



Research Paper

Production of Clay- Bricks As an Alternate to Modern- Bricks for Sustainable Development

Musa Mohammed¹, Mohammed Zannah², Audu Sani³, Saadu Lawan⁴
^{1,2,3&4}Department of Business Administration, Mai Idris Aloomo Polytechnic, Geidam, Yobe State

ABSTRACT

The study examined the impact of production of clay-bricks as an alternate to modern-bricks for sustainable development. It found out the production process of clay bricks as an alternative to modern cement bricks, the financial difference between clay bricks and modern cement bricks as well as their affordability, the contribution of clay bricks production to the national development and to suggest ways of improving clay bricks production and its marketability. The study area includes four (4) wards (Asheikri, Hausari, Kolori and Balle/kelluri) of Geidam Local Government Area, Yobe State. The population includes clay bricks producers and residential households in four (4) wards of the local Government. The Multistage sampling technique is used in the study. A sample size of 40 people was selected for this study (10 from each ward). Questionnaires are used to collect primary data. The analysis is based on the retrieved questionnaires. Data collected were analyzed statistically, using descriptive statistics. Chi-square was used to interpret the hypotheses. The research revealed that production of clay bricks as an alternative to modern cement blocks. It also found out that the production of clay bricks has contributed immensely to the national development of the country. The researcher recommended that government should provide a friendly business environment in terms of adequate infrastructure that would enhance the production of clay bricks for national development and to give opportunities to clay-bricks producers to access soft loans as well as other technical assistance to broaden the opportunities to strive effectively.

KEY WORDS: Clay-bricks, Production, Modern-bricks, Cement, Sustainable Development.

Received 20 June, 2021; Revised: 03 July, 2021; Accepted 05 July, 2021 © The author(s) 2021.

Published with open access at www.questjournals.org

I. INTRODUCTION

Building and sustainable construction are terms that have started to attract interest among youths and practitioners in the field of construction in Gaidam. With the current situation of rapid urbanization, high population and entrepreneurial development. On the practical level, there is really a significant change in the construction practice towards sustainability experts for a few scattered efforts based on individual and personal initiative from experts and practitioners. Sustainable construction has many aspects such as passive design, selection of appropriate materials and construction techniques, and energy efficient systems for minimizing power and water consumption (Sanya, 2010).

Innovation in the field of alternative building materials are starting to attract interest especially in the research field, and many alternatives for building materials and components have been tested and have proven to be successful. (Minke, 2006). More than thirty percent (30%) of the world population are live in home built with unbaked earth" (Houben & Guillard 1989). Earth is one of the oldest building materials in history, existing ancient earth structures demonstrate the potential of the material such as the vaulted structure of the Ramesseum Granaries in Luxor (3,400 years old), the Great Wall of China have whole sections built with rammed earth (3,000 years old), the city of Shibam in Yemen (16th century) and the historic adobe structures in West Africa such as the mosque of Djenné in Mali (13th century).

Earth construction has been promoted in many countries in the modern age as sustainable building materials, with raw techniques that were developed to improve the practice and performance of the materials. Experiments for applying the building techniques in affordable housing have been successful in some developing countries especially in Africa.

The construction rate of individual house hold and commercial organization has change rapidly over some period of time due to frequent increase in the cost of modern cement blocks. As a result of inflation and other economic indices, many households cannot afford modern cementblock since greater percentage of their income goes on to daily household maintenance expenditure and not saving. Therefore, the main problems of the research work is the percentage increase in the cost of modern cement block which resulted to the need of provision of an alternative way out to bridge the gap that exist between the house holds needs and the immediate satisfaction of such need by creating or providing an alternative project that will satisfy such need at lowest cost as well as the highest quality.

The main objective of the study is to determine the production of clay- bricks as an alternate to modern- bricks for sustainable development. The paper is segmented into five sections with introduction as first segment. Other segments of the paper are: section two present literature review, section three is concerned with methodology used in collecting data for the study. Section four was made for data analysis discussing and findings. Section five is concerned with conclusion and recommendations.

