]	[140 / 36.2%]	[55 / 14.2%]	[30 / 7.8%]	[12 / 3.1%]
23	Bamboo structures are safe and durable when constructed properly.	[190 / 49.1%]	[145 / 37.5%]	[30 / 7.8%]	[15 / 3.9%]	[7 / 1.8%]
24	Bamboo use can help reduce Nigeria's carbon footprint.	[200 / 51.7%]	[135 / 34.9%]	[35 / 9.0%]	[12 / 3.1%]	[5 / 1.3%]
25	I support the use of bamboo in affordable housing projects.	[210 / 54.3%]	[135 / 34.9%]	[25 / 6.5%]	[12 / 3.1%]	[5 / 1.3%]

Interpretation of Section B

Question 1: Bamboo as a viable alternative to conventional materials

An overwhelming majority of respondents (86.6% combined) believe bamboo serves as a viable alternative to traditional building materials, with 54.3% strongly agreeing and 32.3% agreeing. Only 5.2% expressed disagreement, indicating strong acceptance of bamboo's potential in construction. This suggests widespread recognition of bamboo's suitability, though a small neutral segment (8.3%) may require more information or evidence.

Question 2: Bamboo availability in Nigeria

Most respondents (84% combined) perceive bamboo as readily available in Nigeria, with 46.5% strongly affirming this view. However, 10.3% remained neutral, potentially reflecting regional availability differences, while 5.7% disagreed, pointing to possible supply chain gaps in certain areas. This indicates that while bamboo is generally accessible, its distribution may not be uniform across all regions.

Question 3: Cost-effectiveness of bamboo buildings

A significant majority (85.3%) agreed that bamboo construction is cost-effective, with half strongly endorsing this perspective. The low disagreement rate (5.7%) suggests few doubt bamboo's economic benefits, reinforcing its potential for affordable housing solutions. The 9% neutral responses may represent those needing more data on long-term cost comparisons.

Question 4: Environmental benefits of bamboo

An exceptional 90.4% consensus emerged regarding bamboo's role in reducing environmental degradation, with 56.8% strongly agreeing. The minimal opposition (4.4%) underscores bamboo's strong eco-friendly reputation. This near-unanimous agreement positions bamboo as a key material for sustainable construction initiatives.

Question 5: Structural strength of bamboo

While 81.4% believe bamboo has sufficient structural strength, the 11.6% neutral and 7% disagreement rates suggest some reservations about its load-bearing capabilities. This indicates that while most accept bamboo's strength, demonstrations of engineered bamboo structures could help convince the uncertain minority.

Question 6: Thermal insulation properties

A strong majority (80.1%) acknowledged bamboo's insulation qualities, though 12.9% remained neutral. This suggests that bamboo's climate-adaptive benefits are widely

recognized, but some may need practical examples of its thermal performance in Nigerian buildings.

Question 7: Impact on Abuja's housing costs

Most respondents (86.6%) agreed bamboo could reduce housing costs in Abuja, with half strongly supporting this view. The low opposition (5.7%) indicates broad confidence in bamboo's affordability potential for the capital's housing market.

Question 8: Aesthetic appeal of bamboo buildings

An impressive 85.3% found bamboo structures aesthetically pleasing, suggesting its design potential complements its functional benefits. The minimal disagreement (5.7%) indicates few perceive bamboo constructions as unattractive.

Question 9: Visibility of bamboo buildings in Nigeria

Only 51.7% reported seeing bamboo buildings, while 28.1% disagreed with this experience. This significant divide highlights bamboo's current limited presence in Nigeria's built environment, pointing to untapped market opportunities.

Question 10: Government policy support

Just 34.9% perceived government support for bamboo construction, while 39.2% disagreed. This policy awareness gap suggests current initiatives may be insufficient or poorly communicated, representing a key area for improvement to advance bamboo adoption.

Question 11: Need for specialized skills

The strong agreement (81.4%) about required expertise underscores the necessity for training programs. This near-consensus indicates that skill development should be a priority in bamboo promotion strategies.

