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INNOVATIVE STRATEGIES IN THE UTILIZATION OF LOCAL MATERIALS FOR SUSTAINABLE BUILDING CONSTRUCTION PROJECT IN AKURE, ONDO STATE, NIGERIA

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ABSTRACT

Purpose: *This study examined the innovative strategies required to enhance the utilization of local materials for sustainable building construction in Akure, Ondo State, Nigeria. The purpose is to identify specific technological strategies that can effectively address the sector's heavy dependence on imported materials and the limited adoption of construction-related innovations in the region.* ***Design/methodology/approach:*** *A quantitative research design was adopted to achieve the study objectives. Structured questionnaires were distributed to 195 purposively selected active construction professionals, including registered Architects, registered Civil Engineers, registered Project Managers, registered Builders, registered Estate Surveyors, and registered Quantity Surveyors within Akure, Ondo State. The sample size was determined based on the availability and accessibility of registered practicing professionals within the study area. The data collected were analysed using descriptive statics and mean score ranking to identify and evaluate the most critical strategies for promoting innovation of local materials for sustainable building construction.*

Findings: *The findings revealed that the most critical strategies for improving local material utilization include investing in research and development (Mean=4.811), encouraging start-ups (Mean=4.78), and training and skill development programs (Mean=4.77). Other key drivers identified include introducing modern machinery and technology (Mean=4.76), and standardizing local materials (Mean=4.76). While these strategies align with existing literature, the study highlights their contextual relevance to Akure's construction environment, where material innovation remains limited.* ***Research limitations/implications:*** *The study is restricted by its focus on a single city, reliance on selfreported perceptions, and the absence of qualitative insights that could provide deeper explanatory understanding.*

Originality/value: *This study contributes to the ongoing discourse of how innovative strategies can drive the sustainable utilization of local materials in construction projects in Akure, Ondo State by offering evidence-based prioritization of innovation-oriented strategies tailored to a rapidly urbanizing Nigerian city.*

Keywords: Innovation; Local Materials; Sustainable Construction; Technology Adoption

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1.0 INTRODUCTION

Construction sector has been widely recognized as a major consumer of natural resources and a significant contributor to environmental degradation through high energy use, material wastage, and carbon emissions (Adebayo & Kareem, 2022). In developing countries such as Nigeria, the construction sector faces persistent challenges associated with high costs of materials, resource depletion, dependence on imported materials, and low level of technological innovation (Ogunbiyi & Afolabi, 2021). These challenges have constrained the industry's capacity to meet the growing demand for affordable, and eco-friendly housing. Yet, Nigeria possesses abundant natural resources such as timber, bamboo, laterite, and clay that if innovatively utilized will promote sustainable building practices, enhance local economic development, and reduce environmental degradation (Olanrewaju *et al*., 2023).

In recent years, there has been increasing drive towards sustainable construction practices that prioritize the use of indigenous materials. Recent studies have shown that local materials when enhanced through research and innovation, can significantly reduce the carbon footprint of buildings, lower construction costs, and support local economic growth (Adebayo & Kareem, 2022), innovation in material processing, standardization, and application can significantly enhance the performance, durability, structural integrity, and aesthetic appeal of local building materials, thereby making them viable alternatives to imported materials (Awodo & Ugwu, 2020; Balogun *et al*., 2023). Such innovations include improved production techniques, material testing, professional training, and integration of modern construction technologies. The level of adoption of these innovations in Nigeria remains low due to poor professional awareness, inadequate technical capacity, weak regulatory frameworks, limited research investment, and persistent socio-cultural biases that associate imported materials with superior quality (Ezeokoli *et al*., 2021).

Although Existing literature has extensively discussed the benefits and challenges of local material utilization, there remains a clear gap regarding the specific innovative strategies required to improve their adoption at the city level. It is not sufficiently clear which innovation driven strategies, technological, policy based, institutional, or capacity building are most critical for enhancing local material utilization in rapidly urbanizing Nigerian cities such as Akure. Furthermore, limited empirical studies have prioritized or ranked these strategies based on the perception of construction professionals who directly influence material selection and project implementation. Akure, the capital of Ondo State, is experiencing rapid urbanization and a rising demand for residential and commercial building. This growth has intensified pressure on housing delivery systems and highlighted the need for affordable, and environmentally responsible construction solutions. Despite the availability of local materials within and around Akure, their application in urban housing projects remains minimal. Studies such as Okafor *et al*. (2020) attribute this trend to weak policy enforcement and insufficient investment in material research and development. However, these studies do not adequately contextualize how innovative strategies can be tailored to address Akure's specific construction environment, professional practices, and technological limitations. Globally, research emphasizes that innovation in construction

thrives in environments supported by effective policies, institutional collaboration, and strong industry academia linkages (Idris and Ojo (2024). Similarly, recent Nigerian studies highlight the importance of combining government incentives, technological integration, and research driven solutions to improve the performance and acceptance of indigenous materials (Olanrewaju *et al*., 2023). Nonetheless, the transferability of these global and national insights to Akure's local context remains underexplored.

