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Dynamic Cost Consideration of Local Materials for Mass Housing Construction in Nigeria

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ABSTRACT

There are lots of building materials that can be sourced locally for building construction purpose. Material is a major component of construction cost and a reduction in the cost of material can also result to reduction in overall construction cost. The cost of building materials poses a significant threat to both the construction industry and people aspiring to own houses. One major way to bring down the cost of materials for affordable housing is a shift toward the usage of local materials. This study therefore investigates the dynamic cost consideration of local materials for mass housing construction in Nigeria. The objectives are to ascertain the available local materials used in housing construction in Nigeria, the factors affecting the use of local building materials for housing construction in Nigeria, and examine the benefits of using local materials for housing construction in Nigeria. The study utilized a literature and field survey research design. The population of the study was the construction professionals that are involved in the usage of local materials. Purposive sampling technique was used to select a sample of 46 from the frame. Frequency and percentage were used to analyze the data. The study reveals 11 local materials in Nigeria but most of the materials are either "rarely used" or "seldom used" with the exception of just eight of them that are "often used". The literature survey also reveals that earth or soil local materials are largely used for housing construction floor finishing. Durability and cost of production contribute most among 14 factors that contribute to the usage of local materials with 57% while air quality properties have least contribution. The result equally showed that provision of affordable housing and reduced construction cost stand top among the eight benefits of local materials highlighted in this study from 65% of the responses. The study recommends that government should formulate policy that should play down the agitations on the use of imported building materials by encouraging research in the production of local building materials. Producers of local materials should also take cognizance of the factors that contribute to the usage of local materials and ensure that they are incorporated in the materials to enhance their usage. The study will contribute significantly to the usage of local materials and improvement of their qualities.

Keywords: Building Materials, Cost, Benefits, Housing Construction, Local Materials.

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INTRODUCTION

The housing construction industry is one of the most significant industries that support the economic growth of any country. Housing is equally one of the basic needs of man due to his desire for security, privacy and protection from negative impacts of the environment [1]. In the social life of every Nigerian, home ownership boosts one's status in the society [2]. However, one of the problems of housing shortage arises from the types and cost of selected materials for its constructions [3]. According to [4], 'building materials are all the physical substances that are assembled to create the interior and exterior of a building'. In the current time, the cost of building construction has been escalated due to the fact that the players of the building industry mostly used conventional materials with little or no consideration for natural or local materials in carrying out its activities [5]. Meanwhile, [6] affirmed that local materials are available in every part of the country. Traditionally, buildings were built from local materials with low energy use and environmental impacts, but in new buildings, materials such as concrete, PVC, glass, cement, aluminium and so on are utilized, which raise energy use and environmental impact [7]. Building materials often constitute the single largest input to housing construction in most developing country cities particularly in Nigeria [1]. It accounts for about 35% to 37% of the construction cost component and in a standard low-income housing unit, the cost of building materials alone can take up to 70% [8]. It therefore remains a major reason for the high cost of building construction [9]. Local building materials (LBMs) are materials sourced locally, either occurring naturally or manufactured with locally sourced raw materials [10]. Such materials are within reach and when compared to imported materials, they are cheaper and more affordable in cost [11].

Africa in general, and Nigeria in particular is endowed with abundant natural resources that can meet their building materials production. However, they still depend largely on imported building materials in order to meet the construction needs [1]. For example, the study of [12] revealed that fibrous tree (used to produce good structural members for roof, wall, lintel, ceiling and bridges construction) is found mainly in the Savannah region (Middle Belt) of Nigeria. Furthermore, grasses found in abundant measures in the Middle Belt and Northern region of Nigeria are used for the purpose of construction in the Nigerian traditional Architecture [13]. [9] affirmed a gradual decline in the use of locally manufactured building materials, as well as massive importation of building materials in Nigeria thus, greatly widening the gap between imports and exports.

