ABSTRACT: There are lots of building materials that can be sourced locally for 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. 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 usage of local materials in building projects. The objectives are to find out the sort of local materials used in building construction, the factors that affect their usage, benefits of local materials and ways of improving their qualities. The study utilized a literature and field survey research design. The population of the study is 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, mean and percentage were used to analyze the data. The study reveals 21 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 local materials are used in Europe and in seismic-prone regions. Durability and cost of production contribute most among 14 factors that contribute to the usage of local materials while air quality properties have least contribution. Provision of affordable housing and reduced construction cost stand top among the nine benefits of local materials highlighted in this study. The study recommends that practitioners and stakeholders should extend their use to all these abundant materials to provide affordable houses. 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: Benefits, housing, local materials, qualities.
in Nigeria are imported. However, Windapo and Iyagba (2007) reveal that materials are about 35% to 37% of construction cost component, which is far less than the finding (Gumel, 2000). 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. Similarly, Oluwari, Jev and Owei (2002) 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, Ademiluyi (2010) suggests that a shift towards the usage of local building materials will ameliorate the scenario of high construction cost in Nigeria and also in Bangladesh (Jamil & Ahmad, 2006).

In the same vein, Ajanlekoko (2001) 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. This research therefore aims at investigating the utilization of local building materials in Nigeria. The objectives are to examine the usage of local building materials in Nigeria, find out the factors that enhance their usage, pin point their benefits and identify ways to improve their qualities. This study is significant because it will contribute towards the affordability of housing by bringing down the cost of material via the usage of local building materials.

**Local Materials:** This term refers to building materials that are sourced locally, either occurring naturally or manufactured with locally sourced raw materials.

**Literature Review**

Olayiwola, Adeleye and Ogunshakin (2005) suggest the use of local building materials to reduce construction cost in Nigeria as it has been done profitably in Tanzania and Sweden. Similarly, Daramola (2006) emphasizes the need to embrace the usage of local building materials to achieve functional and affordable housing scheme in Nigeria. Ademiluyi (2010) also reveals that one of the reasons government interventions in housing scheme in Nigeria has failed is due to high cost of building materials (Akeju, 2007; Akinmoladun & Oluwoye, 2007). Akeju (2007) suggests review of government’s restriction on imported materials and development of local building materials to solve this problem (Erguden, 2001; Jamil & Ahmad, 2006). Windapo and Iyagba (2007) 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 houses to the usage of imported material, which has significant impact on the final construction cost. Windapo and Iyagba (2007) 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 construction cost in Nigeria and promotes affordability (Ademiluyi, 2010; Ademiluyi & Raji, 2008). However, Ademiluyi and
Raji (2008) shed light that public developers do make use of local materials more than their private counterpart; recommending that both of them should desist from over dependency on imported materials to the use of local materials such as, wall, roofing and floor materials that are affordable and durable. In this regard, Adedeji (2005) advocates that high building cost call for a review of conventional building materials and processes. There are abundant local building materials to reduce housing problems but they remain underdeveloped and hence socially unacceptable. Adedeji (2005) suggests the usage of mortarless masonry materials instead of the conventional blocks to reduce construction cost. It is fast, cost-effective, encourages modular design and standardization of building components that can lead to industrial production, promotion of other industries and sustainable development. Similar mortarless blocks made locally from cement and soil known as hydraform blocks have been used in South Africa as exemplified in Plate 1; while Plate 2 shows cross sections of hydraform blocks (Dimoniaku and Obiozo, 2010). Dimoniaku and Obiozo (2010) recommend usage of local building materials to build African cities. Other countries where hydraform blocks have been used successfully are Uganda, Kenya, Ghana, Nigeria, Guinea, Ethiopia, Sudan, Tanzania and Zambia. Efforts like this can also be replicated for other local building materials that are available locally, such as timber. Otuwari et. al. (2002) reveal that clay can be sourced 100% locally and timber can be sourced 80% to 90% in Nigeria but noted that they are not accessible due to certain factors.