II. LITERATURE REVIEW

INTRODUCTION

This chapter is concerned with linking the concept of sustainability and its relation to building material and construction techniques, focusing on the significant to the context of Nigeria and developing countries and posing earth construction within this concept. This is based on a literature reviewed about the concept of appropriate and alternative building materials and technology.

The provision of low-cost but durable clay red bricks for building house is universally accepted as one of the strongest locally made clay brick to improve housing construction in Nigeria in general and Gaidam town and nearby village in particular. Among the building material in use today, the port land cement is the most prominent when mixed with sand water, it hydrate concrete, also the mixed cement will be process to produce cement block which is also very durable and common in the construction and building industries but it is very expensive to be acquired.(Sanya, 2010).

Concrete or cement block as described above is very expensive and heavy, effort are being made to replace the highly cost concrete blocks with the cheap and durable by the masses. The clay brick is made up of the following component, red clay soil, animal dung, ash, water and finally burned to increase it quality and reduce it weight. (Minke, 2006).

CONCEPTUAL FRAME WORK

ALTERNATIVE BUILDING MATERIALS

Alternative technology is aimed to be environmentally friendly, affordable, and to offer people greater control over production process (Sanya, 2010).

The terms alternative materials is usually used to refer to material that are not highly technical, or materials that are not standard material and method used in manufacturing process is local when compared with the other materials that is when comparing cement block is more technical and more standard since it used modern equipment in production. Hall (2012) argues that it is considered inappropriate to use the word “alternative” to describe earth construction, which is the one of the prime building material on earth, and that it is not helpful in the attempts to promote it as a mainstream construction material.

SUSTAINABLE DEVELOPMENT

Sustainable development is a development that meets needs of present without compromising the ability of future generation to meet their own needs.

Sustainable is widely mentioned in architectural and urban design literature, and building materials is considered an important aspect of sustainability, due to its huge impact on the environment during its life cycle starting from raw material extraction, to production, transportation, construction, maintenance and end of life. Environmental and ecological impacts are usually used as the only indicator for sustainable associated to building materials. Edward (2004) define sustainable materials as materials and construction product which are healthy, durable, resource efficient, and manufactured with regards to minimizing environmental impact and maximizing recycling. Kim (1998)

According to Kennedy (2004), sustainable building materials are such that they have to improve quality of life, be comfortable and aesthetically pleasant, improve access to home ownership for the dispossessed and poorest members of society, use materials that are safe to work with, have minimal impact on the environment, be easily recycled at the end of its life, support biodiversity, be resilient to changing environment and social conditions, be locally built, mentioned, fixed and disposed of safely promote community building process, be energy and materials efficient, be socially equitable and empowering.

CLAY BRICK

A solid masonry unit made of clay, usually formed into a rectangular unit while in the plastic state and treated in a kiln at an elevated temperature to harden it.

RAW MATERIALS

Earth, when used as a building materials, is often given different names. Referred to in scientific terms as loam, it is a mixture of clay, silt, (very fine sand), sand, ashes, animal during and occasionally larger aggregates such as gravel or stones. (Minke, 2006).

Clay as the agent that binds the mixture together while sand, silt, ash, animal during and gravel act as aggregates, that is they are the dead filling materials in the mixture. Clay has diameters smaller than 0.02mm, silt has diameter between 0.02 and 0.06mm and sand has diameter 0.06 and 2mm, gravel and sand have diameter lager than 2mm. (minke, 2006)

Raw materials identification is the most important step in the process of building with earth. Soil identification is the base on which the materials production is decided. It is depending on the type of soil and especially the type of clay, the mixture design, technique of material production requirement for stabilization. Minke(2006) describe like composition and varying properties of loam and its relation to earth construction techniques starting that the “Gravelly mountainous loam (if they contain sufficient clay), are more suitable for rammed earth, while riverside loam are after Siltier and are therefore less weather resistant and weaker in compression. Like cement in the loam. Silt, sand and aggregates constitute the fillers in the loam. Depending on which of the three components is dominant, we speak of a clay, salty or sandy loam.