Most of the local building materials industries import their machinery and their spare parts and, in some instances, even have to bring in foreign technical personnel to maintain the equipment. This has become difficult and uneconomical because expenses incurred make the finished products outrageously expensive [8]. Most of the industries, especially cement factories, are operating far below their installed capacities. This is traceable to the difficulty involved in procuring spare parts to repair broken-down kilns and production engines, apart from other problems such as non-availability of cement bags, lack of gypsum and incessant power failure [14]. A restraining factor in the development of the local building materials industry is the import content of building raw materials. This is in spite of the fact that existing indigenous raw materials are not sufficiently used, with deposits of these materials lying largely unexploited [9]. All building materials whose major raw materials and machines input are locally available and are thus locally produced are recognized as local materials [15]. For instance if the essential raw materials for the production of cement which are limestone, clay and gypsum and the technology used in the production can be locally obtained, then cement is a local material [16]. Improved alternatives to indigenous or local materials have arisen out of extensive applied research and development, notably by the Nigerian Building and Road Research Institute (NBRRI). These include stabilized earth blocks, clay roofing tiles, coir fibre cement, and reinforced roofing sheets.

Nigeria being one of the developing nations in the world, it is not unusual to find a large portion of its population living in slums and much depleted houses. The main reasons are shortage of land for construction and affordability of construction materials due to ever rising cost of living [17]. [18] defined building materials as materials used in each construction work starting from the underground work until the finishing work. In a country where over 70% of the citizens live on less than 1 US Dollar per day, accessibility of decent houses in a sanitized environment remains a dream for many Nigerians [5]. The stagnant nature of economic development and rapid population growth of most of the developing countries makes effective and efficient service delivery difficult for governments, to satisfy the need of their residents [19]. The construction of low efficient houses requires reducing wastage of material. Reducing wastage depends on using components which starts from the smaller parts like the masonry block and repeats themselves of longer scale of the whole housing unit. Locally available construction materials have much smaller environmental impact in contrast to materials such as bricks, concrete and iron mainly because of the lower alive energy [18]. Locally available housing construction materials are materials that we can find out from local area, with low environmental impact, low cost, and highly durable. The locally available material is one of the best

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methods of affording housing as it enables the following aspects: the use of natural materials, renewable materials, and eco-friendly building materials used [8]. The use locally available materials and minimizing the resource allocation and innovative methods can be implemented to reduce the cost and to achieve affordable, sustainable and green building [20].

Consequently, the general consensus is that one key reason for high cost of construction in Nigeria is high cost of building materials which are largely imported materials. This is so because several factors affect imported materials' prices such as foreign exchange, freight, inflation, import duties and so on [9]. Similarly, [21] also concur that the rising cost of building due to materials has made it impossible for people to own affordable houses in Nigeria. It can therefore be inferred that local building materials are not well utilized in Nigeria. This is due to the quality and quantity of the materials, social status, acceptability, lack of government policies among others. In view of the implications of this negligence, [22] suggests that a shift towards the usage of local building materials will ameliorate the scenario of high construction cost in Nigeria [23]. In the same vein, [19] also proposed the use of local building materials, intermediate technology and provision of other basic infrastructures like safe drinking water, roads, electricity supply and other social amenities especially to improve the quality, livability, aesthetic and affordability of housing in Nigeria. Vying the abundant availability of local building materials (LBMs) and its under-utilization in Nigeria, several studies have been carried out but none has focused in towns or cities in Nigeria to consider in specific terms, the availability, level of usage and problems associated with the adoption in specific towns. This study tends to bridge the gap by investigating the dynamic cost consideration of local materials for mass housing construction in Enugu State, Nigeria.

Statement of Problem

Building materials have been playing an important role in the construction industry. They are those materials put together in erecting or constructing structures, no field of engineering is conceivable without their use [24]. Building materials contribute immensely to the quality and cost of housing, from what is used in the foundation to the materials for roofing and finishes [25]. The cost of building materials poses a significant threat to both the construction industry and people aspiring to own houses [26]. For example, a bag of cement, which is valued at N1,350.00 in 2006, goes as high as N1,850.00 in 2009 [27] depicting about 37% increment; the bag goes as high as N2,000.00 in 2015 during peak season. As at September, 2023, a bag of cement stands at 5,500.00 naira which made some contractors and potential house owners to consider alternative use of local materials for housing construction in Enugu state, Nigeria. Supporting this view, [28] earlier established that increase in the prices of building materials has multiplier effects on housing development while [29] affirmed that many projects were not completed on time due to the cost of materials, which have been on the increase. Besides timely completion, high prices of building materials form a crucial constraint to improving housing conditions in Nigeria United Nations Centre for Human Settlement [30].

