

Untapped Resources: Locally Available Building Materials in South-Western Nigeria

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Abstract

Although Nigeria is endowed with a plethora of local building materials that have low carbon prints and are environmentally friendly, the materials remain largely untapped. Instead, the nation's construction industry is fraught with high-cost imported materials, most of which are non-eco-friendly, heightening environmental degradation, and undesirable in the local climate and culture. Against this backdrop, this study examined reasons for the underutilisation of local building materials resources that could have positively impacted the nation's construction industry. The research method is quantitative, using primary data from community members and stakeholders in the construction industry. The data were collected through online survey questionnaires and analysed for descriptive statistics across the six (6) south-western states. The sample size was calculated from selected urban districts of the study area, taking the acceptable error 'e' to be 0.05, and 'z', the standard variate at 95% as 1.96. Members of the construction industry were sought through the faculties of built-environment and engineering in the six states. Responses were downloaded and analysed into tables and charts with Microsoft Excel. The study showed that despite the abundance of local building resources in south-western Nigeria, they are not readily available in usable form and that users' perception of them has adversely impacted their use. The study, however, showed that the materials are affordable and require only limited skills for construction. In this way, policy interventions and discussions can enhance the use of local building materials to promote housing development.

Keywords: Local building materials, south-western Nigeria, untapped, perception, bamboo

1. Introduction

Local buildings are environmentally friendly buildings that employ functional and technical solutions that are in harmony with the regenerative capacity of the environment. The materials are natural and have been known in ways based on tradition and experience (Akadiri et al., 2012). The construction method employs traditions and construction know-how of generations that take into consideration passive opportunities. Such opportunities derive from the characteristic properties of wind, sun, currents of air, vegetation, water surfaces, and natural sources of light (Toriola-Coker et al., 2021; Olorunnisola, 2019), hence locally available. Lembi et al. (2021) highlight that they also demand less energy for production, fewer additive chemicals, good compliance with global warming standards, and a smaller carbon footprint.

Ojo and Kayode (2006) observed that Nigeria is enriched with an abundance of these local building materials and that it has the potential to revolutionise the construction industry and promote sustainable development across the country.

Bage (2014) stressed that the significance of utilising local materials in construction cannot be overstated. Local construction is crucial for Nigeria's development, as it can lead to resource-efficient and ecologically sound sustainable built environments (Toriola-Coker et al., 2021). Sambucci (2021) pointed out that harnessing

these local materials is the best way to contribute positively to the environment, mainly because the rapid population growth in the country has led to a surge in construction activities, often at the expense of the environment. Oloruntoba and Ayodele (2013) observed that such materials are within reach and, when compared to imported materials, are cheaper and more affordable. Despite these, Ugochukwu and Chioma (2015) noted that Nigeria, though endowed with these resources, still depends mainly on imported building materials to meet construction needs. Abdulmageed and Ogwuche (2014) went further and pointed out that the potential of local building materials remains vastly underutilised. Given this, several studies have examined local building materials and associated problems with their adoption in specific towns or cities in Nigeria. Very few, however, examine this in the context of geopolitical zones. This study bridged this gap. It focused on the South West geopolitical zone of Nigeria, comprising Ekiti, Lagos, Ogun, Osun, Ondo, and Oyo states.

2. Literature Review

2.1. The South-west of Nigeria

South-west Nigeria is one of the geopolitical zones in Nigeria, comprising six states: Ogun, Oyo, Osun, Ondo, Ekiti, and Lagos. It is a region known for its rich cultural heritage, economic activities, and significant historical contributions to Nigeria. The South-west region of Nigeria has a population of 47 million people,

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which is about 22% of the total population of the country (Adegbehingbe, 2011). The approximate area of land covered by each state in the south-western region of Nigeria is indicated in Table 1.