QUALITY OF EARTH BRICK.

Quality is define as “fitness for proposed” or compliance with specification. (Anosike, 2011),Taylor (2002) argued further that it is the overall characteristics needed by a product or service to satisfy standard defined quality as “the totality of feature and characteristics of a product or service that bears its ability to satisfy stated or implied needs”. In addition, the manufacturing business dictionary, define quality as a measure of excellence or a state of being free from defects, deficiencies, and significant variation.

BRICKS PRODUCERS

This study finds that brick producer in Gaidam can be categorized into private and commercial purpose producers.

PRIVATE USERS/ PRODUCERS

These are those who produce bricks strictly for private use. Some clients and contractors engage in the business of making bricks for private use on their building and infrastructural project such clients and building contractors employ bricks makers to provide them with material and all other necessary logistics to produce the brick requirement of their project for the purpose of insuring quality and reducing cost. (Abdullahi 2005)

COMMERCIAL PRODUCERS

They include both small and large scale producers. Small scale producers use manual method of maxing and molding while large scale producer employ more workers to produce the bricks in large quantity for commercial purpose. Therefore, those who cannot produce the brick on their own patronized the one produced by the commercial producers.

RAISING PRODUCTION CAPITAL

According to (Abdulahi 2005), raising capital for any kind of business is usually a major challenge. This study report that small scale brick producers who produce bricks for personal use depend mostly on personal saving to raise capital. While those who produce for commercial purpose raise capital from both personal saving and short term loans. Contractor who produce brick for use on their project usually make use of part of their advance payment and subsequent payment received on evaluation to finance their brick production unit on site (Abdulahi, 2005).

PRODUCTION PROCESS

Production is the act of converting or transforming raw materials into finished goods that will be used by a final consumer or as an input to some industries or companies.

The production process of a brick involved three steps, which include:

- **Mixing:** the mixing population was specified in volume not by weight because the bulk relative deceived are not in the same measure due to some different number of brick to be produced at a time. In the mixing process. Dry red clay soil, animal dung, ashes, are mixed together before water will be added.
- **Bricking:** there, the mixed soil will be put into a mounds to forms the bricks, the bricks are usually of two types, that is, 3 inches and 6 inches size as the size of the mounds.

- **Burning of the dried bricks to become red:** the dried bricks will be arranged in required position in number of not more than 200-250 bricks in a hole or woven where grasses, shrubs and some animal dung will be used to burn the brick to become red. The purpose is to increase quality, reduce weight as well as to prevent easy water penetration. Hali, M. (2012).

TOOLS USED IN MAKING THE BRICKS.

The following are the tools used in making brick and such tools are always available and within one reach at any time such tool are:

- a. Shovels
- b. wheel barrows
- c. diggers
- d. head pan
- e. mounds
- f. hand globes
- g. Boot or court shoe (Unesco, 2008).

HUMAN RESOURCES NEEDED IN THE INDUSTRY

For the purpose of producing the red bricks using clay soil, the proposed number of people to be needed will be up to six (6) peoples of which one must be professional and can be able to read write for the purpose of record keeping as well as a foreman to oversee the production and guide the other workers. While the others serve as workers. A group of two peoples will be molders, while the other one will supply the mixed soil to each group for easy production. In addition to the above workers, one person will be employed as seller. Hali, M. (2012).

FINANCIAL DEFFERENT BETWEEN CLAY BRICKS AND MODEEN CEMENT BLOCKS AS WELL AS THEY AFFORDABILITY

The estimated number of blocks in building one room of 12 by 12 featuring modern cement blocks is 400 units which cost about N52000. Below is the break down. Each block cost #130 include transportation cost, therefore, cost of blocks multiply by number of block required is equal to the total cost of blocks needed i.e. $130 \times 400 = \text{N}52000$.