In addition, Alagbe (2010) also suggests usage of locally produced Compressed Stabilized Laterite Bricks (CSLBs) as an alternative to construction of sustainable houses. These laterites are similar to Caliche that are fabricated to strong blocks and used in Texas (Fisk, 1982). Similarly, Oni (2009) suggests clay brick in place of cement-based materials and factory blocks. Oni (2009) further explains that it will be difficult to produce affordable housing without locally sourced materials via research and development. Kadiri (2005) also proposed unstabilized laterite blocks (i.e. adobe, rammed earth and compressed earth blocks, Fisk, 1982.) in place of expensive

Plate 1: Hydraform Cottage in Cape Town, South Africa. 
Source: Dimoniaku and Obiozo (2010), 12
sandcrete blocks for building construction. Kadiri (2005) highlights the support required to make laterite blocks popular as: provision of blockmaking machines; training; codal support; inclusion in schedule of rates; wide usage for public buildings; public and students’ awareness; transfer and implementation of its technology; and entrepreneurs’ interest. Moreover, apart from African countries, local building materials have been found useful in constructing houses that can withstand earthquakes in seismic-prone areas such as Turkey, India, Japan, El Salvador, Peru, Kyrgyzstan, Portugal, Italy and so on (Sassu, 2005). Fisk (1982) highlighted Caliche and other local building materials in Texas, United States of America. Caliche is a high calcium carbonate soil characteristic of lower soil horizons in arid, semi-arid environments. It is estimated that these soils comprise 14% of the earth’s surface, and over one-third of Texas’ land mass. Other local materials among others identified by Fisk (1982) are insulating blocks made from sawdust and bamboo used as reinforcing bars in foundation. Marthur (2006) also reveals the usage of locally sourced sisal and jute fibres as reinforcement and wood substitute in India. Similarly, Morel, Mesbah, Oggero and Walker (2001) describe the construction of three stone masonry houses in South France using three local materials: soil mortar stabilized with 6% to 15% cement, stone and timber. Ninety percent of the mortar used for the stone masonry comprised of an inorganic subsoil layer extracted close to the site leading to reduced transportation. Stone (dolomite limestone) for the masonry work were obtained from a local quarry, which significantly reduced transportation and environmental impact (Fisk, 1982). A local fir tree was used as the source of all timber used for the horizontal frame and roof which reduced the embodied energy level by at least 70 times compared to imported tropical wood, that is about 215% reduction for stone masonry and 285% for the rammed earth walls. Furthermore, apart from provision of affordable and cheap buildings, Adogbo and Kolo (nd)
reveal other benefits of local building materials as: employment opportunity; satisfaction of demand for housing stock; utilization of environment friendly resource; conservation of energy; development and propagation of indigenous technological ingenuity and skills of the local people; enhancement of the economic strengths of people and the nation; and provision of a source of study and research for both present and future generations. Fisk (1982) noted that development of local building materials can breed a lot benefits among which are creation of stabilized local economies. Kadiri (2005) identifies the benefits of using unstabilized blocks as: high thermal insulating properties; high sound insulation; not susceptible to insects or rodents; no waste generated; inert-contains non-toxic substances; construction is inexpensive and simple; high workability and flexibility; fire resistant; availability; and recyclability.

Inspite of the obvious need and benefits of local building materials, they are still bedeviled by several problems that hampered their usage. Adogbo and Kolo (nd) indicate that local building materials are sparsely used in Nigeria mainly due to discrimination though there are other factors incidentals to this. The discrimination in the usage of local building materials is due to their: doubtful durability and life span; low aesthetic value; poor social acceptability by general public; non-commercial status and lack of standards. Other problems highlighted by Adogbo and Kolo (nd) include limitation in design forms, inadequate supply of the materials, cost implications, structural problems, non compatibility with other materials, transportation and constructability problems. These problems and constraints are not peculiar to Nigeria alone. Similar scenario exists in other countries but at varying degrees. Jamil and Ahmad (2006) identified problems of local building materials in Bangladesh as poor quality and lack of technological innovations which has hindered their availability, patronage and usage. Gichunje (2001) and Kadiri (2005) reveal the problems of local building materials in Kenya and Nigeria as non inclusion in the building code, lack of awareness, lack of government support, consumers’ bias, non availability of labour and technology.

However, Adogbo and Kolo (nd) suggest ways to minimize these problems and also stressed the importance of the usage of local building materials. Some of the suggestions are professional requirement for retraining to think in terms of these materials; establishment of standards and specifications; change in pricing and subsidy structures; education of clients and stakeholders to think in terms of building with local materials in-lieu of the conventional ones. Gichunje (2001) also recommends revision of building codes to incorporate indigenous and appropriate building materials and standards. Government should also make funds accessible to potential manufacturers of building materials in addition to tax relief and incentives to boost their usage (Olayiwola et al., 2005). In addition, Morel et al. (2001) recommends specificity of local materials through laboratory analysis and field test for suitability; and training of building professionals and personnel to use local materials wherever possible.