Table 1: Land area covered by the South-West Nigerian states

Local Building Materials	Approximate land area (sq. km)		
	Sq. m	million	Ratio (approx.)
Lagos	3,577	16.5	4
Ekiti	6,353	3.5	1
Osun	9,251	4.7	1
Ondo	15,500	5.3	2
Ogun	16,980	6.4	2
Oyo	28,454	8.0	3

The south-west is also an area typically accepted as most urbanised in Nigeria (Fasakin, 2000). Its housing infrastructure, thus the need for building construction and materials, compares favourably with other geopolitical zones of the federation. Instances of this become copious considering that the south-west has over 40 per cent of government residential estates in the country (Adegbehingbe, 2011). It is worth noting that all other states of Nigeria shared the remaining 60%. South-west Nigeria is also distinguished amongst other geopolitical zones for its economic significance, as it hosts the largest city and commercial hub of Nigeria, Lagos. The view that housing is often seen as a barometer for the state of the economy suggests that the South-west has attracted the construction industry in a manner comparable to other parts of the country. Moreover, owing to its rich tapestry of burgeoning culture, the region is unfit for imported construction materials, most of which are non-organic and unsuitable for tropical climates. Aside, it owns a vibrant agricultural sector producing arable and perennial crops including cassava, yams, maize, rice, plantain, banana, cocoa, rubber, palm oil, and timber. Their by-products are natural fibre composites applicable as local building materials for construction. On this account, this study examined the underuse of local building materials for construction in South-West Nigeria.

2.2. Some Local building materials, characteristics, and benefits

A plethora of local building materials, such as bamboo, laterite, and fibre across Nigeria, offers a wealth of possibilities for innovative and eco-friendly construction practices. The applications of some of these in construction are as follows:

2.2.1. Laterite and bamboo

Laterite is rich in iron and aluminium oxides (Ojo & Kayode, 2006). Using locally sourced laterite in construction can be viable and economical (Ifeanyichukwu et. al., 2021; Kehinde, Adedeji and Nnamaka, 2018). Bamboo is light, has strong

compressive strength and is fire-resistant (Tunji-Olayeni et al., 2018).

2.2.2. Fibres

Fibres can be derived from natural sources such as plants or animals (Mayomi et al., 2018). Plant fibres can be extracted from cereal straw, corn stalk, or cotton stalk (Adedeji, 2011; Fagorite et al., 2019). Fibre composites have proved to have wide applications in building construction (Abdulmageed & Ogwuche, 2014; Kaushik et al., 2017; Hadi et al., 2021).

3. Research Methodology

The study area is south-western Nigeria. The data used were obtained through primary and secondary sources. Primary data were obtained through questionnaires and interviews with stakeholders in the construction industry, namely architects, masons, joiners, engineers, and other members of the community. An online survey was carried out via Google Forms and distributed through Facebook to various respondents across the six south-western states. The questionnaire was divided into three sections. The first section was used to obtain demographic information on respondents, their length of stay in South-West Nigeria, and their experience in construction. The second probe into respondents' knowledge of local material(s) and the factors that may influence the use of these material(s) in their state. The third examined the perception of respondents on the principle of sustainability and how the use of local materials can enhance it. The census population of selected urban districts of the study area is 125,524 (FGN, 2022). Thus, a sample size of 2,192 was calculated, taking the acceptable error 'e' to be 0.05, and 'z' (value of the standard variate at a given confidence level) as 1.96 from the table under normal curve distribution at 95% confidence level. A total of 5072 responses were obtained through the Facebook media survey. This constitutes the pool from which the sample size was drawn. Hence, 2,192 questionnaires were randomly selected and downloaded from this pool. At each selection, the six states were tossed between nos. 1-6.

Depending on which number each state falls under, the selection was carried out from the pool. For instance, if

Ondo state falls to number 1 and Lagos to 2 at a particular random toss, the first download from the pool will be attributed to Ondo state, while the second goes to Lagos, and so on. Moreover, the downloads per state are in the ratios of their populations (see Table 1). For instance, for 1 (one) download of Ekiti state, 2 goes to Ondo, 3 to Oyo, and 4 to Lagos state. This is according to their population ratio (see Table 1). This is also to achieve fair distribution. Members of the construction industry were sought through the faculties of built environment and engineering in universities in the six states through the Facebook media platform. Responses were analysed into tables and charts with Microsoft Excel.

4. Findings and Discussion

The analysis shows that 72.9% of respondents are familiar with local building materials (Figure 1) and that 84.2% of respondents have lived in their state for more than 10 years (suggesting the likelihood of owning their residential properties). Aside, 74.4% are between 51-60 years, buttressing that they own their residential properties. However, a large percentage

This is an indication that they are unlikely to have their own houses since they are likely to be at lower income levels. Buttressing this, Onyike (2007) examined housing affordability in Owerri, Nigeria, under a new salary and allowance regime, considering a market value survey of 66 bungalows and houses.

