

Prospects and Challenges of Green Materials for Construction of Low-Cost Building in Nigeria

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ABSTRACT

The provision of housing plays an important role in the wellbeing of human, because it is the only place where people can fall back to relaxed and re-calibrated to put body and soul together. Thus, this paper been part of the larger study, is on prospects and challenges of green materials an alternative material to provide housing for the low-income earners at affordable price in the developing countries such as Nigeria. The approach used to carry out the research is gathering information through the primary and secondary source. Four hundred structured questioners were design and administered to the experts in the building industry out which 305 were considered usable after the data screening on the subject matter. The analysis was carried with statistical package for social science (SPSS) 23 software, the results from the response received reveal that relevant green materials has the following advantages affordability, renewability and naturality, free from volatile organic compound, durability among others. On the other it has hitches of human neglect, lack of information, socio economic influence, climate and whether influence among others.

Keywords: Green Materials, Construction, Low-Cost Building, Industry, Design

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1. INTRODUCTION

It is no more news that Nigeria has about 20 million housing deficits in the recent time. Housing plays a predominant role in the well-being, economy, education, environmental, political and social life of any nation (Alaghbari, et al 2011) . Despites this role, many people in the low-income categories in the developing countries found it difficult to have building of their own due to high cost of conventional materials used in constructing the building. This major problem makes the experts in building industry to source for alternative building materials terms 'green materials' that is affordable and available within the grasp of the citizen.

Green materials are all eco-friendly materials that is categorized into three main group; earth materials, Natural fibre and industrial waste materials (Ogunkah & Yang, 2012,Hsieh, et al 2012,Oshike, 2015, Srivastavash & Kumar, 2018). Therefore, this paper focused on the prospects and challenges of green materials with particular reference to provision of affordable and low-cost building to the citizen of the developing countries. The approach used in carryout the study was gathering data from the expert in the building with the aids of structured questionnaires, the analysis was done with descriptive statistics using SPSS version 23.

Affordable Building

The major challenge of the low-income group is the affordability of building home of their own due to high cost of construction or purchasing a house. Affordable building has been defined in various forms by scholars in building industry. Affordable building may be referring to as house that can be acquired by median group whose income is below middle-class income in the society. Globally affordable housing is defined in many ways, and one of such definition is that affordability which takes into consideration the measure of spending on housing to income of the house hold. according to Gopalan & Venkataraman (2015) this definition is accepted by government of Indian which refers to any building that meet up with some of the affordability criterion such as the income level of the family, family size or comparative ratio of house price to annual income. The U.S Department of housing and urban development (2006) opined that housing is said to be affordable only when the rental value per annual of repayment of mortgage does not exceed 30%-40% of the employees.

Green Materials

One of the major resources required in the construction of building from foundation to the finishing level is building materials, the cost of construction therefore depend on the types of materials used in the erection of the structure, conventional materials has dominated the building industry over some time. However, the high cost of these materials has made it difficult for many people especially the level below the middle class in the society to became a household (Ugochukwu & Chioma, 2015). This challenge prompt the experts in finding alternative materials such as green materials that will produce building at lower cost. Green materials are eco-friendly and energy efficiency materials that are readily available within the society (Developers 2005, Vidya 1980, and Magutu 2015).



Figure 1: Earthen materials used for bricks

Green materials are in three categories; the earth materials, natural fibre, industrial and building waste recycle materials (Srivastavash & Kumar, 2018). Hsieh et al., (2012) described green materials as natural materials that are available within our environment and that is suitable for the construction of buildings. The earth materials consist of; earth soil, stone/rocks, timber, thatches and grass etc.

The Natural fibre includes; the bamboo, straw, husk etc. and the industrial waste consist of; industrial and building waste that are subjected to recycle and re used such metal scraps, sugar bagasse, fly ash etc. (Srivastavash & Kumar, 2018). Figure 1.0 shows the making of earth brick with manual molding machine, it is very clear from the texture of the bricks that it only required little adhesive such as cement in its formation. Bamboo one of the green material is gaining popularity in the usage for construction of building, for instance bamboo apart from its usual usage for support and scaffolding is now proposing to replaced steel reinforcement in short beam and column (Mark & Russell 2011, Hsieh et al. 2012, Sabnani et al. 2013). Figure 2.0: shows the application of bamboo as reinforcement in the ground beam and column.



Figure 2: Bamboo used to reinforce concrete in beam and columns

Prospects of Green Materials

The building of houses with low cost building resources expand the quantity of housing development for low cost income group. According to (Vidya, 1980) low cost building could be attained by application of “efficient planning and project management, low cost materials, economical construction technologies and use of alternate construction methods available”. Potential green materials produce building at low cost when compared with the use of conventional materials thus, green materials are cost effectiveness in construction of building (Adeniyi & Mohamed, 2019). Furthermore the prospects of green material are highlighted by Onyegiri & Ugochukwu, (2016) as follows:

- Readily available
- It is affordable
- It saves energy
- It is ozone friendly
- It is reusable
- It is biodegradable

Challenges of Green Materials

The practitioners in the building construction sector must takes in to consideration the selection of high-quality materials which are durable, aesthetics and with little maintenance during its life span.