This study sort to investigate and prioritize innovative strategies for utilizing local materials for sustainable building construction projects in Akure, Ondo State. By adopting a quantitative survey approach that captures the perceptions of actively practicing construction professionals, the study aimed to identify context specific, evidence-based strategies capable of addressing existing adoption barriers. The findings are expected to contribute to policy formulation, professional practice, and academic discourse by clarifying what is currently unknown and providing a structured pathway for enhancing innovation driven use of local materials sector.

2.0 Literature Review 2.1 Concept of Innovation of Local Materials for Construction

Innovation of local building materials refers to the systematic improvement in indigenous materials through technological enhancement, standardization, improved processing methods, and novel applications that improve performance, durability, and acceptability in modern construction (Adebayo & Kareem, 2022). Recent studies emphasize that innovation goes beyond material substitution to include design adaption, production efficiency, and integration with contemporary construction systems (Balogun *et al*., 2023). While several scholars highlight the technical potential of local materials such as laterite, bamboo, and timber, findings differ regarding their scalability and acceptance in urban construction. For instance, Olarewaju *et al*., (2023) reported that improved stabilization techniques significantly enhance laterite strength, making it comparable to conventional materials. Conversely, Ezeokoli *et al*. (2021) argued that despite technical feasibility, poor perception among professionals remains a major barrier to adoption. These contrasting views suggest that innovation is not purely technical but also institutional and socio-cultural. Yadav et al. (2024) highlighted that innovation of local materials supports the circular economy model by integrating recycling and reusability principles, reducing waste generation, and lowering the embodied carbon of building. Across various regions, researchers have explored novel ways to improve the mechanical and environmental performance of local materials. In Asia, bamboo and rice husk ash have been innovatively applied as structural reinforcements and cementitious substitutes. Studies in India and ash-based cement replacements can deliver compressive strengths comparable to conventional materials strengths comparable to conventional materials when properly processed (Zhang *et al*., 2021). Similarly, in Latin America, soil cement blocks and earthen materials have been optimized through the incorporation of natural fibres and chemical stabilizers, leading to enhanced durability and resistance to moisture (Cruz & Taveres, 2020). These practices reflect a deep understanding of local resources environmental conditions, blending traditional craftsmanship with modern material science.

In Africa, Innovation of local materials has primarily focused on reducing the cost of construction and promoting sustainability through resource efficiency. Abdulrahman and Ali (2022) found that laterite, palm kernel shell, and bagasse ash can serve as viable alternatives to conventional aggregates and cement, achieving notable reductions in carbon emissions. Similarly, Ohemeng and Ramabodu (2025) highlighted that the valorisation of construction and demolition waste through innovative recycling methods contributes significantly to sustainable infrastructure in sub-Saharan Africa. These innovations have not only improved materials performance but also created economic opportunities by supporting local production chains and minimizing reliance on imported resources. In Europe and North America, innovation of local materials has been closely linked with environmental policies and

green building standards. Al-Kadmany and Ali (2023) reported that locally sourced low-carbon materials such as timber, hempcrete, and straw bale systems are increasingly used in sustainable housing developments across the Uk and the US. These materials are being improved through digital fabrication, moisture control systems, and hybrid composites to enhance their fire resistance and longevity. Likewise, a study in Sweden demonstrated that innovations in wood modification and biobased composites could reduce the carbon footprint of residential buildings by more than 40% compared to concrete structures (Johanson *et al*., 2022).

2.2 Innovation for Sustainable Construction

Sustainable construction refers to the creation of built environments that are resource efficient and environmentally responsible throughout a building's life cycle from design and material selection to operation and eventual demolition (Olanrewaju *et al*., 2021). It emphasizes the integration of innovative practices, technologies, and materials that promote energy efficiency, durability, and affordability without compromising the quality of life for present and future generations. Sustainable construction emphasizes environmental responsibility, economic efficiency, and social inclusion across the building lifecycle (Idris & Ojo, 2024). Innovation plays a vital role in achieving these objectives by enabling efficient material use, waste reduction, and carbon emission mitigation. Recent studies link's the innovative use of local materials to circular economy principles, where materials are sourced locally, processed efficiently, and reintegrated into the local economy (Adebayo & Kareem, 2022).

However, many studies adopt a broad sustainability lens, often combining digital technologies such as Building Information Modelling (BIM), renewable energy systems, and smart construction practices without explicitly relating them to indigenous materials (Balogun et al., 2023). Innovative approaches in sustainable construction often involve the use of renewable and locally available materials, modern construction techniques, and environmentally friendly design principles. For instance, the adoption of green building technologies such as solar panels, energy-efficient lighting, and water recycling systems reflects a growing commitment to innovation in the industry (Adebayo & Ogundipe, 2020). Additionally, the shift toward modular and prefabricated construction methods has reduced waste and accelerated project delivery, thereby enhancing sustainability outcomes (Ofori, 2019).