Onyike (2007) found that only those on salary grade levels 13 and above in the federal public service and grade levels 16 and above in the state civil service can afford the cheapest adequate bungalows at 6% interest rate. At an 18% interest rate, only those on grade level 17 and above in the federal service, but not in the state civil service, can afford adequate housing. In his conclusion, he pointed out that income disparities are a significant determinant of house ownership. Likewise, Constant, Roberts, and Zimmermann (2007), in their study on home ownership, highlighted access to home financing as a significant determinant of homeownership in developing countries. Considering the income distribution of Figure 2, 35% of the respondents earn less than 20,000 per month, and 33.3% earn between 20,000 and 50,000 per month.

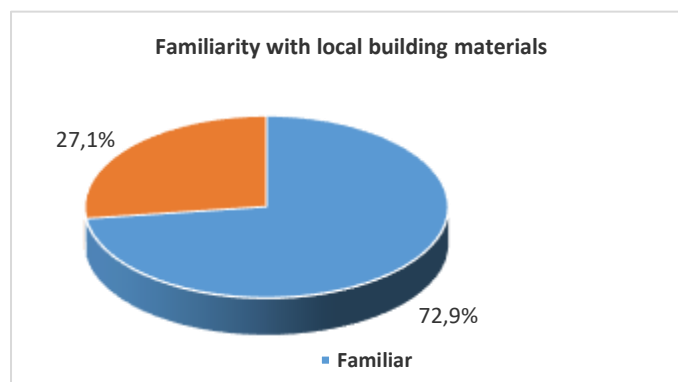


Figure 1: Familiarity with local building materials

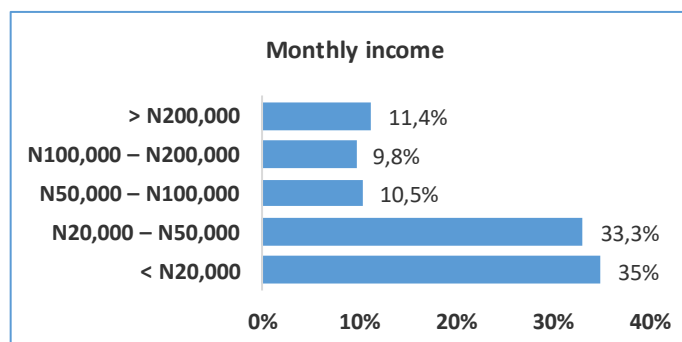


Figure 2: Income distribution

(65.4%) of the respondents received only a primary six certificate qualification, with a modicum of respondents (3.8%) receiving NCE/ND/HND education (Nigerian Certificate in Education, National Diploma and Higher National Diploma, respectively).

This is grossly below the African poverty line of 2.3 Dollars per day as defined by the African Development Bank (PPP, 2011). This buttresses the point that they are unlikely to have their properties. However, it

strengthens the point that they are likely to use local building materials since this is cheaper.

Regarding experience in the use of the local building materials, the study highlights that 24.8% of construction workers including architects, engineers, contractors, builders, and researchers have no experience, that 32.3% have less than a year experience, and 14.3% have between 2-5 years' experience (Figure 3). Only 2.3% and 9.8% have 5-10 years' experience and more than 10 years, respectively. Hence, most construction workers are relatively inexperienced.

