

EVALUATION OF THE PROSPECTS AND CHALLENGES OF BENUE LOCALLY PRODUCED BURNT BRICKS FOR HOUSING CONSTRUCTION

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ABSTRACT

The housing deficit in Nigeria, driven by the scarcity and high cost of conventional building materials, presents a significant challenge to affordable housing development. To address this issue, the use of locally produced burnt bricks an alternative to conventional building materials currently in use has been proposed as a cost-effective and durable solution. This study aims to evaluate the prospects and challenges of adopting locally manufactured burnt bricks in Benue State, Nigeria. The specific objectives are to assess public acceptance of the material for housing construction, examine user perceptions of its performance, identify barriers to its widespread use, and recommend strategies to increase awareness and encourage stakeholder adoption. A structured questionnaire was administered, and data were analyzed using mean score analysis. The results show that 84% of respondents are familiar with locally manufactured burnt bricks and are willing to use them due to their perceived durability and availability. The material was regarded positively for its strength, fire resistance, and resistance to water ingress. However, significant barriers to the use of the material include challenges in mass production, social acceptability, and the absence of regulating standards. The study concludes that locally produced burnt bricks offer a promising solution to Nigeria's housing challenge. To promote wider adoption, it is recommended that public awareness be raised through media demonstrations and policy support to standardise production processes.

KEYWORDS: Brick, Building Material, Construction, Housing, Performance

INTRODUCTION

The building materials sector plays a crucial role in the construction industry, accounting for nearly half of the total project cost (Baiden, Agyegum and Ofori-kuragu, 2014). In Nigeria, the housing deficit continues to widen due to the scarcity and high cost of conventional materials such as cement and steel (Tse, 2012). Consequently, there is an urgent need to explore alternative, affordable, and durable local building materials to support mass housing delivery (Maton, Danjuma, Didel and Edom, 2014).

One promising material is locally produced burnt bricks, made from abundant clay resources found in many parts of Nigeria, including Benue State (Njoku, 2012). Burnt bricks are noted for their durability, strength, fire resistance, and thermal efficiency, making them suitable for a variety of building types (Olawuyi, Olusola, Ogunbode and Kyenge, 2010; Ushie & Anike, 2010). Despite these advantages, the adoption of locally produced burnt bricks in Nigeria remains limited due to perceptions of inferiority, production challenges, and

lack of regulatory standards (Koko, 2016; Odunjo, Oladimeji & Okanlawon, 2015). This study therefore aims to evaluate the prospects and challenges of using locally produced burnt bricks for housing construction in Benue State, Nigeria with specific objectives to: Assess public acceptance of the bricks for housing construction; Examine users' perceptions of the material's performance; Identify barriers to its wider adoption; and Recommend strategies to enhance awareness and promote its use among stakeholders.

LITERATURE REVIEW

Burnt Bricks

Burnt bricks are building blocks made from wet clay that are shaped, dried and then fired in a kiln or clamp at high temperature to harden and strengthen them. Such bricks are typically used for permanent structure rather than sun-dried bricks which are used for temporary work (Omole & Bako, 2013).

Burnt bricks are either factory manufactured or locally manufactured. Factory produced burnt bricks are made using specialised machinery and controlled processes, ensuring high quality, strength and uniformity (Tse, 2012). While locally produced burnt bricks often relies on more traditional and labour intensive techniques, the resulting bricks are typically more rustic and variable in quality than factory versions (Koko, 2016). In Benue state burnt bricks are made using locally available lateritic clay and are often fired in clamp kilns (traditional open kilns).

Utilisation of locally produced burnt bricks

The changes in the building materials industry have greatly affected the use of local building materials not only in Nigeria, but in other parts of the world.

Formerly, most housing and other buildings were constructed from locally available natural materials and/or materials manufactured locally (FAO, 1993). Although still widely used in rural areas, many of these local materials have been gradually replaced with conventional building materials especially in urban areas. This replacement is largely due to factors such as urbanisation, modernisation of construction practices and the growing preference for modern aesthetics associated with conventional materials (Njoku, 2012). Despite this, there is resurgence in the demand for locally produced burnt bricks as seen with the emergence of a strong local burnt bricks industry in the 1990's in Nigeria (Tse, 2012). However, the widespread adoption of burnt bricks faces several challenges, particularly related to acceptability, sustainability, performance and barriers to use.