As mentioned, the bricks or clay brick are of two types that is 3 inches 6 inches tricks. A single room of 12 by 12 feet's using 3 inches clay bricks in required 5000 bricks while 2500 bricks will be needed using 6 inches bricks. The cost of one unit off 3 inches bricks is ₦5 and ₦10 for 6 inches bricks. Therefore, $\text{N}5 \times 5000$ is equal to = 25000, and $\text{N}10 \times 2500$ is ₦25000.

In view of the above, the cost of cement blocks for a single room is ₦52000, while using clay bricks is ₦25000 using both 3 and 6 inches, hence building a house using clay bricks is very cheap and the affordability encourages mass to own their personal houses. (Uzomaka, 1977).

CONTRIBUTION OF YOUTH STRUGGLE IN THE PRODUCTION OF CLAY BRICKS TO THE NATIONAL DEVELOPMENT.

Some of the contribution of youth involvement in clay production includes the following.

- a. Employment opportunity
- b. Job creation
- c. Provision of goods to the society
- d. Source of income
- e. Reduce level of depending on government/ parent
- f. Self-reliance
- g. Improve standard of living

III. RESEARCH METHODOLOGY

STUDY AREA

Geidam is one of the seventeen (17) local Government of Yobe state, The Local Government was created in the year 1976 by the local Government act of 1976 during General Murtala Ramat Mohammed's regime. The local Government was among the eighteen (18) local Government areas of former debunt Borno state. The local government is located in the northern part of Yobe state, it bordered with Yunusari local Government to the north, Tarmuwa local government to the south, Bursari local Government to the west and Gubio local Government of Borno state to the east. The local Government is about 180 km away from Damaturu the state capital of Yobe state. It covers an area of about 3892 kilometers squares with the population of about 157,295 people according to 2006 population census (census 2006). The local government is made up of eleven

(11) wards comprises of Asheikri, Kolori, Hausari, Gumsa, Kusur, Ma'anna-Dagamdi, Borko, Zuru-Ngulaiya, DejinaFukurdi, Futchimiram, Balle-Kelluri, Jororo-Kalgeri. Therefore, this study covered four (4) wards of Asheikri, Hausari, Kolori and Balle-Kelluri wards.

RESEARCH DESIGN

This research is based on the production of clay- bricks as an alternate to modern- bricks for sustainable development. The design was descriptive study which used quantitative tool. The study is based on the use of questionnaire. These approaches were used because they are satisfactory tools for collecting data for the sample population to investigate the research topic.

POPULATION OF THE STUDY

According to Creswel, (2008) population refers to group of people who have many things in common. In other words, it refers to all members of any well-defined class of individuals, events or objects (Ary et al., 2010). Moreover, the population of this study will be clay bricks producers and some residential households in four (4) wards (Asheikri, Hausari, Kolori and Balle-Kelluri wards) of Geidam local Government area of Yobe State Nigeria. Which are 19,865 inhabitants (census, 2006). But the target population is only (3,637) people.

SAMPLING TECHNIQUES

The process of selecting individuals from the target population lead to the sampling procedure. (Suliman, 2004). The researcher used multi stage sampling techniques thus, stratified and simple random sampling techniques was used in the study. Stratified sampling technique is the most effective method of sampling when the researcher wants to get a representative of a population. It refers to the process of selecting a respondents according to strata (Sit i& Ruziah, 2012).So, in order to drawn or get the respondents of this study from the four wards, the entire target population were divided into different strata (ward), and then randomly select the final subjects from each stratum (wards).

A sample size of 40 people was used for this study (10 from each ward), to ensure that the sample is been represented enough to draw conclusion.

DATA COLLECTION INSTRUMENTS

The researcher used questionnaire. The researcher prepared the questionnaire to be responded by the sampled bricks producers and household inhabitants of the wards.

SOURCES OF DATA

Both primary and secondary source of data was used in conducting the research.

In getting primary data there are several approaches available in gathering data. In order to collect reliable and valid information, the researcher used questionnaire and interview methods in collecting the primary data. The reason of using questionnaire is to identify and assess the youths struggle to ward sustainable development: The production of clay bricks as an alternate to modern bricks. A set of questionnaire was prepared with open - ended questions. Siti, A. H. & Ruziah, G. (2012)

TEST OF VALIDITY AND RELIABILITY OF INSTRUMENTS

Validity is the ability of measuring instrument to measure what is supposed to be measured. To know the validity of the instrument to be used, the following tests were considered.