**RESEARCH METHODS**

The study used a literature survey and a survey research design to investigate the use of local building materials in construction projects. The population of the study is construction professionals in Lagos State, Nigeria. 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 questions include the respondents’ and organizations’ profiles, the
usage of 21 local building materials measured on a 5-point Likert scale (i.e. not used to always used); the impacts of 14 factors coined from literature on the usage of local building materials on 11-point Likert scale; achievement of 10 hypothesized benefits of local building materials; and respondents were asked to list possible ways of improving the quality of local building materials. The statistical tools used are mean and frequency. Figure 1 and Figure 2 reveal the respondents’ and organizations’ profiles respectively. Twenty one respondents are quantity surveyors, 13 are builders, five are civil engineers and three are architects; one has National Diploma (ND) degree, eight have Higher National Diploma (HND) degree, 26 have B.Sc degree, nine have M.Sc degree, two have PhD degree; 10 are not grade members of their professional bodies, five are associate members 20 are graduate members, seven are corporate members and only one is a fellow member; 18 have less than 5 years construction experience, 17 have 6 to 10 years, eight have 11 to 15 years, two have 16 to 20 years and one has over 20 years construction experience. Similarly, Figure 2 sheds light that 40 respondents are from indigenous organizations while 6 are from the multinationals; 30 from organizations of 8 to 11 staff strength, 9 from 1 to 7 staff strength and 7 from 12 to above 120 staff strength; 24 are from organizations that have existed for 6 to 10 years, 12 are from 11 to 15 years, 7 are from above 20 years and 3 from less than 5 years. This shows that the respondents and the organizations are fit to supply the required information.

Figure 1: Respondents’ profile

Figure 2: Organizations profile
FINDINGS AND DISCUSSION

Usage of local building materials.
Figure 3 sheds light on the level of usage of 21 local building materials. It shows that all the materials are used in Nigerian project. However, granite and gravel are the most frequently used local building materials in Nigeria (mean = 4.65). These are followed in descending order of usage by timber, plywood, laterite, marble, bamboo, asbestos, natural fibre, limestone, fired blocks, gypsum, asphalt, shale, silica, slate, clay mud blocks, coal, pozzolan and thatch.

This finding confirms Adedeji (2005), 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. For example, caliche, sawdust, and bamboo are found in USA (Fisk, 1982), while sisal and jute fibres are in India (Marthur, 2006). However, most of these are not well utilized in Nigeria. The mean shows most of them are either “rarely used” or “seldom used”. Only eight of them are “often used”, that is granite, gravel, timber, plywood, laterite, marble, bamboo and asbestos. Granite and gravel have the highest level of usage because they are the only coarse aggregate in concrete, there is no substitute for these components of concrete and most houses have concrete as an element. The sparsely usage of these materials contributes immensely to the high cost of construction in Nigeria. Local materials are more utilized in the rural areas than urban areas and some of these materials are raw materials for the finished products. High cost of production of the finished product defeat the purpose of sourcing the materials locally, which also places limitation to their usage. Therefore, the use of such finished products that have been suggested by researchers is not extensive. Suggested finished products include compressed stabilized laterite bricks (Alagbe, 2010), clay bricks (Oni, 2009) and unstabilized laterite blocks (Kadiri, 2005).

Factors Affecting the Use of Local Building Materials
Table 1 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

![Figure 3: Mean scores and ranks (R) of the usage of local building materials](image)

Note that: 1.00 = never used, 2.00 = rarely used, 3.00 = seldom used, 4.00 = often used and 5.00 = always used.
Table 1: Factors affecting the use of local building material

<table>
<thead>
<tr>
<th>S/N</th>
<th>Factors</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Durability and lifespan of materials</td>
<td>3.82</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Cost of production</td>
<td>3.59</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Reusability of materials</td>
<td>3.37</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Public awareness about the local materials</td>
<td>3.30</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Government intervention</td>
<td>3.26</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Renewability of materials</td>
<td>3.20</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Availability of the local materials</td>
<td>3.15</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Availability of manpower</td>
<td>3.11</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Aesthetic purposes</td>
<td>2.89</td>
<td>9.5</td>
</tr>
<tr>
<td>10</td>
<td>Social acceptability of materials</td>
<td>2.89</td>
<td>9.5</td>
</tr>
<tr>
<td>11</td>
<td>Sound insulation properties</td>
<td>2.78</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Embodied energy of materials</td>
<td>2.70</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>Water reduction properties</td>
<td>2.67</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>Air quality properties</td>
<td>2.33</td>
<td>14</td>
</tr>
</tbody>
</table>

Note that total respondent (n) = 46, 1 = nil, 2 = very low, 3 = low, 4 = average, 5 = high and 6 = very high.