The incorporation of building information modelling (BIM) and digital design tools allows for efficient planning and resource management, minimizing the environmental footprint of construction projects. According to Eze *et al*. (2022), technological innovation is vital for achieving sustainable construction objectives, particularly in developing countries where resource constraints and environmental degradation are prevalent. These tools enhance collaboration among stakeholders, reduce design errors, and improve construction accuracy, ultimately supporting sustainable outcomes.

2.3 Barriers to Innovation of Local Materials Utilization

Despite the growing recognition of local materials as viable alternatives for sustainable construction, numerous barriers continue to hinder their effective utilization and innovation in the construction industry. These barriers identified include inadequate technical knowledge, lack of standard specifications, weak policy enforcement, limited research funding, and negative professional perceptions (Ezeokoli *et al*., 2021; Okafor *et al*., 2020). One of the most critical barriers is limited funding and investment in research and development (R&D). In many developing countries, including Nigeria, there is inadequate financial support for testing, improving, and standardizing local materials (Olayiwola *et al*., 2020). This underinvestment discourages innovation and prevents the development of large-scale production processes that could enhance material quality and availability. According to

Ede and Afolayan (2021), without adequate funding, the transition from experimental to commercial application of innovative local materials remains slow and unsustainable.

Technical limitations and lack of standardization also pose serious barriers. In many cases, local materials have not undergone sufficient scientific evaluation to determine their structural, thermal, or environmental properties. The absence of standardized testing and certification frameworks makes it difficult to guarantee performance reliability (Abubakar & Kolo, 2021). Consequently, engineers and architects are hesitant to specify such materials for large scale or high value projects. Standardization is crucial for building trust among professionals and for ensuring that local materials meet national and international construction codes. Institutional and policy related barriers further exacerbate the problem. Weak government policies, inadequate enforcement of existing regulations, and the absence of incentives for innovation in local material production have limited progress in the industry (Nwosu & Ojo, 2020). The lack of collaboration between research institutions, universities, and industry players means that innovative findings rarely translate into practical applications (Ogunleye et al., 2023). Moreover, bureaucratic bottlenecks in patent registration and funding access discourage small scale innovators from pursuing development initiatives. Socioeconomic and infrastructural challenges play a vital role. Poor road networks, unreliable power supply, and inadequate manufacturing facilities impede the large-scale processing and transportation of local materials (Okeke & Udo, 2022). Additionally, limited access to modern equipment and technology restricts the ability of artisans and small manufacturers to improve the efficiency and quality of production. These infrastructural deficiencies hinder innovation, scalability, and competitiveness in the construction market.

3.0 METHODOLOGY 3.1 Research Design and Population of Study

This study adopted quantitative survey research design, considered appropriate for systematically capturing professional perceptions and prioritizing innovative strategies across a diverse respondent group (Adebayo & Kareem, 2022). A quantitative approach enables objective comparison and ranking of strategies, which aligns with the study's aim. The target population comprised registered construction professionals practicing in Akure, which include Architects, Builders, Civil Engineers, Estate Surveyors, and Quantity Surveyors. Census sampling was adopted, where all 195 identified registered professionals constituted the sample size. Purposive sampling was used based on professional registration, active involvement in building projects, and minimum years of experience. This ensured that response were obtained from professionals who are knowledgeable about material selection and innovation practices.

Table 1: Distribution of Active Registered Professional Subscribers in Akure S/N Active Registered Professional Subscribers Size Percentage

1.	Registered Architects	40	20.51
2.	Registered Builders	40	20.51
3.	Registered Civil Engineers	40	20.51
4.	Registered Estate Surveyors	30	15.38
5.	Registered Project Managers	30	15.38
6.	Registered Quantity Surveyors	15	7.69
	Total	195	

Source: Registration board of construction professionals, Akure (2025)

3.2 Instrumentation of Data Collection and Response Rate of Questionnaire

A structured questionnaire was used to collect data on stakeholder perceptions of strategies for promoting innovation in the utilization of local materials. A total of 170 valid responses were analysed using descriptive statistics and mean score ranking. The instrument employed a five-point likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), to assess the level of agreement with various statements relating to innovation and sustainability practices. Data were presented in frequency tables and interpreted based on the mean scores. Content validity was established through expert review by academics and industry professionals. Prior to the main survey, a pilot test was conducted among 20 construction professionals who were not included in the main study. The pilot test assessed the clarity, structure, and comprehensibility, and structural validity of the questionnaire. Reliability analysis using Cronbach's alpha yielded a coefficient of 0.88, indicating a high level of internal consistency and reliability (Hair *et al*., 2019).