A major constraint in mass housing construction in Nigeria is the scarcity of building materials and the concomitant high costs of available ones. This is due, in part, to the heavy reliance on importation of building materials and the poor state of the building materials industry in Nigeria [31]. The reliance on foreign goods by Nigerians is a reflection of their consumer culture, and a result of their changing tastes, aspirations and needs. The production of local building materials has continually lagged behind this trend, resulting in the massive importation of building materials. Besides, indigenous materials have not developed in appearance, technology of production and application with time, therefore making them socially and psychologically unattractive to the generality of Nigerians [19]. The economic depression experienced in the nation, and the consequent low values of the Naira (Nigerian currency) against hard currencies have made importation of building materials and raw inputs inexpedient [32]. There is a dire need therefore to develop the local building materials industry in order to bring down the cost of the materials and ensure their availability. In recognition of this need, government has proposed import restriction of building materials to encourage and protect the production of building materials (such as plastic pipes, asbestos roofing sheets, tubes and pipes of cast iron or steel, galvanized roofing sheets) within the country [33]. There is no shortage of raw materials for the production of cement, bricks, lime, asbestos sheets and wood components, thus asserting that Nigeria is in a position to develop its building materials industry thereby offsetting the enormous outlay on imports.

Despite the construction industry contributing at least 3% to the annual gross domestic product (AGDP) and an average of at least one third (1/3) of the total fixed capital investment in Nigeria, the building construction industry still faces the challenges of low levels of working capital, high rates of inflation and increasing costs of development/construction [34]. Most of these situations are currently not properly attended to; subsequently, it leads to some development projects being abandoned, uncompleted and vandalized [35]. The repercussions of not

tackling these issues, especially the increasing costs of developments as a result of the increasing costs of building/construction materials means that current demand outweighs the available supply [36]. The tendency is for the units' sale price to rise or the rent increases are passed to the prospective tenant. This reduces the prospects of relocating people (and current residents) to obtain affordable appropriate accommodations. Appropriate, accessible, ample and sustainable shelter is necessary since it remains a basic need of humankind and requires being continuously available, cheap, affordable, durable, cheap to own and manage/maintain in the built environment [37]. To the construction industry, this is important as it makes the property development deliver higher financial returns and improved market performance for the relevant stakeholders.

There are still several factors militating against the use of local building materials (LBMs) for building construction in Nigeria. [10] noted legal acceptability, social acceptability, doubtful durability, technology to handle setting, uncertainty of cost, double standard on the part of the government, lack of standards and specification, problem of mass production, uncertainty about the demand and uncertainty about the strength of material when compared with their imported counterparts. The lack of access to adequate and affordable building materials hampers housing development and is a reason for the poor state of repair of buildings in both rural and urban centres in Nigeria. The state of repair of buildings takes into consideration the soundness of the roofs, walls, floors and foundations. The high cost of building materials in recent times has served as a hindrance to housing development in the country. Though, people still build, there has been a reduction in the number of builders especially with the present dwindling economy. Thus, most landlords tend to put their rents on the high side and this is attributed to the high cost of construction, of which the most falls on the building materials used in the construction process.

Aim and Objectives of the Research Study

The aim of this study is to investigate the dynamic cost consideration of local materials for mass housing construction in Enugu State, Nigeria, while the specific objectives are to:

i. ascertains the available local materials used in housing construction in Enugu State, Nigeria.
ii. find out the factors affecting the use of local building materials for housing construction in Enugu State, Nigeria.
iii. examine the benefits of using local materials for housing construction in Enugu State, Nigeria.