According to Bredenoord, (2017) a building should be able to provide protection against weather effects, such as heat, wind, coldness, rain, etc. In the study carried by Onyegiri & Ugochukwu, (2016) it was revealed that building constructed with natural material is associated with problems of acceptability, low strength, high level of maintenance, deforestation among other issues.

3. METHODOLOGY

In carrying out this study, secondary information from related journal, magazine, article seminar, workshop and conference papers etc. sourced through the internet were used to was review literature on green materials field, and this helps in identified the prospects and problems of using green materials. Structured questionnaires were design and distributed face by face to the various randomly selected building practitioners in the northcentral Nigeria seeking their opinion on topic. A five-point likerk scale instrument format (1= not agreed, 2= slightly agreed, 3= moderate, 4= agreed 5= strongly agreed) was adopted. Descriptive data analysis was applied in running the data.

4. DATA PRESENTATION, ANALYSIS AND RESULTS

The primary data was obtained from the questionnaire distributed to the building professionals in the northcentral Nigeria and the summary of the responses were shown in Table 1.0

Table 1: Summary of Responses by Building Experts

Sample	Number of responses	Percentage %
Building Professionals	400	100.0
Unsuitable questionnaires	95	23.8
Suitable questionnaires	305	76.2
Overall response useable rate		76.20

Table 1.0 indicates that 400 questionnaires was distributed to randomly to various building professionals in the northcentral, however, 305 represent 76.2% of the returned questionnaires were suitable for analysis while 95 questionnaires represent 23.8 % was either not properly filled or not fill at all. Table 2.0 shows the distribution analysis of the important prospects of green materials. The analysis of all the eight (8) items have means score that are above the average mean value of 3.00 for determines the topmost prospect. However, items 7, 1, 8, 6 and 4, with mean values of 4.20, 4.07, 4.05, 4.01 and 3.96 took precedence over others and were ranked 1st, 2nd, 3rd, 4th and 5th respectively. Therefore, the topmost prospects for selecting GMs for low-cost building construction in Nigeria are affordability, naturalist and renewability, free from volatile organic compound, durability and reusability.

Table 2: Prospect of Green Materials for Low Cost Building

Item No	Prospects	Mean	Rank
7	Affordability	4.20	1 st
1	Natural and renewable	4.07	2 nd
8	Free from volatile organic compound	4.05	3 rd
6	Durability	4.01	4 th
5	Reusability	3.96	5 th
4	Waste reduction	3.81	6 th
2	Recycle content	3.78	7 th
3	Embodied energy	3.65	8 th

Table 2.0 indicates the factors hindering the sustainability of green materials. The results of the nine variables revealed that all the factors highlighted are hindrance to sustainability of the green materials. This is because all the indicators or items have mean values that are above the average (benchmark) mean value of 3.00 for determining the topmost hindering factors. However, items 3, 8, 2, 5 and 1, with mean values of 3.96, 3.94, 3.92, 3.90 and 3.88 took precedence over others and were ranked 1st, 2nd, 3rd, 4th and 5th respectively. It can be deduced therefore, that all the identified factors hinder sustainability of green materials but the topmost among them are human neglect, limited accessibility to relevant information, socio-economic influence, climatic and weather influence, and client's preference.

Table 3: Challenges of Green Material Sustainability for Low Cost Building

Item No	Challenges of GM	Mean	Rank
3	Human neglect	3.96	1 st
8	Limited accessibility to relevant information	3.94	2 nd
2	Socio economic influence	3.92	3 rd
5	Climatic and weather influence	3.90	4 th
1	Client's preference	3.88	5 th
4	Discontinuity of local labour	3.73	6 th
9	Building code restriction	3.71	7 th
6	Aesthetic less pleasing	3.63	8 th
7	Uncertainty in the project outcome	3.58	9 th

5. CONCLUSION

Homeownership has been a heavy issue for the people in the developing countries, for instance Nigeria has been reported by many scholars of having about 20million housing deficit (Yang & Ogunkah 2013, Iheme et al. 2015, Olanrewaju et al. 2016). The major cause of this shortcoming is the high cost of conventional materials used for the building construction. Thus, this study was carried out on the prospect and challenges of using green materials for building affordable housing for the low-income group in the society. The results of the analysis revealed that green materials have its merit and demerits as an alternative to conventional materials. The prospect is affordability, renewability and naturality, free from volatile organic compound, durability among others. On the other it has problem of human neglect, lack of information, socio economic influence, climate and weather influence among others. The results are comparable to the study of Omole & Bako (2013), Chowdhury & Roy (2013) and Kumar et al. (2017). In conclusion it is strongly belief that if considerations are given for the use of green building material (GBMs) in housing delivery, it could reduce cost and enhance housing affordability to the low-income group in our society.

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