A total of 195 questionnaires were distributed among the respondents. From Table 4.3, it can be observed that out of the 195 distributed questionnaires, 87.2% were retrieved and were duly and completely answered by the respondents, which represents 87.18% of the total questionnaires distributed. According to Moser and Kalton (2017), a survey's results can be deemed significant if the response rate is not lower than 35%. Therefore, the response rate of 87.18% in this study is considered highly reliable and sufficient to achieve the research objectives.

Table 2: Response Rate of Questionnaire

Copies of Questionnaire	Frequency	Percent
Quantity Distributed	**195**	**100.0**
Quantity Retrieved	**170**	**87.18**
Quantity Analyzed (completely and duly filled)	**170**	**87.18**

Source: Researcher's Field Report (2025)

3.3 Data Analysis Techniques

Data were analysed using descriptive statistics, including frequencies, percentages, mean scores, and mean ranking with SPSS version 26. Mean score ranking was employed to identify critical innovative strategies based on professional consensus. Mean values were interpreted using predefined thresholds, where higher mean scores indicated greater perceived importance. This approach is suitable for perception-based studies and aligns with the study objectives.

3.4 Ethical Considerations

Ethical standards were strictly observed throughout the research process. Participation was entirely voluntary, and all respondents were informed of the study's purpose and assured of confidentiality and anonymity. No personal identifiers were recorded, and data collected were used solely for academic purposes, in accordance with the ethical principles of responsible research conduct.

4.0 Data Presentation, Analysis and Interpretation of Results 4.1 Respondents' Demographic Information

Table 3 presents the frequency and percentage distribution of the respondents' demographic information. Of the 170 respondents, 79.4% were male, while 20.6% were female, indicating a pronounced gender imbalance. This reflects the male dominated nature of Nigeria's construction industry. In terms of age distribution, 49.41% of the respondents were between the ages of 31 and 40, 24.1% were between 20 and 30 years old, 18.8% were between 41 and 50 years old, 5.3% were above 60 years old, and 2.4% were between 51 and 60 years old. Resulting in a cumulative 68.2% between 31 and 50 years. This concentration indicates that the study largely captured the views of mid-career professionals who are actively involved in decision making and project execution. While this strengthens the practical relevance of the findings, it may underrepresent younger professionals who are often more receptive to digital technologies and experimental innovations, as well as older professionals who may prioritize conventional practices and risk mitigation. Regarding educational qualifications, the majority of the respondents possessed advanced academic credentials, with 61.8% holding MSc degree and 24.7% holding Ph.D degree, while only 13.6% had qualifications at Bachelor's level or below. This high level of academic attainment suggests that respondents are likely to have strong theoretical exposure to sustainability and innovation concepts. However, it also introduces a potential academic bias, as highly educated respondents may emphasize research driven, policy oriented, or design led innovation strategies over informal, craft based, or indigenous knowledge systems commonly applied by artisans and small-scale builders.

Professional background analysis reveals that Civil Engineers (23.5%), Architects (20.6%), and Builders (17.6%), constituted the majority of respondents, followed by Estate Surveyors (17.6%), Project Managers (14.7%), and Quantity Surveyors (5.8%). The dominance of technical and managerial professionals suggests that the prioritization of innovation strategies may be influenced by design efficiency, project delivery, and regulatory compliance considerations. The relatively high representation of project managers may have contributed to the emphasis on structured strategies such as standardization, policy frameworks, and process driven innovation. Most respondents had substantial professional exposure, with 45.6% having 6-10 years of experience, 19.4% having 11-15 years, and 8.2% having over 15 years. Consequently, 74.1% of respondents had more than six years of experience. This level of experience enhances the credibility of the findings, as respondents are likely to base their judgements on practical exposure rather than theoretical assumptions. However, experienced professionals may also demonstrate conservative tendencies, potentially explaining the relatively low prioritization of high-risk strategies such as heavy investment in research and advanced machinery.

Professional certification shows that a large proportion of respondents were affiliated with recognized professional bodies, including NSE, NIOB, and NIA (17.6%), PMI (14.7%0, and NIQS (11.8%), among others. This suggests strong professional legitimacy and ethical grounding. At the same time, professional affiliation may shape respondents' preferences toward formalized, institutionally supported innovation strategies, rather than grassroot or informal innovation pathways. Finally, respondents were almost evenly distributed between management level (51.2%) and supervisory level (48.8) positions. This balance enhances the robustness of the data by capturing perspectives from both strategic decision makers and

operational actors. Nevertheless, differences in hierarchical roles may influence how innovation strategies are perceived, with managers potentially favouring policy, standardization, and collaboration, while supervisors may prioritize skills development and practical design adaptability.