LITERATURE REVIEW

Local Material

This term local material refers to building materials that are sourced locally, either occurring naturally or manufactured with locally sourced raw materials. [38] suggest the use of local building materials to reduce construction cost in Nigeria as it has been done profitably in Tanzania and Sweden. Similarly, [39] emphasizes the need to embrace the usage of local building materials to achieve functional and affordable housing scheme in Nigeria. [40] also reveals that one of the reasons government interventions in housing scheme in Nigeria has failed is due to high cost of building materials [41]. [41] suggests review of government's restriction on imported materials and development of local building materials to solve this problem. [8] also posit that high cost of production of building materials are responsible for increased housing construction costs in Nigeria. It is observed from their study that material is the highest cost component of construction in Nigeria. Unavailability of durable local building materials has forced several producers of house to the usage of imported material, which has significant impact on the final construction cost [23]. [8] reveal that there is a significant positive relationship between the level of housing construction cost and building materials price, property price, foreign exchange rates, labour cost, national disposable income and money supply. Materials are therefore one of the predictors for future cost of construction in Nigeria. This finding implies that a shift to the usage of locally produced materials will result to possible reduction in building construction cost in Nigeria and promotes affordability [22, 40]. There are abundant local building materials to reduce housing problems but they remain underdeveloped and hence socially unacceptable. [5] suggests the usage of mortarless masonry materials instead of the conventional blocks to reduce construction cost. [42] recommend usage of local building materials to build African cities. Other countries where hydra form blocks have been used successfully are Uganda, Kenya, Ghana, Nigeria, Guinea, Ethiopia, Sudan, Tanzania and Zambia. [43] asserts that earth materials has thermal comfort and durability including cost efficiency.

Local Building Materials (LBMs) in Nigeria

There are two Research Institutes that are presently sourcing for all functional materials in Nigeria i.e. Raw Materials Research Institute (RMRI) and Nigeria Building Road Research Institute (NIBRRI) [44]. The major role of these Institutes has to do with the selling-out of information on local materials through seminars, conferences and workshops. NIBRRI is specifically required to research into all forms of construction materials. [11] gave insight to the potentials of LBM as an alternative to imported building materials at different stages of building construction. According to them, stones and rocks with laterite can be utilized jointly to form a very strong strip

foundation that will stand the test of time. Similarly, laterite when reinforced with bamboo or coconut palm, can be used as bamboo reinforced terracrete which is as good as concrete slab. Timber, when well treated and impregnated with liquid preservation can be used to achieve good timber board flooring [45]. In the same vein, Bamboo floor and foist provide good building flooring when polished and treated to form Bamboo floor and foist. Cow dung when properly mixed with clay screening produced strong and good looking floor. This can be improved with the addition of fermented leaves and bitumen to further improve the flooring having a reasonable damp resistance.

Furthermore, Brick with laterite joining forms a good building wall with good conductivity advantage over the hollow concrete block. Also, Stone jointed with laterite mortar or lime stabilized mortar produces a desirable building wall with high compressive strength while Coconut palm, bamboo and Timber treated as stakes inside earth form a desirable building wall. Earth when required to mix cement, conserves the volume of cement used because of its cohesive properties. Earth wall can also be reinforced with some additives (Vegetable, stems, reeds and straws) to achieve desirable strength and check cracking in walls. Laterite reinforced with bitumen for wall will have in addition to the strength the ability to act as a repellant to ants and rodents. Clay and bricks stand out among other materials for building walls. [46] submits that clay products are significant areas that need be explored urgently considering such advantages that go along with its usage. (e.g., Durability, aesthetic, cost effectiveness and fire resistance). [11] asserted that Bamboo in particular has a meaningful tensile strength depending on the specie. The ultimate tensile strength of some species of bamboo has been found to be about the same as that of steel at its yield point-Average1,400kg/cm to 2 2,800kg/cm [47]. Such remain a very good local material option for building roof. Similarly, Sun-dried earth block bricks have also been used in the construction of vault and domes; the procedure involves laying and bonding the masonry units over a wooden framework which is to be removed when the vaults or domes becomes dried [48]. Clay and bricks stand out among other materials for building walls according to [11]. For finishes and fittings, Earth stabilized with cement forms a good plastering material. Stones can be used as stone facing on the walls while timbers are good cladding.

Challenges in the use of Local Building Materials in Nigeria

Taiwo and Adeboye [9] noted that some existing locally produced building materials are capital intensive to manufacture locally, as their production is based on sophisticated technologies. In the same vein is the findings of [10] that technology to handle the setting and uncertainty of the cost is a major challenge facing the production of locally produced building materials. In addition to this is the problem of legal and social acceptability and doubtful durability. Other criticisms of local building materials in the Nigerian context are lack of standards and specification, lack of organizational and institutional framework, problem of mass production, uncertainty about the demand and uncertainty about the strength of material when compared with their imported counterparts. [18] also identified the problem of acceptability with the public, durability and low strength, deforestation, civilization, frequent maintenance and challenges with the use for tall buildings as other factors affecting the use of LBMs in Nigeria.