Table 2 shows the respondents’ opinion on the benefits of using local building materials. Affordability of houses is the topmost benefit (mean = 4.35). This is followed in descending order by reduced construction cost, improvement of local economy, economic empowerment, employment opportunities,
Table 2: Benefits derived from the use of local building materials.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Benefits</th>
<th>Mean</th>
<th>Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Affordable housing</td>
<td>4.35</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Reduced construction cost</td>
<td>4.22</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Improvement of local economy</td>
<td>4.20</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Economic empowerment</td>
<td>3.91</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Employment opportunities</td>
<td>3.89</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Development and patronage of indigenous technology and skills</td>
<td>3.83</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Usage of environmental friendly resources</td>
<td>3.54</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Longer lasting products</td>
<td>3.46</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Provision of energy conservative products</td>
<td>3.39</td>
<td>9</td>
</tr>
</tbody>
</table>

Note that total respondent (n) =46, 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = moderately agree and 5 = strongly agree.

enhancement of local technology and skills, usage of environmental friendly resources, durability and provision of energy conservative products.

This finding corroborates the works of Olayiwola et al. (2005), Adogbo and Kolo (nd) and Ademiluyi (2010). All these works that were done in Nigeria, agree that the chief benefit that can be derived from the usage of local building materials is affordability of houses through reduced construction cost; which is also same with the finding of Jamil and Ahmed (2006) in Bangladesh. The finding also corroborates the work of Fisk (1982) in USA. Fisk (1982) 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. Adogbo and Kolo (nd) also indicate employment opportunities and propagation of indigenous technology ingenuity and skills as benefits of local building materials and they are part of the findings of this present study. The study has shown that the benefits of local building materials are so enormous that government and stake holders cannot afford to pay indifferent attitude to their usage.

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 Gichunge (2001) who indicated non-availability of technology as a constraint of local building materials in Kenya. Adedeji (2005) also indicated that local building materials are underdeveloped and hence are socially unacceptable. Similarly, Windapo and Iyagba (2007) 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 (Dimoniaku and Obiozo, 2010). 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, Jamil and Ahmad (2006) 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 Gichunge (2001) and Kadiri (2005), 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 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 (Olayiwola et. al 2005). Producers currently spend a lot of money in generating electricity and other needed resources in Nigeria. If government can produce these infrastructures, the producers can transfer the money toward improving quality.

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 Morel et.al (2001). Morel et.al (2001) 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 (Morel et.al, 2001). Therefore stakeholders should sponsor researches and findings should be adequately transferred to the industry and implemented.

vii. **Standard Requirement:** There should be establishment of minimum requirements that local building materials must meet before being released to the public and industry for usage. Relevant agencies must be set up to ensure that all materials go through standard tests and pass before usage. Sanctions should be introduced for defaulters and incentives provided for those that comply. This is in line with the opinions of Adogbo and Kolo (nd), who suggest establishment of standards and specification to curb the problems of local building materials.

**CONCLUSION AND RECOMMENDATIONS**

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 eight of them that are “often used”. Granite and gravel are the topmost used materials in Nigeria among these eight, probably because there is no substitute for them as coarse aggregates in concrete. 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, 14 important factors that contribute positively to the usage of local building materials are also revealed. Durability and cost of production contribute most among the 14 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. This is also confirmed from the literature study. Government and house producers should take advantage of these benefits to meet the housing needs of people. The challenge of high construction cost can be minimized through the usage of local building materials.

Furthermore, though local building materials have been blamed for poor quality as shown from literature, this study shows seven ways to improve their qualities as use of modern technology; skillful and innovative workers; improved production method; government intervention; training; research; and standard requirements. The study therefore recommends the employment of these seven strategies and those highlighted from the literature in this study to improve the qualities of local building materials.

REFERENCES