- Content Validity: this is designed to ensure that the content of a measuring instrument adequately covers all relevant areas.
- Construct Validity: This measures the extent to which a particular test reflect hypothetical construct presumed to underline the performance and also the extent to which a test reflects the theories underlying the construct.

ADMINISTRATION OF INSTRUMENTS

Two hundred (40) copies of the questionnaire was distributed to respondents at work place and individual households. After some time, the researcher went back and collected the answered questionnaire.

METHOD OF DATA ANALYSIS

The data collected is analyzed statistically, using the descriptive Statistic, Representations like tables and graphs were used to ensure easy and quick interpretation of data. Responses is expressed in percentages. Chi-square is used in testing the hypothesis formulated.

IV. DATA PRESENTATION AND ANALYSIS

Test of Hypothesis

The two hypotheses earlier formulated will be tested using the chi-square (X^2) method.

Decision Criteria

The decision rule is that if the calculated values of X^2 is greater than the tabulated value (or critical value), we accept the alternative hypotheses and reject the null hypotheses or vice versa.

Hypothesis One

- H₀₁:** Production of clay bricks is not an alternative to modern cement blocks

Table I

Alternatives	Responses	Percentage (%)	Aggregate
Strongly agree	22	55	80
Agree	10	25	
Undecided	2	5	5
Disagree	4	10	15
Strongly disagree	2	5	
Total	40	100	100

Source: Survey Report, 2021.

Table II. Contingency Table

Alternatives	O _i	E _i	O _i -E _i	(O _i - E _i) ²	(O _i - E _i) ²
					E _i
Strongly agree	22	8	14	196	24.5
Agree	10	8	2	4	0.5
Undecided	2	8	(6)	36	4.5
Disagree	4	8	(4)	16	2
Strongly disagree	2	8	(6)	36	4.5
X² cal					36

E_f = Total Frequency

Number of Responses

$$40/5 = 8$$

Level of significance (α) = 5% (0.05)

Critical Value = ($\mu - 1$), α

Where; μ = No of options

$$= (5 - 1), 0.05$$

$$= 8 (0.05)$$

$$X^2 \text{ Tab} = 15.51$$

- Decision:** Since X^2 calculated is greater than the X^2 tabulated, ($36 > 15.51$) we accept alternative hypothesis and reject the null hypothesis. Hence, we conclude that the Production of clay bricks is an alternative to modern cement blocks for sustainable Development.

Hypothesis Two

H₀₂: Youth struggle in the production of clay bricks does not contribute to the national development.

Table III

Alternatives	Responses	Percentage (%)	Aggregate
Strongly agree	14	35	75
Agree	16	40	
Undecided	4	10	10
Disagree	2	5	15
Strongly disagree	4	10	
Total	40	100	100

Source: Survey Report, 2021.

Table IV: Contingency Table

Alternatives	O _i	E _i	O _i -E _i	(O _i - E _i) ²	(O _i - E _i) ²
					E _i
Strongly agree	14	8	6	36	4.5
Agree	16	8	8	64	8
Undecided	4	8	(4)	16	2
Disagree	2	8	(6)	36	4.5
Strongly disagree	4	8	(4)	16	2
X ² cal					21

E_f = Total Frequency

Number of Responses

$$40/5 = 8$$

Level of significance (α) = 5% (0.05)

Critical Value = ($\mu - 1$), α

Where; μ = No of options

$$= (5 - 1), 0.05$$

$$= 8 (0.05)$$

$$X^2 \text{ Tab} = 15.51$$

Decision: Since X² calculated is greater than the X² tabulated, (21 > 15.51) we accept alternative hypothesis and reject the null hypothesis. Hence, we concluded that the production of clay bricks has contributed to the national development of Nigeria..