Building Materials and Housing Construction in Nigeria

There is a correspondence between the attitude of an architect to space and the choice of materials he employs in defining and articulating it. As a synthetic product, housing depends on available materials with particular regard to their properties and technical possibilities. The range and quality of building materials enhance their aesthetic values and structural performances [49]. Owing to the poor state of development of the building materials industry in Nigeria, the nation relies on importation of building materials for its construction activities [50]. The economic depression in the country which has weakened the *Naira* (Nigerian currency) against foreign currencies has made importation a costly and difficult venture, resulting in exorbitant prices of building materials imported into the country. It has further led to an alarming dearth of building materials needed in the country as local production is significantly low. Aside from the quality of design and construction work, an important factor that determines quality in housing is the building materials and products used [49]. The technical characteristics of these materials, their historical precedents and future potential are determinants of the quality of architectural objects [51]. Housing quality is therefore a function of the quality and efficiency of building materials. Important properties of building materials that come into reckoning in evaluating quality include strength, stiffness, heat resistance, fire resistance and those which the durability and functional performances of buildings depend upon. Colour, face patterns, surface finish and texture all come into play in the determination of the aesthetic value of the building [51]. The process of design is influenced by decisions which are dependent on such factors as socials, structure, climate, culture, economics, technology, and available resources. This is manifested in traditional architecture which is evolved by the people, built by them and in the context of their community. The acceptance and development of values of the natural domestic (traditional) architecture of a people is vernacular architecture [52]. This is definable in terms of climate, culture and materials, and is congenial to a people and sympathetic to their environment. [50] noted that

vernacular architecture is thus a generalized way of design derived from traditional architecture as built within the community, essential to its life and resolved through available materials [23]. These materials could be indigenous building materials (such as stone, clay and its derivatives, timber, bamboo), improved alternatives (such as cement stabilized block from lateritic soil, bricks and blocks from mineral and industrial wastes, cement bonded wood, wood boards) and novel man-made materials (such as coated fabric and synthesized membranes). The adoption of vernacular architecture and consequently the social structures and cultural values that impinge on house forms would encourage the use of local building materials of indigenous origin by modern architects [49]. These materials have been used for generations in Nigeria and are being improved upon technically through research. They are particularly applicable in housing with the principal objective of bringing it within the economic reach of Nigeria's poor majority who live in straitened circumstances.

Ways of Improving the Quality of Local Building Materials

In this section, respondents were asked to give their opinions via open-ended question in the questionnaire, on the possible ways of improving the quality of local building materials used for construction in Nigeria. Seven suggestions were given by the respondents as follows:

i. Use of modern technology: Appropriate technology should be employed in the production of local building materials. This agrees with the opinion of [53] who indicated non-availability of technology as a constraint of local building materials in Kenya. [5] also indicated that local building materials are underdeveloped and hence are socially unacceptable. Similarly, [8] confirmed that local building materials are not durable and consequently have compelled house producers to imported materials. A transformational example of what appropriate and modern technology can do is seen in the turning of soil to mortarless blocks, produced by a technology of a South African-based organization called Hydraform [42]. The blocks have produced several beautiful and durable houses and the awareness is growing. As a result of its good quality and durability, it has been transported to several African countries and it is void of any form of discrimination or biases. In this regard, [23] also pinpointed lack of adequate technology being responsible for poor quality products in Bangladesh.

ii. Skillful and Innovative Workers: Requisite skills and innovative approach will enhance the quality of local building materials. One key factor that has led to major breakthrough in other field of endeavour is innovative thinking and skillful personnel. For example, in the automobile industry, innovative and skilled craftsmen have brought about unimaginable products. The Toyota manufacturer has a slogan – "good thinking, good products". Attention must be given to skill acquisition and innovation by producers of local materials to have good quality.

iii. Improved Production Method: There are several techniques in the construction industry that can be employed to improve the quality and production processes of local building materials. Examples are the Lean construction (LC) and Total Quality Management (TQM). A lot of techniques of LC are directed toward either improving processes or the finished products.