Acceptability

The acceptability of burnt bricks in Nigeria, particularly in urban areas, remains limited. Despite their advantages, buildings made from locally produced burnt bricks are often stigmatized as "poor man's buildings" (Odunjo *et al.*, 2015). This perception is reinforced by a lack of awareness and understanding of the material's benefits. Danquah, Abrokwhah, Twumasi and Ankrah, (2015) reported a similar trend in Ghana, where people preferred conventional materials like cement blocks to avoid social stigma, even though they acknowledged the potential benefits of burnt clay bricks. The lack of information and motivation for stakeholders contributes significantly to this low acceptance (Baiden *et al.*, 2014).

Sustainability

Sustainability is a critical concern when considering large-scale adoption of burnt bricks. The environmental impact of burnt brick production, especially in traditional kilns, includes deforestation, land degradation, and pollution due to inefficient fuel use (FAO, 1993; Deboucha & Hashim, 2011). However, modern brick production techniques have reduced these negative impacts, with improved energy efficiency and better land management practices (Danquah, 2009). Burnt bricks, known for their durability and ability to withstand environmental conditions, also contribute to long-term sustainability if produced responsibly.

Performance

The performance of burnt bricks is one of the key reasons for their consideration in building construction. They are durable, fire-resistant, and resistant to water ingress, making them suitable for various types of buildings, from residential houses to infrastructure projects (Olawuyi *et al.*, 2010). Their thermal properties contribute

to energy efficiency in buildings, providing natural insulation and reducing heating and cooling costs. The use of burnt bricks, particularly in regions with high temperatures, is especially beneficial due to their ability to regulate indoor temperatures (Ushie & Anike, 2010).

Barriers to Utilisation

Several barriers hinder the widespread use of locally produced burnt bricks. The major challenges include: Lack of standardization: There are no regulatory standards to guide production, leading to inconsistent quality; Mass production challenges: The limited capacity for large-scale production makes it difficult to meet the demand for affordable housing; Social stigma: As mentioned earlier, burnt bricks are often viewed as substandard in urban settings, impeding their adoption; Environmental concerns: Although modern production methods have reduced the environmental impact, concerns about energy use and pollution in traditional kiln methods persist (Deboucha & Hashim, 2011).

2.3 Conceptual framework of factors influencing adoption of Benue locally produced burnt bricks for housing construction in Benue state

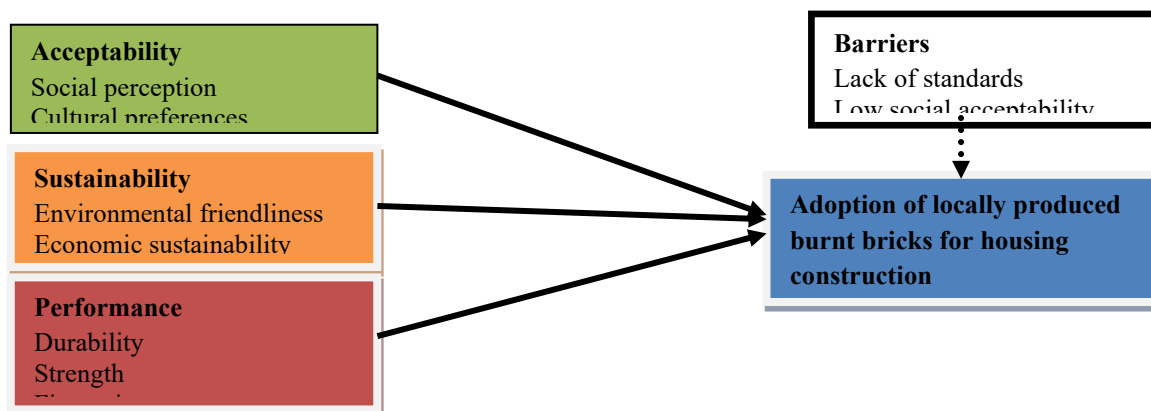


Fig. 1 Conceptual framework of factors influencing adoption of Benue locally produced burnt bricks for housing construction in Benue State.

The framework in Figure1 illustrates how acceptability (which affect willingness to use and market demand), sustainability (which promotes long-term use and policy support) and performance (which

determines user satisfaction and technical viability) serve as positive drivers while barriers act as constraints influencing the level of adoption of locally produced burnt bricks in housing construction.

RESEARCH METHOD

Study Area

The study centres on plains in four Local Government Area headquarters of Benue state, North Central Nigeria. Makurdi in Makurdi local government area, Naka in Gwer-West local government area,

Katsina-Ala in Katsina-Ala local government area and Vandeikya in Vandeikya local government area where the bricks are famously utilised. The four local government areas (Fig. 2) were selected based on their geologic setting.