Table 3: Respondents' Demographic Information

Variables	Frequency	Percentage (%)
Gender		
Male	135	79.4
Female	35	20.6
Age		
20-30 years	41	24.1
31-40 years	84	49.4
41-50 years	32	18.8
51-60 years	4	2.4
>60 years	9	5.3
Highest Education Qualification		
HND	1	0.6
PGD	3	1.8
B.SC	19	11.2
MSc	105	61.8
Ph.D	42	24.7
Current Profession		
Project Manager	25	14.7
Civil Engineer	40	23.5
Architect	35	20.6
Builder	30	17.6
Quantity Surveyor	10	5.9
Estate Surveyor	30	17.6
Years of Experience		
1-5 years	44	25.9

6-10 years	79	46.5
11-15 years	33	19.4
>15 years	14	8.2

Professional Membership/Certification

PMI	25	14.7
NSE	30	17.6
NIOB	30	17.6
NIA	30	17.6
NIQS	20	11.8
NIA;PMI	13	7.6 NIQS;PMI 12 7.1
NSE;PMI	10	5.9

Position in the Organization	**Frequency**	**Percentage (%)**
Management position	87	51.2
Supervisory position	83	48.8

Source: Researcher's Field Report (2025)

4.2 Organization Status

The respondents are primarily from three types of organizations: Construction contracting firms (36.4%), Construction consultancy firms (33.3%), and Government agencies (30.2%). This indicates that the survey gathered insights from a diverse range of stakeholders involved in different aspects of the construction sector in Akure, Ondo State, including those involved in executing projects, providing consulting services, and working within government bodies related to construction.

Table 4: Organization Status

Organization Status	Frequency	Percentage (%)
Construction contracting Firm	59	36.4
Construction consultancy Firm	54	33.3
Government agency	57	33.5

Source: Researcher's Field Report (2025)

4.3 Stakeholder's Perception of Innovation Strategies for Local Materials Utilization

The results indicate varying levels of stakeholders' responses regarding strategies for promoting innovation of local material utilization, with mean values ranging from 1.13 to 2.25. The highest ranked strategy is innovation in design and aesthetics (Mean=2.25), followed closely by standardization of local materials (Mean=2.24). Training and skill development programmes (Mean=1.23) ranked third, while encouraging start-ups and local entrepreneurs (Mean=1.22) were ranked fourth and fifth positions, respectively. Other strategies received relatively lower rankings, including adoption of digital platforms (Mean=1.21), government incentives (Mean=1.19), investment in research and development (Mean=1.19), introduction of modern machinery and technology (Mean=1.17), and collaboration between academic institutions and the construction industry (Mean=1.13). The prominence of design and aesthetic innovation suggests that stakeholders perceive visual appeal and functional adaptability as the most immediate and practical means of improving the acceptance of local materials. This indicates a market driven orientation, where innovation is closely linked to end-user perception and confidence rather than purely technical advancement. The high ranking of material standardization reflects stakeholders' concerns with reliability, quality assurance, and regulatory acceptance. Without standardized specifications, local materials may continue to face resistance from professionals who prioritize predictability and compliance with formal construction codes.

The positioning of training and skill development as a mid-ranked strategy highlights recognition of human capital as a facilitator of innovation, though it may be viewed as secondary design led improvements. Similarly, the moderate ranking of entrepreneurship and supportive policies indicates acknowledgement of institutional and economic enablers, albeit with less urgency compared to aesthetic and standardization concerns. Research and development, government incentives, and technological advancement were ranked relatively low. This suggests that stakeholders may perceive these strategies as long-term, capital intensive, or externally driven, making them less immediately impactful within the local context. The lowest ranking of academia industry collaboration points to weak institutional linkages rather than a dismissal of its importance. The emphasis on design led innovation and aesthetics aligns with Chen *et al*. (2019), who identified creative design as a critical driver of product competitiveness in the construction sector. Adebayo and Kareem (2021) similarly reported that design-led innovation enhances the perceived value of indigenous materials and mitigates socio-cultural bias against their use. The importance attributed to standardization supports findings by Abisuga *et al*. (2020), who identified the absence of performance benchmarks as a major constraint to the adoption of local materials in developing economies. Furthermore, Kumar and Kasim (2021) emphasized that skill development improves craftsmen's capacity to implement innovative construction practices effectively.

Although ranked lower, the relevance of digital platforms, research investment, and modern technology is well documented. Olawo *et al*. (2022) highlighted the role of digital tools in innovation diffusion,

while Harty (2016) and Ugochukwu and Onyekwena (2019) underscored the long-term importance of R&D and fiscal incentives. Similarly, Akinade *et al*. (2017) demonstrated that mechanization significantly enhances efficiency and material performance. The low ranking of academic-industry collaboration contrasts with Wanga *et al*. (2020), who established its role in sustaining applied innovation. The findings showed that stakeholders currently prioritize visible, market-oriented strategies, such as design enhancement and standardization, over systemic and institutional innovation mechanisms. While this may improve short-term acceptance of local materials, it risks underinvesting in foundational drivers such as research, technology, and knowledge transfer. The narrow range of mean scores also suggests limited discriminatory power among the strategies, indicating broad agreement rather than clear prioritization.