There is no way we can continue to produce mud-blocks by pressing with legs and expect quality product.

iv. Government Intervention: This suggestion is tailoring along the opinions of [53, 37], which revealed that the problems of local materials comprise non-inclusion of some of them in National Building Codes and lack of governments' support. Inadequate funding can also affect quality, which can be solved by government through provision of access to funds, tax reduction and incentives [38].

v. Training: Training is very vital in the production of quality products. Producers of local building materials should embark on training their staff geared toward improving the quality of their products. Consumers can also be trained on the appropriate handling and usage of their products. This is in consonance with the opinions of [54]. [54] recommends training of building professionals and personnel on the usage of local materials.

vi. Research: Researches in the development of new products and improvement on the qualities of existing materials should be vigorously pursued. This can bring about durable and reliable local building materials through laboratory analysis and field test for suitability [54]. Therefore, stakeholders should sponsor researches and findings should be adequately transferred to the industry and implemented.

RESEARCH METHODOLOGY

The study used a literature survey and a survey research design to investigate the dynamic cost consideration of local materials for mass housing construction in Enugu State. According to [55], survey research is that type of study in which a sample is selected randomly from the study population and studied, and the results are used to make generalization on the matter investigated. The population of the study consisted of construction professionals in Enugu State, Nigeria. Respondents for the study include Professionals involved directly and indirectly with Construction Activities-Builders, Engineers, Quantity Surveyors, Architects, Project and Facility Managers in Construction companies that either has a branch or it headquarter in Enugu State. A questionnaire was designed to

elicit data from the respondents. A purposive sampling technique was used to select a sample size of 46 professionals from the frame. The questionnaire consists of questions that bother on the objectives of the study. The instrument used for data collection was structured questionnaire. The instruments were designed in a 4-point likert scale format, which ranges from 4 – 1 (strongly agree = 4; Agree = 3; Disagree = 2; Strongly disagree = 1). Method of data collection in this study is researcher's ability to sever distributed questionnaire copies to respondents and return same by himself. The researcher did not use any assistance to distribute his copies of questionnaire and return same for the fear of been mutilated. The researcher used simple percentage data presentation and analysis to analysis the data derived from questionnaire instrument. Responses from the questionnaire were analyzed using the descriptive statistics of frequency counts and percentage. Descriptive statistics of frequency counts and percentages were used in analyzing demographic variables and research objectives.

DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

The Socio-demographic Characteristics of the Respondents

This section deals with the description of the characteristics of all the respondents (46) involved in the study by randomly selection of respondents from the study area. The characteristics of respondents include age, sex and marital status.

Table 1: Age, Sex and Educational Status Composition of the Respondents

Variable Name	Categories	Frequencies	Percentages	Total	
Age	21-30 Years	6	13%	Respondents	%
	31-40Years	31	67%	46	100
	41-50Years	9	20%		
Sex	Male	36	78%		
	Female	10	22%	46	100
Educational Status	HND, BSc	30	65%		
	M.Sc., PhD	16	35%	46	100

The table 1 above shows the age, sex and educational distributions of the respondents. The result indicates that 6(13%) of the respondents are into the age bracket of 21-30 years, while 31(67%) are into the age bracket of 31-40 years and 9(20%) of the respondents are into the age bracket of 41-50 years. Also, from the table, 36(78%) the respondents were male, while 10(22%) were female. The result equally shows that 15(33%) of the respondents were with First degree, 30(65%) of the respondents were of higher degree. This entails majority of the respondents were male who have minimum of first degree and fell into the age category of 31-40 years.

Table 2: The local materials used for housing construction in Enugu State, Nigeria

S/n	Construction materials	Number of housing Constructed	Percentage (%)
1	Flooring		
	Earthen	32	70
	Stone	14	30
2	Walling		
	Limestone	41	89
	Wood	5	11
3	Roofing		
	Corrugated iron sheet	30	65
	Wood	16	35