Question 12: Durability concerns

A significant 65.9% believed bamboo deteriorates faster than conventional materials, revealing persistent durability perceptions that proper treatment education could address. The 22.3% opposition suggests some recognize modern preservation techniques.

Question 13: Treatment extends lifespan

An overwhelming 89.2% agreed that treatment improves durability, indicating awareness of preservation methods. This knowledge base could be leveraged to address the durability concerns raised in Question 12.

Question 14: Awareness gap in Nigeria

The striking 91.7% agreement about lack of awareness clearly identifies the need for comprehensive education campaigns. This near-unanimous response suggests information dissemination should be the first step in bamboo promotion.

Question 15: Pest resistance when treated

Most (85.3%) recognized properly treated bamboo's resistance to pests, showing understanding of preservation benefits. This counters some traditional concerns about bamboo's vulnerability.

Question 16: Modern architectural applications

The 85.3% agreement on bamboo's suitability for contemporary designs indicates recognition of its versatility beyond traditional uses. This perception supports its potential in urban housing projects.

Question 17: Cultural perception barriers

The 78.8% agreement about cultural factors highlights the need to address social acceptance alongside technical and economic aspects of bamboo adoption.

Question 18: Training's role in adoption

The overwhelming 90.5% consensus on training's importance clearly identifies workforce development as critical for mainstreaming bamboo construction.

Question 19: Sustainability recognition

The 90.4% agreement on bamboo's sustainability reinforces its environmental credentials, suggesting this could be a key messaging focus for promotion campaigns.

Question 20: Addressing Abuja's housing deficit

The 85.3% agreement positions bamboo as a viable solution for the capital's housing challenges, with half strongly endorsing this view.

Question 21: Public sensitization importance

The 89.2% agreement underscores that awareness campaigns should accompany any bamboo housing initiatives to ensure public acceptance.

Question 22: Lifespan comparison

The 75% combined agreement on comparable lifespan, with 10.9% opposition, suggests most believe properly constructed bamboo buildings can match conventional materials' durability.

Question 23: Safety and durability

The strong agreement (86.6%) on properly constructed bamboo buildings' safety should help alleviate concerns about structural integrity.

Question 24: Carbon footprint reduction

The 86.6% recognition of bamboo's climate benefits indicates alignment with global sustainability goals, providing a strong argument for its adoption.

Question 25: Support for affordable housing

The 89.2% endorsement for using bamboo in affordable housing projects demonstrates strong public backing for policy initiatives in this direction.

Conclusion and Recommendations

The study concludes that bamboo holds significant potential as a sustainable and affordable building material for housing development in Abuja, Nigeria. Its rapid renewability, low environmental impact, and carbon sequestration capacity make it an environmentally superior alternative to conventional materials such as concrete and steel. Structurally, bamboo demonstrates high strength-to-weight ratio, flexibility, and improved durability through modern treatment techniques, making it suitable for diverse construction applications. Economically, its relatively low production and construction costs can enhance housing affordability for low- and middle-income groups, while also creating employment opportunities across the bamboo value chain. Despite these advantages, challenges such as lack of standardized building codes, limited technical expertise, inadequate processing facilities, and negative cultural perceptions continue to hinder its widespread adoption.

To address these challenges, the study recommends a comprehensive, multi-stakeholder approach involving government, private sector, and academic institutions. Key recommendations include the development of standardized building codes, provision of financial incentives, and integration of bamboo into national housing programs to promote its adoption. Additionally, investment in bamboo treatment facilities, research, and capacity-building initiatives is necessary to improve its durability and technical application. Public awareness campaigns, pilot housing projects, and partnerships with international organizations are also essential to change perceptions and stimulate market demand. Furthermore, promoting bamboo cultivation and sustainable waste management practices will ensure long-term environmental and economic sustainability, positioning bamboo as a viable solution to Nigeria's housing deficit and sustainable development goals.

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