Discussion of Findings

The research analysis revealed that Production of clay bricks as an alternative to modern cement blocks enhances economic development in Geidam, Yobe state, Nigeria. This is in line with Oyeleran (2012) who noted that small scale industries provide industrial opportunities for the development of local skills and technology acquisition through education. The “Aba Made Goods Syndrome”, a concept adopted by some Nigerians is a clear manifestation of such technological acquisition and this gives force to rapid development in the economy. The study also revealed that the production of clay bricks has contributed immensely to the national development of the Country.

V. CONCLUSION AND RECOMMENDATIONS

In spite of government policies aimed at providing financial and technical support for the promotion of small business enterprises in Nigeria, they have performed less satisfactorily largely because of operational bottlenecks including lack of depth of the financial system, inadequate infrastructural facilities, poor management practices and low entrepreneurial skills to mention but a few. Banks which are supposed to provide adequate credit facilities in compliance to government policies usually place exorbitant interest rate alongside huge collateral securities that scare away investors. Despite all these bottlenecks, small scale businesses have contributed significantly to economic, social and industrial development of the country.

Based on the exploratory survey of this study, the research makes the following recommendations:

- Government should provide friendly business environment in terms of adequate infrastructural that would enhances the production of clay bricks for National Development.
- Business firms should develop and implement policies and strategies that will enable them strive and compete favorably in carrying out their business activities effectively.
- Government through its agencies such as Small and Medium Enterprises Development agencies of Nigeria (SMEDAN) etc should develop a holistic approach to provide adequate training and workshops/seminars for clay-bricks producers so as to update their skills.
- Clay-bricks producers should be given opportunities to access soft loans as well other technical assistance so as to broaden the opportunities to strive effectively

ACKNOWLEDGMENT

I sincerely wish to express my gratitude to the Management of Tertiary Education Trust Fund(tetfund) and the Management of Mai Idris Alooma Polytechnic Geidam for sponsoring this research.

SPONSORED BY:



REFERENCES

- [1]. Abdullahi, M. (2016). Properties of some fine aggregates in minna, Nigeria and environment Leonardo journal of sciences.
- [2]. Anosike, M.N. (2011). Parameter for good site bricks production management practice in Nigeria. Unpublished PhD thesis, covenant university, Nigeria
- [3]. Amin, M. E (2005). Social Science research: conception, methodology and analysis. Kampala: Makerere University Press.
- [4]. Creswell, (2008). Educational research: Planning, conducting, and evaluating quantitative and qualitative research. Upper saddle River, NJ: Pearson.
- [5]. Hali, M. (2012). Earth and structure bale: an investigation of their performance and potential as building material in new Zealand, S.L.: Victoria University of wellington.
- [6]. Hoban, J. & Gaillard, H.(1989). Earth construction, a comprehensive guide.Marseille: practical action pub.
- [7]. Hunt, N. & Tyrrell, S. (2001) Stratified sampling. W Marseille: practical action pub.
- [8]. Kennedy, J. F(2004). Building without borders, sustainable construction for the global village, s.l.:sn
- [9]. Kim, T.E. (1998). Integration of engineering, projects, and production management.Journal of engineering, project and production management.
- [10]. Minkey, Z.O.(2006). Construction material: types used and applications, john wiley& sons inc. U.S.A. P. 271 -1999.
- [11]. Oyekan, G.L. (2001). Effect of granite fines on the compressive strength of sancrete blocks and clay bricks, I proceeding of conference on construction technology, sebah, Malaysia. P.14-17.
- [12]. Sanya, T. (2007). Living in earth, the sustainability of earth architecture in Uganda, theoslo school of architecture and design.
- [13]. Sanya, T. (2010). Innovation and alternative building technology within a sustainable development parading. Human settlements review.
- [14]. Siti, A. H. & Ruziah, G. (2012) Quick tips fast track conducting quantitative research.
- [15]. Unesco (2008). Some other factors which affects crushing strength of bricks, material and structure 10(1), 44-48
- [16]. Uzoamaka, O.J. (1977) Nigeria technical and vocational revitalization project phase ii workshop practice .