Source: Field survey, 2023

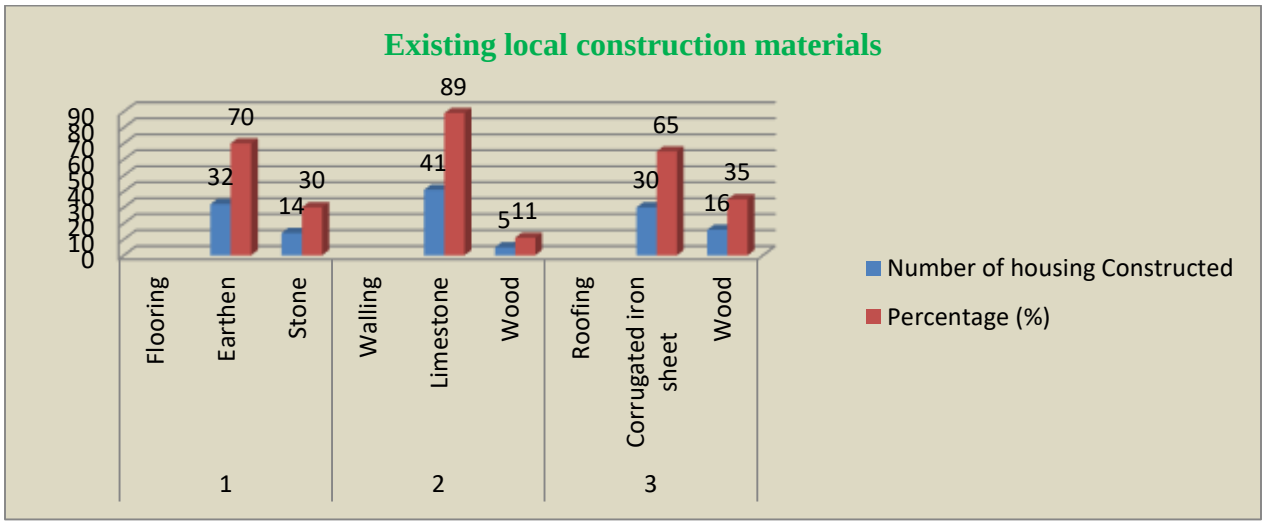

Figure 1: Existing local construction materials

Table 2 and Figure 1 sheds light on the level of usage of local building materials. It shows that all the materials are used in Nigerian project. The survey result reveals that the larger numbers of housing units floor finishing are earth or soil i.e. 32(70%) housing units floor finishing are earth and 14(30%) housing units are stone concrete. The construction materials of wall from which the study area houses wall were constructed, 41(89%) have limestone wall and small amount of clay soil for cementing, 5(11%) were constructed from wood. The construction materials of roof of the study area 30 (65%) made up of corrugated iron sheet and 16 (35%) made up of wood. Also it can be seen from the table below that the majority of the houses were built from temporary material which can be rotten in short period of time. Thus; construction of wall should be from hollow block and other permanent construction material. Soiled floor is not good for dwellers health while it is not easily cleanable and may dispersed with wind causing contamination to food and drink. In line with this, soiled floor should be discouraged and the house should have cemented or if not stone concreted floor. This finding confirms [5], which states that there are a lot of materials that can be sourced locally in Nigeria for construction of buildings; just as it is in other countries though they vary in qualities and quantities. Based on the above analysis result anybody can conclude that the housing condition of the study area is somewhat sub-standard.

Table 3: The factors affecting the use of local building materials for housing construction in Enugu State, Nigeria

S/N	Factors	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
1	Durability and lifespan of materials	26(57%)	16(35%)	4(9%)	0(0%)
2	Cost of production	22(48%)	12(26%)	7(15%)	5(11%)
3	Reusability of materials	19(41%)	15(33%)	8(17%)	4(11%)
4	Public awareness about the local materials	20(43%)	17(37%)	3(7%)	6(9%)
5	Government intervention	18(39%)	20(43%)	2(4%)	6(13%)
6	Renewability of materials	21(47%)	14(30%)	9(20%)	2(4%)
7	Availability of the local materials	16(35%)	19(41%)	5(11%)	6(9%)
8	Availability of manpower	13(28%)	23(50%)	7(15%)	3(7%)
9	Aesthetic purposes	23(50%)	19(41%)	3(7%)	1(2%)
10	Social acceptability of materials	17(37%)	21(47%)	6(9%)	2(4%)
11	Sound insulation properties	24(52%)	10(22%)	8(17%)	4(9%)

Source: Field survey, 2023

Table 3 above reveals the respondents' opinion on the factors that contribute to the usage of the materials. It is of note that all the factors contribute positively to the usage of local building materials. Durability and lifespan of materials contribute most to making the respondents' use of local building materials, i.e. 26(57%). This is followed in descending order of contributions by cost of production, reusability of materials, public awareness, government intervention, renewability, availability, manpower, good aesthetics, social acceptability, and sound insulation. The finding confirms the assertions of [42] who opined that the use of local building materials will reduce construction cost and enhance affordability of houses. It also explains the reason for low and non-usage of local materials because many of them are not durable. The study also agrees with the opinion of [41] on governments' non-incorporation of many local building materials; though with the exception of timber, stones and sand.