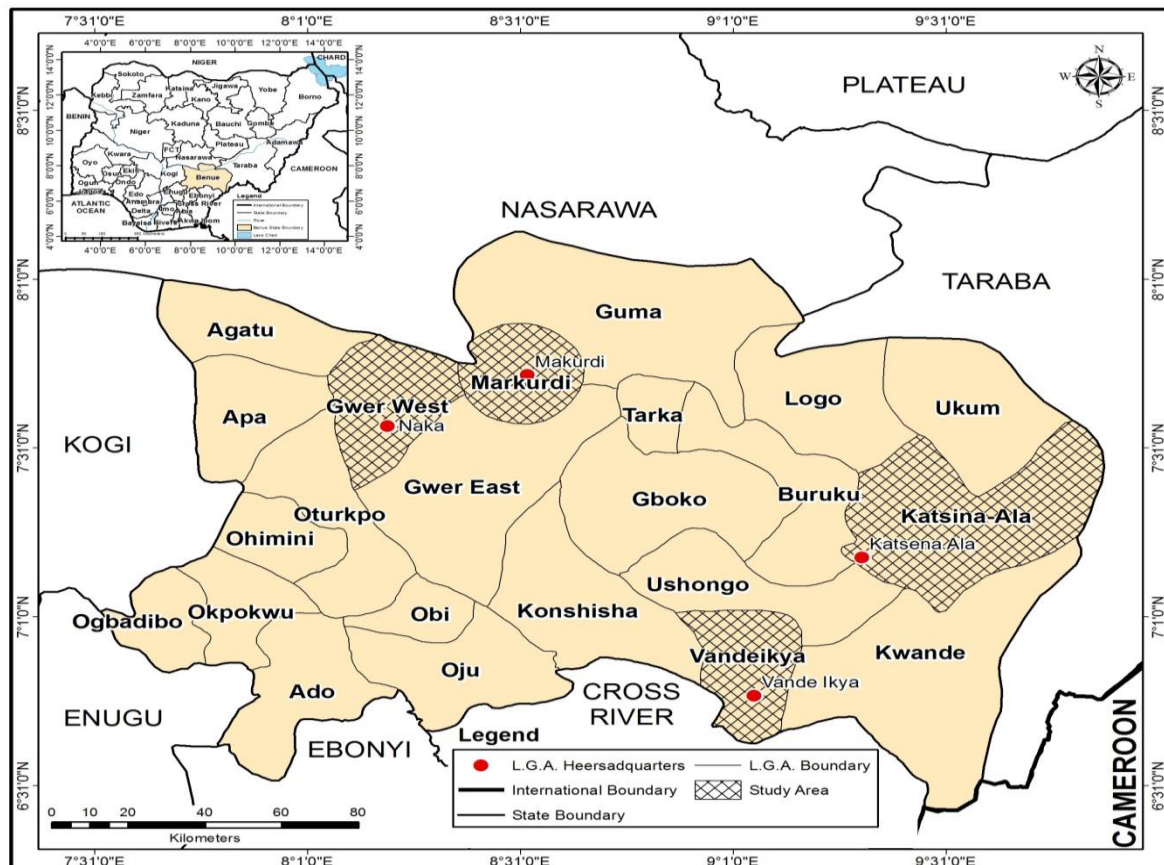


Figure 2: Benue state showing study area

Source: Modified from the administrative map of Benue State

Data Collection

Primary data for the study was obtained through field survey. Two separate questionnaires were designed for the two

types of respondents who were construction practitioners (Architects, Builders, Engineers and Quantity surveyors) and house owners. The

questionnaires were structured to elicit information relevant to the objectives of the study, with both closed-ended and open-ended questions included to ensure comprehensive responses.

Population of the Study

The population of the study consists of practitioners in the construction industry (which includes Architects, Builders, Engineers, Quantity surveyors) and house owners. The specific population size could not be ascertained as a pilot study revealed that most practitioners in the study areas were not registered with their professional bodies which made it difficult to get their exact number. Also there was no exact population of house owners in the study areas at the time of the study.

Sampling

Cluster sampling technique and subsequently the convenience sampling technique were adopted for selection of the respondents. Since the exact population of the study was not known, a suitable sample size for the study was determined using the

formula (Glenn, 2003) $n = \left(\frac{z^2 pq}{d^2} \right)$

RESULTS AND DISCUSSION

Response to Questionnaire Administered

Two sets of questionnaires were distributed to two categories of respondents which comprise house owners and construction practitioners. All the fifty six (56) questionnaires directed to house owners were returned making a hundred percent (100%) response rate. Fifty six (56) questionnaires were given to construction practitioners; only forty three were returned making a response rate of seventy seven percent (77%).

