

PAPER • OPEN ACCESS

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

To cite this article: Shogo Musbau Adeniyi and Sarajul Fikri Mohamed 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **884** 012048

View the [article online](#) for updates and enhancements.

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

Shogo Musbau Adeniyi¹ and Sarajul Fikri Mohamed²

¹Department of Quantity Surveying, Faculty of Environmental Studies Federal Polytechnic Offa, Kwara State. NIGERIA

²Department of Quantity Surveying, Faculty of Built Environment and Surveying Universiti Teknologi MALAYSIA

Email: sogo4qs@gmail.com

Abstract. Housing plays an essential role in the wellbeing of people 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 more extensive 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 designed 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 have 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 weather influence among others.

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, and education, environmental, political and social life of any nation [1]. 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 are categorized into three main group; earth materials, Natural fibre and industrial waste materials [2, 3, 4, 5]. 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.



2. 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 degree of spending on housing to income of the house hold. according to [6] this meaning is recognized 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 accommodation is alleged to be inexpensive simply when the rental charge yearly refund of mortgage does not surpass 30%-40% of the workers.

3. 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 become a household [7]. These challenges 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 [8, 9, 10].

Green materials are in three categories; the earth materials, natural fibre, industrial and building waste recycle materials [5],[3], described green materials as natural resources that are accessible within our location and that is appropriate for the erection 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. [5]. 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.



Figure 1. Earthen materials used for bricks

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 [11, 3,12]. Figure 2.0: shows the application of bamboo as reinforcement in the ground beam and column



Figure 2. Bamboo used to reinforce concrete in ground beam and columns

4. Prospects of Green Materials

The building of houses with affordable resources expands the quantity of housing development for low cost income group. According to [9] 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, the use of green materials are cost effective than the conventional materials in the construction of building [13]. Furthermore the prospects of green material are highlighted by [14] as follows:

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

5. 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 [15] a building should be able to provide protection against weather effects, such as heat, wind, coldness, rain, etc. In the research done by [14] it was established that building constructed with natural material is associated with problems of acceptability, low strength, high level of maintenance, deforestation among other issues.

6. Methodology

In carrying out this study, secondary information from related journal, magazine, article seminar, workshop and conference papers etc. were utilized to 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 liker 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.

7. Data Presentation, Analysis and Results

The primary data was obtained from the questionnaire distributed to the building professionals in the north central Nigeria and the summary of the responses were shown in Table 1.

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 indicates that 400 questionnaires was distributed to randomly to various building professionals in the north central, 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 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 3 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

8. 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 [16, 17,18]. 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 [19, 12, 20]. In conclusion it is strongly belief that if considerations are given for the utilisation of green building material (GBMs) in the construction of building might decrease price and expand housing ownership to the low-income group in our society.

Acknowledgment

The authors would like to express their appreciation for the support of Federal Government of Nigeria through TETFUND and the ministry of education (MOE) Malaysia via research university grant (RUG) funding project number PY/2017/01501 for the financial assistances and support while conducting this research.

References

- [1] Alaghbari, W., Salim, A., Dola, K., & Abdullah Abang Ali, A. (2011). Developing affordable housing design for low income in Sana'a, Yemen. *International Journal of Housing Markets and Analysis*, 4(1), 84–98. <https://doi.org/10.1108/17538271111111857>
- [2] Ogunkah, I., & Yang, J. (2012). Investigating Factors Affecting Material Selection: The Impacts on Green Vernacular Building Materials in the Design-Decision Making Process. In *Buildings* (Vol. 2). <https://doi.org/10.3390/buildings2010001>
- [3] Hsieh, T., Chiang, C., Ho, M., & Lai, K. (2012). The Application of Green Building Materials to Sustainable Building for Environmental Protection in Taiwan. 344, 267–272. <https://doi.org/10.4028/www.scientific.net/AMR.343-344.267>
- [4] Oshike, E. E. (2015). Building with earth in Nigeria: A review of the past and present efforts to enhance future housing developments. 4(1), 646–660.
- [5] ManjeSrivastavash, & Kumar, V. (2018). The methods of using low cost housing techniques in India. *Journal of Building Engineering*, 15(January 2017), 102–108. <https://doi.org/10.1016/j.jobe.2017.11.001>
- [6] Gopalan, K., & Venkataraman, M. (2015). Affordable housing: Policy and practice in India. *IIMB Management Review*, 27(2). <https://doi.org/10.1016/j.iimb.2015.03.003>
- [7] Ugochukwu, I. Ben, & Chioma, M. I. Ben. (2015). Local Building Materials: Affordable