Table 5. Strategies for Innovation

Content		SD	D	N	A	SA	MEAN	RANK
Collaboration between academic	**Frequency**	1.0	4.0	4.0	15.0	145.0	1.13	10
Institutions and the construction	**Percent**	0.6	2.4	2.4	8.9	85.8		
industry promotes innovation.								
Digital platforms can help	**Frequency**	2.0	2.0	4.0	15.0	146.0		
1.21 6 **promote innovative ideas**	**Percent**	1.2	1.2	2.4				
8.9 86.4 **and best practices for local material use.**								
Encouraging start-ups and	**Frequency**	0.0	3.0	6.0	17.0	144.0	1.22	
4 **and local entrepreneurs can**	**Percent**	0.0	1.8	3.5	10.0			
84.7 **drive innovation in the local materials sector.**								
Government incentives	**Frequency**	0.0	1.0	9.0	12.0	147.0		
1.19 7 **can encourage innovation**	**Percent**	0.0	0.6	5.3				
7.1 87.0 **in processing local materials.**								
Innovation in design and	**Frequency**	1.0	4.0	6.0	14.0	145.0	1.25	
1 **aesthetics can make local**	**Percent**	0.6	2.4	3.5	8.2			
85.3 **materials more appealing in**								
modern construction.								
Introducing modern machinery	**Frequency**	1.0	2.0	3.0	15.0	147.0	1.17	
9 **and technology can enhance**	**Percent**	0.6	1.2	1.8	8.9			

87.5 **the efficiency of using local materials.**							
Investing in research and	**Frequency**	1.0	1.0	6.0	14.0	148.0	1.19
8 **and development can improve**	**Percent**	0.6	0.6	3.5	8.2		
87.1 **the quality of local materials.**							
Policies that support sustainable	**Frequency**	1.0	3.0	4.0	18.0	143.0	1.22
5							
Construction can accelerate inno-	**Percent**	0.6	1.8	2.4	10.7	84.6	**vation**
with local materials.							
Standardizing local materials can	**Frequency**	1.0	1.0	8.0	17.0	143.0	1.24
2							
increase their acceptance and	**Percent**	0.6	0.6	4.7	10.0	84.1	**stimulate**
innovation							
Training and skill development	**Frequency**	1.0	3.0	6.0	14.0	146.0	
1.23 3 **programs can support innovative**	**Percent**	0.6	1.8	3.5	8.2	85.9	
practices with local materials							

Source: Researcher's Field Survey (2025)

4.4 Stakeholders' Awareness on the Use of Local Materials

Table 6 presents stakeholders' levels of awareness regarding the use of selected local construction materials. The results indicate high awareness of laterite, bamboo, and timber; moderate awareness of thatch and coconut shell; and low awareness of agricultural residues such as palm kernel shell, groundnut shell, and cotton stalk. This distribution reflects uneven familiarity with locally available materials among construction stakeholders.

The high awareness of laterite, bamboo, and timber suggests that stakeholders are more familiar with materials that are traditionally embedded in indigenous construction practices and widely available within the local environment. These materials are also commonly encountered in both formal and informal construction, which reinforces professional exposure and acceptance. Conversely, the moderate awareness of thatch and coconut shell indicates a transitional perception, while recognized as local materials, they are increasingly viewed as less suitable for modern construction due to concerns about durability, maintenance, and aesthetic relevance. The low awareness of agricultural by-products reveals a significant knowledge gap. Despite their potential for sustainable innovation, these materials remain marginal within professional practice, largely due to limited technical validation, minimal exposure in professional training, and weak integration into construction standards. The high awareness of laterite, bamboo, and timber is consistent with findings by Olowo *et al*. (2022) and Okonkwo and Oke (2018), who attributed their widespread recognition to accessibility, affordability,

and cultural familiarity. Similarly, Nwosu *et al*. (2021) stated that these materials remain integral to indigenous building systems due to their proven performance and availability. The moderate awareness of thatch and coconut shell aligns with Ameh and Oke (2017), who stated that traditional materials often suffer declining relevance in contemporary construction because they are perceived as outdated or structurally inferior.

Low awareness of agricultural residues supports the conclusions of Adebayo and Oduwaye (2021), who identified poor research dissemination, lack of technical knowledge, and absence of standardized design guidelines as major constraints to their adoption. Internationally, the prominence of bamboo and recycled materials reflects broader sustainability trends. Chinwuba and Mgbemena (2020) and Ghisellini, Cialana, and Ulgiati (2016) linked growing awareness to circular economy initiatives and eco-innovation policies. In contrast, studies from Tanzania and Malawi reported similarly low awareness of agricultural by-products due to limited policy support and technical exposure (Kimaro *et al*., 2020; Mpakati-Gama *et al*., 2022). The findings showed that awareness is strongly influenced by tradition, policy support, and professional exposure, rather than by sustainability potential alone. Materials with established cultural relevance or institutional backing enjoy greater recognition, while innovative but less conventional materials remain underutilized.