From the formula, a sample size of 56 was arrived at for each cadre of respondents making a total of 112. Twenty eight (28) questionnaires were administered in each of the four local government areas.

Data analysis

The data collected was analysed using percentages and mean score, then presented in tables for clarity and ease of interpretation.

Reliability and Validity

To ensure the reliability and validity of the research instrument, several steps were taken. The questionnaires were subjected to expert review by two academics and one industry professional to ensure content validity confirming that the questions adequately covered all aspects of the study objectives. A pilot test was conducted with a small group of respondents similar to the target population to identify ambiguities and inconsistencies in the instrument. Reliability of the instrument was further checked using the internal consistency method.

Respondents Profile

The profile of construction practitioners as shown in Table 1 indicates that Civil Engineers form the largest group of practitioners (47%), followed by Builders and Architects (23% each) and Quantity surveyors (7%). This suggests engineering dominated industry with limited representation from design and cost professionals. Over half of the respondents (55.8%) hold at least a bachelors' degree, reflecting a relatively high educational level. However, the majority (60.5%) are not registered with professional bodies, indicating gaps in formal regulation. Most practitioners (83.7%) operate in individual practice,

with half in the organised private sector (9.3%) and public (7%) sectors, highlighting a predominantly informal

construction landscape that may affect standardisation and innovation in material use.

Table 1: Respondents profile

Variable	Frequency	Percentage
Profession		
Architects	10	23
Builders	10	23
Civil Engineers	20	47
Quantity Surveyors	3	7
Total	43	100
Educational Qualification		
OND	4	9.9
HND	9	20.9
PGD	6	14.0
BSc	20	46.5
MSc	3	7.0
Phd	1	2.3
Total	43	100
Professional Qualification		
Corporate	6	14.0
Graduate	11	25.6
Not Registered	26	60.5
Total	43	100
Sector of Construction Industry		
Public	3	7.0
Organised Private Sector	4	9.3
Individual	36	83.7
Total	43	100

Public Acceptance of locally produced burnt brick

Results of analysis in Table 2 show that majority of the respondents (house owners) are familiar with burnt bricks as a building material and are willing to utilise the material for housing construction. The level of acceptance demonstrates a general positive perception towards burnt bricks and indicates a potential market for their increased adoption. Table 2 further reveals

the preferences of construction practitioners regarding specific building components suitable for burnt bricks. The highest proportion of practitioners (37.2%) preferred using the material for substructure. A slightly smaller proportion (34.9%) indicated preference for using burnt bricks in the entire building, while 27.9% preferred its use for fence walls.

Table 2: Public acceptance of burnt bricks

Variable	Frequency	Percentage
Familiarity with Burnt Bricks		
Familiar	47	84
Not Familiar	6	11
Undecided	3	5
Total	56	100
Willingness to utilize Burnt Bricks		
Willing	32	68
Not Willing	12	26
Undecided	3	6
Total	47	100
Part of Building Burnt Bricks are Preferred		
Whole	15	34.9
Fence Wall	12	27.9
Substructure	16	37.2
Total	43	100

Reasons for utilisation of locally produced burnt bricks

Table 3 presents the ranking of responses from house owners in regarding the criteria influencing the use of locally produced burnt bricks for housing construction. The findings indicate that

durability, availability and cost effectiveness are the major factors motivating their adoption. This suggests that users prioritise materials that guarantee long service life, affordability and acceptability within their local environment.

Table 3: Reasons for utilisation of burnt bricks

Reasons	N	TS	Mean Score	Rank
Durability	47	186	3.96	1
Availability	47	173	3.68	2
Cost effectiveness	47	168	3.57	3
Compatibility with other materials	47	151	3.21	4
Recommendation from professionals	47	129	2.74	5

Perception on the performance of burnt bricks

The result in Table 4 indicates that, durability, strength and fire resistance top the list of perceived performance characteristics of burnt bricks, reflecting

confidence in their structural integrity and resilience. Serviceability and maintainability were least rated, indicating perceived challenges in maintenance or adaptability.