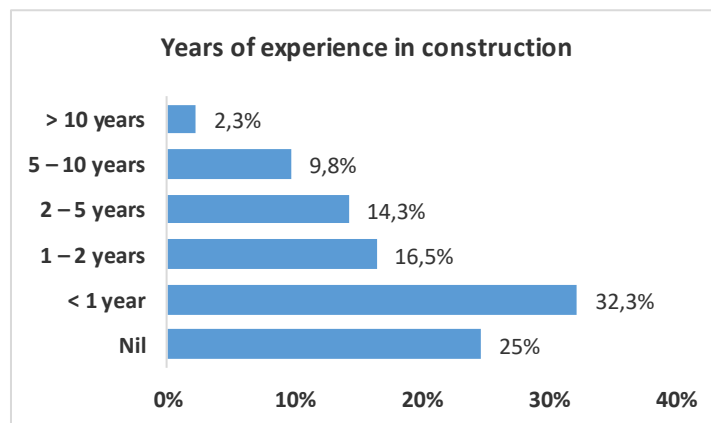


Figure 3: Years of experience in the construction industry

However, considering that 72.9% of respondents are familiar with local building materials (Figure 1), it can be construed that the poor experience of the construction workers in local building construction is informed by the sparse use of the locally available building materials for construction and the limited local skilled handlers. Osasona (2007) shed some light on the local construction methods and handlers. She highlighted that before the building process generated specialisation and produced these handlers, it was a community craft, featuring men, women, and children, each group having their specific area of expertise. Over time, certain individuals who became recognised as being extra-skilful in various aspects of building construction became known as handlers, resulting in the formation of guilds and the birth of the apprenticeship. Numerous studies have, however, demonstrated that there was a shortage of local skilled workers because of a decline in apprenticeship culture owing to the emergence of modern and late modern architecture after infiltrating the country (Prucnal-Ogunsote, 2007).

Despite the decline in use, Figure 4 shows that the difficulty with construction in local materials is low. 41% of respondents agree that low technical know-how is required, and 18% agree that no technical know-how is required, suggesting that even the poor experiences

of the construction workers may not affect the use of the local construction materials.

However, unlike the difficulty in construction, 41% of respondents agree that the impact of local materials on the quality of buildings is high (Figure 4). Respondents therefore agree that the quality of buildings is strongly impacted by the use of local materials, showing that their perception is strongly impacted by buildings constructed with local materials. This view is in tandem with Baiche, Osmani, Hadjri, and Chifunda (2008). According to them, earth buildings are perceived as aesthetically unpleasant, not durable, a sign of poverty,

and an indication of backwardness. Along this line, Zami and Lee (2011) reported that earth materials and techniques are perceived as second-tier or substandard, while modern construction methods and materials are seen as symbols of affluence or 'civilised'. Additionally, designers and contractors were reluctant to specify and select earth materials due to their technical and performance limitations.

Going further, 42 and 41 per cent agree that the availability and accessibility of local materials highly impact the use of local building materials. This shows that despite the availability of the local materials in their natural deposits, they have not been made accessible and usable for construction. Part of the