Table 4: The benefits of using local materials for housing construction in Enugu State, Nigeria

S/N	Benefits	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
1	Affordable housing	30(65%)	10(22%)	5(11%)	1(2%)
2	Reduced construction cost	25(54%)	14(30%)	4(9%)	3(7%)
3	Improvement of local economy	23(50%)	15(33%)	2(4%)	6(13%)
4	Economic empowerment	19(41%)	13(28%)	12(26%)	2(4%)
5	Employment opportunities	20(43%)	10(22%)	11(24%)	5(11%)
6	Development and patronage of indigenous technology and skills	18(39%)	21(46%)	3(7%)	4(9%)
7	Usage of environmental friendly resources	22(48%)	16(35%)	6(13%)	2(4%)
8	Provision of energy conservative products	27(57%)	12(26%)	4(9%)	3(7%)

Source: Field survey, 2023

Table 4 shows the respondents' opinion on the benefits of using local building materials for housing construction in Enugu State, Nigeria. Affordability of houses is the topmost benefit with 30 representing 65% of the responses. This finding corroborates the work of [22] which agreed that the chief benefit that can be derived from the usage of local building materials is affordability of houses through reduced construction cost. The finding also corroborates the work of [56] in USA. [56] among other things state that the use of local building materials will result in creation of stabilized local economies and consequently economic empowerment for the people.

CONCLUSION

Having the literature review in mind and findings on the study area the following conclusions are drawn out from the study. When coming to the conclusions, the objective aspects of this study are considered. Those are: ascertain the available local materials used in housing construction in Enugu State, Nigeria, the factors affecting the use of local building materials for housing construction in Enugu State, Nigeria, and the benefits of using local materials for housing construction in Enugu State, Nigeria. The study has brought to the fore a lot of findings on local materials both through the literature and field survey, which forms the premise for recommendations in this section. A wide range of local building materials are available in Nigeria but most of the materials are either "rarely used" or "seldom used" with the exception of just few of them that are "often used". In general, the costs of imported international construction materials are very high and affordability of housing is directly related to the cost of materials, it is impossible to afford for housing in Enugu State, Nigeria. The necessary choice to afford housing in this area is the local construction material so that we can find them in the local area without much money delay for transportation. Natural stone is an available material in this area in different types and forms. The literature survey shows that local building materials can be used and are used to construct cheap and durable buildings; not only in Africa but also in Europe and seismic-prone region. Practitioners and stakeholders should extend their use to all these abundant materials to provide affordable houses. In addition, 11 important factors that contribute positively to the usage of local building materials are also revealed. Durability and cost of production contribute most among the 11 factors while air quality property has least contribution. Producers of local building materials should take cognizance of these factors and ensure that they are incorporated in the production of the materials to enhance their

usage. Moreover, provision of affordable housing and reduced construction cost stand top among the nine benefits of local building materials highlighted in this study. Government and house producers should take advantage of these benefits to meet the housing needs of people. This study contributed to local knowledge in the area of Building construction and Construction business noting among other things that the key constraints to the realization of the full potentials of local materials in the study area include, technological constraints and poor quality of product which is as a result of non-compliance with standards.

RECOMMENDATIONS

Having conducted this research and analyzed the field data, the study recommends the following points;

i. Government should also take drastic steps to reduce the cost of production and transportation of goods by ensuring an adequate supply from the power sector and production of petroleum products through the local refineries as against dependency on importation.
ii. Government should formulate policy that will play down the agitations on the use of imported building materials by encouraging research in the production of local building materials.
iii. Finally, relevant bodies like Nigerian Building and Road Research Institute (NBRRI) among others should in collaboration with the professionals conduct further studies that will conform to the socio-economic set up of people as well as locally acceptable to the people on the utilization of the materials.

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