Table 4: Perception on the performance of burnt bricks

Factors	N	TS	Mean Score	Rank
Durability	47	198	4.21	1
Strength	47	193	4.11	2
Fire resistance	47	187	3.98	3
Resistance to water ingress	47	179	3.81	4
Aesthetics	47	174	3.70	5
Bullet proof	47	172	3.66	6
Thermal comfort	47	163	3.47	7
Cost saving	47	157	3.34	8
Resistance to environmental conditions	47	157	3.34	8
Serviceability and Maintainability	47	128	2.72	10

Benefits derived from the use of locally produced burnt bricks

Table 5 revealed the key benefits of using burnt bricks to include; meeting housing demand, provision of employment and

enhancing local economic strength. This implies that, the use of burnt bricks will support local production and small-scale enterprises, generate employment for artisans and reducing unemployment

Table 5: Benefits derived from the use of locally produced burnt bricks

Benefits	N	TS	Mean Score	Rank
Meeting increased demand for housing stock	43	189	4.40	1
Provision of employment opportunities	43	180	4.19	2
Enlargement and promotion of the economic strength of the people and country at large	43	163	3.80	3
A good measure of conserving foreign exchange	43	160	3.72	4
Provision of affordable housing	43	149	3.47	5
Development and propagation of indigenous technological ingenuity and skills of the local people	43	142	3.30	6
Reduction in the cost of construction	43	142	3.30	6
Use of environmental friendly resources	43	132	3.07	8

Barriers to the use of burnt bricks for housing construction

Table 6 presents the mean scores of construction practitioners' perception of the barriers to the use of locally produced burnt bricks. The result indicates that limited mass production; low social acceptability and lack of standardisation are the major barriers to the widespread adoption of locally produced burnt bricks for housing construction. These constraints

discourage professionals from using the material for large-scale housing projects as conventional materials are perceived to be more standardised and convenient.

Table 6: Barriers to the use of locally manufactured burnt bricks

Barriers	N	TS	Mean Score	Rank
Problem of mass Production	43	188	4.37	1
Social acceptability	43	182	4.23	2
Lack of standards	43	175	4.02	3
Constructability problem	43	160	3.72	4
Transportation problem	43	158	3.67	5
Excessive cost implication	43	138	3.21	6
Non compatibility with other materials	43	133	3.09	7
Structural problem	43	131	3.05	8
Inadequate supply of clay	43	126	2.93	9
Unavailability	43	125	2.91	10
Low demand	43	94	2.19	11
Doubtful durability and life span	43	87	2.02	12

Increasing Awareness and Motivation Towards the Use of Burnt Bricks

Table 7 outlines several strategies perceived as effective for increasing awareness and stakeholder motivation toward the use of locally produced burnt

bricks. These include media publicity of burnt brick projects, training for masons, formulation of clear material standards and development of production technology.

Table 7 Awareness and motivation towards the use of burnt bricks.

Ways	N	TS	Mean Score	Rank
Showcase on construction using burnt bricks projects through the media	43	199	4.63	1
Seminars and trainings for masons	43	192	4.45	2
Formulation of standards for the use of the material	43	179	4.16	3
Development of technologies for mass production of the Material	43	174	4.05	4
Agreement on specification and construction methods	43	170	3.95	5

DISCUSSION

The findings collectively reaffirm the viability of locally produced burnt bricks as an effective building material for sustainable housing delivery. The strong

preference for durability, availability, and cost-effectiveness corresponds with the results of Odunjo *et al.* (2015), who reported that quality and availability were the primary determinants of burnt brick

utilisation across different Nigerian regions. This convergence suggests a consistent user perception, where the choice of building materials is guided by practical considerations of longevity, affordability, and local access.

Similarly, respondents' high rating of durability and strength corroborates Olawuyi *et al.* (2010), whose laboratory analysis confirmed that locally manufactured burnt bricks in Benue State met standard compressive strength and water absorption limits. The alignment between perception-based and performance-based findings strengthens the argument for the technical suitability of burnt bricks in Nigeria's construction sector.

In contrast, the findings of this study as it relates to barriers to burnt bricks utilisation diverge from those of Baiden *et al.* (2014), who highlighted low demand, high cost implications and incompatibility with other materials as key barriers. Nonetheless, both studies underscore the need for policy, technological improvement and awareness creation to enhance the utilisation of locally produced burnt bricks in housing delivery.

Conclusion

The study revealed that locally produced burnt bricks are widely recognised and highly preferred for housing construction due to their durability, availability and cost effectiveness. The study also revealed that full potentials of locally produced burnt bricks still remain constrained by production limitations, weak standardisation and low public awareness.

Overall, the results and comparative insights underscore the potential of locally produced burnt bricks to contribute meaningfully to affordable housing delivery, sustainable construction and rural industrialisation in Nigeria. However, realising this potential requires

policy intervention, investment in production technology and enforcement of quality standards. Further studies should focus on large scale performance evaluation, life-cycle cost analysis, standardisation of production process and integration of burnt bricks in contemporary architectural designs to expand their applicability in modern housing projects.

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