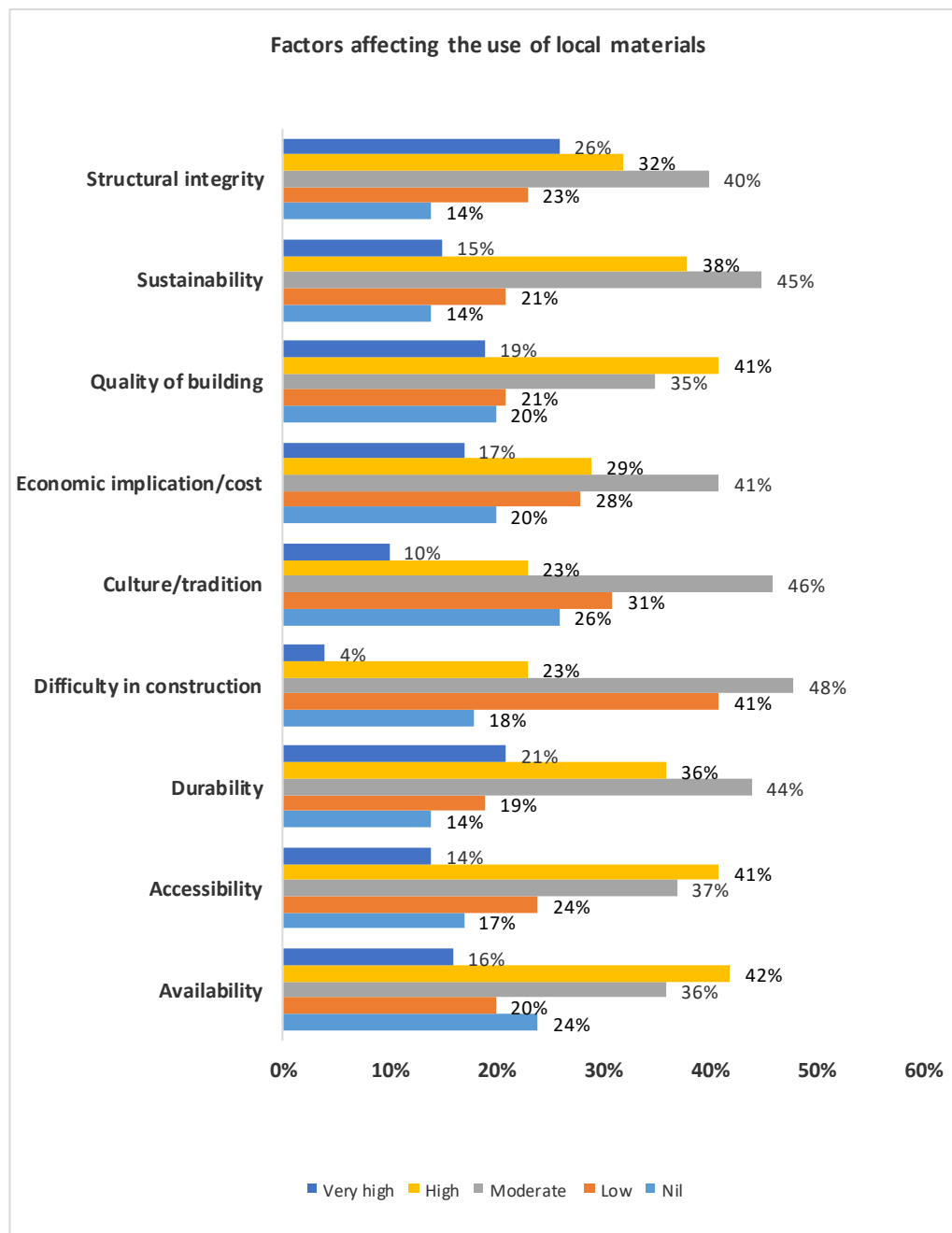


Figure 4: Factors affecting the use of local materials

reason for this may relate to the perception of these materials in buildings. Regarding the economic variable, Figure 4 shows that only 29% of respondents consider it high. This is relatively low compared to the 42, 41, 41, 41, and 38 per cent impacted by availability, accessibility, difficulty in construction, quality of buildings, and durability, respectively. Several studies agree with this (Jibrin et al., 2018; Akadiri et al, 2012). Accordingly, Oloruntoba and Ayodele (2013) asserted that the setback in housing provision is linked to the high cost of imported construction materials compared to the local. They stressed that the local building materials offer unique opportunities for home ownership to the lower-income groups and enhance

housing affordability. Omole and Bako (2013) observed that while local building materials can enhance foreign exchange, they simultaneously reduce the cost of housing delivery. Ultimately, Figure 4 shows that the impact of the economic variable on the use of local materials in the study area is low, indicating that the local building materials are affordable. However, it also shows that structural integrity has a significant adverse impact on the use of local materials. Accordingly, this has a value of 26% compared to "very high" in others: 16, 14, 10, and 4% for availability, accessibility, culture, and construction, respectively. Accordingly, local building resources remain untapped owing to users' perceptions about them.

Notwithstanding this, policy interventions, as well as campaigns by governmental and non-governmental organisations, can be employed to enhance its use and to take advantage of its affordability.

Summing up, the study shows that local materials are low-cost, require low skills for production, and are abundantly available in their natural, unrefined state, yet not available in the form required for construction. Moreover, the study posits that user perception impacted its availability.

5. Conclusion and Further Research

Although the study observed that professionals in the construction industry lack experience in the study area, the study showed that local construction handlers require low technical skills for construction. The study further showed that economic impacts on the use of local materials are the least of the variables examined. The study also showed that accessibility to local building materials is not readily available. This is despite the rich deposits of the materials in Southwestern Nigeria. Lastly, the study showed that users' perception of the quality of local building materials adversely affected their acceptability. Accordingly, this study posits that despite the rich availability of local building materials in their natural state, the resources remain untapped primarily because of users' perceptions. The study recommends a public

awareness campaign to mitigate the negative perception of local materials. NGOs and government agencies can perpetuate this. Moreover, the government should recognise local building materials as a resource for affordable housing and, as a result, expedite actions and policy interventions to enhance the availability of the materials in usable form. This will require industrial production on a large scale and as a result, can serve employment generation for low-income and the urban poor. Further studies on the material properties and strength of the local materials are encouraged, particularly because the study showed that the impact of structural integrity on the use of the material is highest compared to other variables.

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