Table 6: Level of Stakeholders Awareness (EA=Extremely Aware, VA=Very Aware, SA=Slightly Aware, SWA=Somewhat Aware, NA=Not Aware)

Bamboo	**EA**	**VA**	**SA**	**SWA**	**NA**	**MEAN**	**RANK**
(Frequency)	134.00	20.00	5.00	9.00	1.00	4.61	
2							
(Percent)	79.29	11.83	2.96	5.33	0.59	**Coconut**	
Shell							
(Frequency)	10.00	20.00	14.00	38.00	12.00	1.53	9
(Percent)	79.29	11.83	2.96	5.33	0.59		
Groundnut Shell							
(Frequency)	3.00	8.00	97.00	41.00	18.00	2.58	8
(Percent)	1.80	4.79	58.08	24.55	10.78		
Laterite							
(Frequency)	135.00	18.00	7.00	9.00	1.00	4.63	1
(Percent)	79.41	10.59	4.12	5.29	0.59		

Palm Kernel Shell							
(Frequency)	6.00	14.00	57.00	77.00	14.00	2.50	10
(Percent)	3.57	8.33	33.93	45.29	8.33		
Recycled Plastic Bottles							
(Frequency)	126.00	14.00	10.00	16.00	4.00	4.42	4
(Percent)	8.24	8.24	5.88	9.41	2.35		
Thatch							
(Frequency)	14.00	109.00	10.00	31.00	6.00	3.60	5
(Percent)	8.24	64.12	5.88	18.24	3.53		
Timber							
(Frequency)	131.00	21.00	5.00	9.00	2.00	4.60	3
(Percent)	77.98	12.50	2.98	5.36	1.19		
Maize Stalk							
(Frequency)	4.00	10.00	106.00	33.00	16.00	2.70	6
(Percent)	2.37	5.92	62.72	19.53	9.47		
Cotton Stalk							
(Frequency)	4.00	5.00	102.00	39.00	20.00	2.6	7
(Percent)	2.35	2.94	60.00	22.94	11.76		

Source: Researcher's Field Survey (2025)

4.5 Factors Hindering the Use of Local Materials in Akure

The results presented in Table 7 indicate that lack of technology and innovation recorded the highest overall mean score (Mean=4.65), ranking as the most significant constraint to the adoption of local construction materials in Akure. This was followed by limited knowledge and awareness (Mean=4.40) and perception of inferiority (Mean=4.21), both of which reflect human, cultural, and informational barriers. In contrast, inadequate supply and availability recorded the lowest mean score (Mean=3.82), suggesting that while material availability remains a challenge, it is perceived as less critical compared to technical and perceptual constraints.

The dominance of technological constraints indicates that stakeholders associate the limited use of local materials primarily with insufficient processing technologies, weak innovation systems, and limited access to modern construction methods. Without adequate technological support, local materials are perceived as unable to meet contemporary performance, durability, and aesthetic expectations. The high ranking of limited knowledge and awareness further suggests that information gaps among professionals and end-users significantly influence material selection. When stakeholders lack exposure to the performance capabilities and potential applications of local materials, reliance on imported alternatives becomes entrenched. Similarly, the strong influence of perceived inferiority reflects deep-seated socio-cultural biases that associate imported materials with superior quality and status. In contrast, the relatively lower ranking of supply constraints implies that the physical availability of materials alone does not guarantee adoption; rather, adoption is driven by confidence, knowledge, and technological capacity. These findings align with Adebayo and Oduwaye (2021), who identified inadequate technological infrastructure and weak innovation systems as major impediments to the effective utilization of indigenous construction materials in Nigeria. Olowo *et al*. (2022) stated that limited technical knowledge and poor dissemination of research findings restrict professionals' willingness to adopt local materials. The influence of perception-based barriers corroborates the work of Abisuga *et al*. (2020), who emphasized that sociocultural biases often outweigh technical considerations in material selection decisions. Studies by Okonkwo and Oke (2018) stated that material availability alone has limited impact on adoption when users lack trust in performance and quality standards.

The results showed that strategies aimed at increasing the adoption of local materials should prioritize technological innovation, professional education, and perception management, rather than focusing solely on improving material supply chains. Investment in modern processing technologies, skills development, and research dissemination is essential for enhancing the technical performance and credibility of local materials.