- Strategy for Housing the Urban Poor in Nigeria. *Procedia Engineering*, 118, 42–49. <https://doi.org/10.1016/j.proeng.2015.08.402>
- [8] Developers, A. G. F. O. R. (2005). *CREATING SUSTAINABLE COMMUNITIES A GUIDE FOR DEVELOPERS AND COMMUNITIES GREEN*. (October), 2005–2007.
- [9] Vidya, A. (1980). *ALTERNATIVE LOW-COST BUILDING MATERIALS*.
- [10] Magutu, J. (2015). Towards Populization of Low Cost Building Materials and Technologies for Urban Housing in. 2(1), 20–43.
- [11] Mark, A. A., & Russell, A. O. (2011). A comparative study of Bamboo reinforced concrete beams using different stirrup. *International Journal of Civil and Structural Engineering*, 2(1), 407–423.
- [12] Chowdhury, S., & Roy, S. (2013). Prospects of Low Cost Housing in India. *Geomaterials*, 3(April), 60–65. <https://doi.org/10.4236/gm.2013.32008>
- [13] Adeniyi, S. M., & Mohamed, S. F. (2019). Investigating Potential Green Materials to improve cost Effectiveness for Low-Cost Building Construction in Nigeria. (1), 270–274.
- [14] Onyegiri, P. I., & Ugochukwu, I. Ben. (2016). Traditional Building Materials as a Sustainable Resource and Material for Low Cost Housing in Nigeria : Advantages , Challenges and the Way Forward. 3(2).
- [15] Bredenoord, J. (2017). Sustainable Building Materials for Low-cost Housing and the Challenges Facing their Technological Developments: Examples and Lessons Regarding Bamboo, Earth-Block Technologies, Building Blocks of Recycled Materials, and Improved Concrete Panels. *Journal of Architectural Engineering Technology*, 06(01), 1–10. <https://doi.org/10.4172/2168-9717.1000187>
- [16] Ogunkah, I., & Yang, J. (2012). Investigating Factors Affecting Material Selection: The Impacts on Green Vernacular Building Materials in the Design-Decision Making Process. In *Buildings* (Vol. 2). <https://doi.org/10.3390/buildings2010001>
- [17] Ihome, J. O., Effiong, J. B., & Ekung, S. B. (2015). The Effect of Government Policy on Housing Delivery in Nigeria: A Case Study of Port Harcourt Low Income Housing Programme. *International Letters of Social and Humanistic Sciences*, 61(September 2016), 87–98. <https://doi.org/10.18052/www.scipress.com/ILSHS.61.87>
- [18] Olanrewaju, A., Anavhe, P., & Hai, T. K. (2016). A Framework for Affordable Housing Governance for the Nigerian Property Market. *Procedia Engineering*, 164, 307–314. <https://doi.org/10.1016/j.proeng.2016.11.624>
- [19] Omole, F. K., & Bako, A. I. (2013). Analysis of the Problems and Prospects in the Use of Local Building Materials : Review of Literature. *Civil and Environmental Research*, 3(11), 1–8.
- [20] Kumar, V., Gupta, V., Sagar, S., Singh, S., & Haroon, M. (2017). A Review Study on Alternate Low Cost Construction Materials & Techniques for Building Design. *International Research Journal of Engineering and Technology(IRJET)*, 4(4), 1575–1578. Retrieved from <https://www.irjet.net/archives/V4/i4/IRJET-V4I4323.pdf>