Table 7: Factors Hindering the Use of Local Materials in Akure

Variable	Description of Focus	Section / Overall Mean Score	Rank (Influence)
Lack of Technology and Innovation	Absence of modern machinery, limited research and innovation	4.65	1
Limited Knowledge and Awareness	Insufficient training, poor sensitization, lack of public awareness	4.40	2
Perception of Inferiority	Negative attitudes, preference for foreign materials	4.21	3
Cost Implications of Sustainable Construction	High initial cost, specialized labor, absence of financial incentives	4.15	4
Resistance to Change	Fear of risk, lack of exposure, professional and client reluctance	4.03	5

Cost of Processing and Production Constraints	High labor/transport cost, absence of subsidies or equipment	4.00	6
Inadequate Supply and Availability	Seasonality, poor supply chain, limited distribution	3.82	7 (Lowest)

6.0 Discussion of Findings

The findings showed that the introduction of modern machinery and technology is the most significant strategy for driving innovation (Mean= 4.88). This underscores the need to modernize the processing and production of local materials to improve their quality and competitiveness. According to Afolabi and Oyeyipo (2019), technological innovation enhances production efficiency and reduces dependency on imported inputs. The second and third highest ranked strategies is government incentives (Mean= 4.87) and investment in research and development (R&D) (Mean= 4.87). These results support the position of Adedeji *et al*. (2021), who argue that financial incentives and government policies are crucial in stimulating innovation within the construction industry. R & D promotes product testing, material improvement, and the creation of innovative applications for local resources.

Other notable strategies include collaboration between academia and industry (Mean= 4.86), training and skill development (Mean= 4.86), and innovation in design and aesthetics (Mean= 4.85). These emphasize the human capital dimension of innovation, highlighting the importance of knowledge transfer and continuous learning (Olanipekun & Fapohunda, 2018).

The study also found that digital platforms (Mean=4.84) play a critical role in promoting innovative ideas and sharing best practices. These findings align with Bamidele *et al*. (2022), who emphasized that digital transformation enhances communication, collaboration, and visibility of sustainable practices in construction. Furthermore, respondents emphasized the importance of sustainable construction policies (Mean= 4.84) and standardisation of local materials (Mean= 4.84). Standardization improves trust and market acceptance, while policies provide a stable regulatory environment that encourages innovation (Adeleke *et al*., 2020).

Overall, the narrow range of mean scores (4.84 - 4.88), suggests that stakeholders unanimously agree on the need for multi-dimensional approach involving technological, institutional, educational, and policy mechanisms to achieve sustainable innovation of local material utilization. Future research should focus on long-term monitoring of the performance and durability of local materials under Akure's climatic conditions. There is also a need for detailed life-cycle assessment (LCA) studies that utilize primary data from local production processes to accurately measure environmental benefits and trade-offs. Further investigation into cost benefit analysis, whole-life economic modelling, and supply chain dynamics would also provide valuable evidence for policy formulation and investment decisions.

6.1 Conclusion

This study examined innovative strategies for enhancing the utilization of local materials in sustainable building construction in Akure, Ondo State, Nigeria. The findings reveal that stakeholders place the highest priority on design and aesthetic innovation (Mean = 2.25) and standardization of local materials (Mean = 2.24), indicating that market acceptance and performance reliability are more influential in driving innovation than purely technological considerations. These results suggest that improving the visual appeal, functional adaptability, and regulatory credibility of indigenous materials is critical for increasing their acceptance in contemporary construction practice within the study area.

The study further demonstrates that capacity-related strategies, including training and skill development (Mean = 1.23) and support for start-ups and local entrepreneurs (Mean = 1.22), play a complementary role in promoting innovation. However, strategies traditionally emphasized in the

literature such as investment in research and development, government incentives, and advanced machinery adoption were ranked relatively lower by stakeholders. This indicates a contextual reality in Akure where immediate, practice-oriented solutions are perceived as more impactful than longterm, capital-intensive interventions. Analysis of stakeholder awareness shows high familiarity with commonly used materials such as bamboo, laterite, and timber, while awareness of agricultural byproducts (e.g., palm kernel shell and groundnut shell) remains low. Additionally, the study identifies lack of technology and innovation, perception of inferiority, and limited knowledge and awareness as the most significant barriers to the adoption of local materials, outweighing issues of physical availability. These findings highlight that socio-technical and informational challenges, rather than resource scarcity, are the dominant constraints within Akure's construction sector.

Despite the robustness of the response rate and the professional diversity of respondents, the study has limitations. The reliance on a quantitative survey restricts deeper exploration of contextual and behavioural factors influencing innovation decisions. Furthermore, the geographic focus on Akure limits the generalizability of the findings to other Nigerian cities with different institutional, economic, or cultural conditions. Future research should adopt mixed-method or qualitative approaches to explore stakeholder perceptions in greater depth and examine how demographic factors such as experience, professional role, and organizational type influence innovation adoption. Comparative studies across multiple urban centres in Nigeria are also recommended to identify regional variations and develop scalable policy and industry frameworks. Expanding research on underutilized agricultural residues and their performance characteristics could further support evidence-based innovation in sustainable construction. The study recommends that regulatory bodies should prioritize the development and enforcement of clear standards, certification procedures, quality assurance systems for indigenous materials, targeted support, Structured partnerships and establishing performance benchmark

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