



Professionals' Perception of the Challenges of Sustainability of Green Materials for Construction Projects in Abuja, Nigeria

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ABSTRACT

The clamour for sustainable development and reduction of greenhouse gases led to the green concept which in recent times, has gained significant momentum. It is a well-known fact that housing play an essential role in the wellbeing of people because it is only place where people can fall back to relaxed and re-calibrated to put body and soul together. The purpose of this study was to investigate professionals' perception on the challenges of sustainability of green materials for construction projects in FCT Abuja and to identify the challenges militating against green materials for construction projects. A structured questionnaire was used to collect information from various respondents who were construction professionals. The survey was conducted using random sampling techniques were used to select one hundred and twenty (120) respondents out of which (90) of them were suitable for analysis, which represent a potential responses rate of seventy five percent (75%) of the total. The data were analyzed using simple percentile and mean item score. The research shows that built environment professionals need more sensitization to raise the level of awareness is recognized. The finding revealed that green features lack of awareness, human neglect, limited accessibility to relevant information, social economic influence, climatic and weather influence, client's preference, non availability of local materials, no standard for structural control of the green building, lack of adequate knowledge and technical know-how by professionals to handle the job, lack of interest in sustainable building development. In conclusion, there is need to educating the relevant parties to raise awareness of the green concept is vital to overcoming several challenges in the dissemination of sustainable practice such as lack of awareness and knowledge of these methods.

Keywords: Green materials, Challenges, Construction projects.

INTRODUCTION

The activities of human being on the environment, regarding meeting his daily needs, exert pressure on the environment. For

instance, construction activities which are regarded as the heart of every development constitute a powerful influence on the environment. According to Kolawole & Anigbogu (2005) state that what is needed is a dynamic equilibrium, in other words, production process that is friendly to the ecosystem, yet competitive and possess no any form of threat (Zubairu 2012), environmentally friendly buildings, popularly called 'green building materials'. Green materials are materials that are found with vegetation environment, and they are natural materials that required little or no process before it could be used. According to Mehta & Sharma (2014), the use of green materials and its products stimulates the preservation of deteriorating non-renewable materials". Additionally, re-introducing green building materials into building developments will assist in reducing the ecological influences related to the abstraction, conveyance, treatment, assembly, fixing recycle, reusing, and discarding of building sector of materials sourcing. According to Alam and Haque (2016), defined it as "a building whose construction and an operational lifetime assure the healthiest possible environment while representing the most efficient and least disruptive use of land, water, energy and resources". Green materials are also available in variety thus, the need to assess the relevant and sustainable ones among them and recommending its total or a combination with conventional materials will go a long way in the delivery of affordable and sustainable accommodation for the middle people of the country. In the recent time, the government of Nigeria recognized the significant of housing to the socio-economic and physical development of the society by signing a global commitment to housing for all as a fundamental human right (Muhammed, Johar & Sabri, 2015). Green materials are all eco-friendly materials that is categorized into three main groups: 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 professionals' perception on the challenges of sustainability of green materials for construction projects in Abuja and identify the challenges of green materials for construction projects.

LITERATURE REVIEW

Concept of 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 depends on the types of materials used in the erection of the structure, conventional materials have 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 (Ugochukwu & Chioma, 2015). 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 (Developers 2005, Magutu 2015). 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 as metal scraps, sugar bagasse, fly ash etc. (Srivastavash & Kumar, 2018). Bamboo one of the green materials 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).

Selection of green building materials and their function

Wastiels & Wouters (2009) affirmed that materials selection process is a complex process that is influenced and determined by numerous preconditions, decisions and considerations. They stated further that material selection is not about choosing the strongest, cheapest, or most obvious materials available, but considering a wide range of variable that affect the choice of materials during the design and selection processes. Baruwa (2011) opined that green buildings may incorporate sustainable materials in their construction (e.g reused, recycled - content, or made from renewable resources); create healthy indoor environments with minimal pollutants (e.g reduced product emissions); and / or feature landscaping that reduces water usage (e.g by using native plants that survive without extra watering). The materials for green building are generally consisting of renewable resources and environmental responsible due to the fact that their impacts are on project lifecycle consideration. In accordance with Cullen (2011), green building materials can be selected by evaluating characteristics such as re - used and recycled content, zero or low off - gassing of harmful air emission, zero or low toxicity, sustainable and rapidly renewable harvested materials, high recyclability, durability, longevity and local production.

Table 1: Materials for Green Building. Function and Location

Green building materials	Function	Location	Source
Abaca	It is like banana plant and can be used in house in form of woven clothes	Centre and side tables as interior decoration.	Bhushan (2013)



	and curtain to small furniture.		
Bamboo	Made to bathroom mat, floor, roof and wall panel	Floor finishes	Wikipedia (2020)
Banana leaves	Dried banana leaves are weaved to beautifying baskets, trays, picture frame	Interior decoration	Bhushan (2013)
Coconut shield	To create house hold items likes curtains, wall décor, door mat and rug	Interior decoration	Bhushan (2013)
Corn	Corn composite board for furniture and construction	Ceiling finishes and interior decoration	Bhushan (2013)
Cord wood	Short round pieces of wood laid one above the other with special mortal mix in wall	Walls of all kind to give good appearance of the structure and strong environmental friendly	Wikipedia (2020)
Jute	Jute rugs, curtain and sack	Interior decoration and storage	Bhushan (2013)
Hemp	Hemp fibres bound with lime to create concrete like shape that strong and light	Walls and columns construction	Bhushan (2013)
Intensive green roof	Lowering urban air temperature and mitigate the heat island effect, require more maintenance	Roof covering with minimum depth 12.8cm	Vandermeulon et al. (2011)
Extensive green roof	Lowering urban air temperature and mitigate the heat island effect, require minimal maintenance	Roof covering with minimum depth ranging from 2 - 12.7cm	Volder (2014)
Wall climbing green wall	Climbing plants cover the walls building with the of trellis and supporting system	Wall finishes and exterior decoration for multi - storey buildings	Wilmer (1990)
Hanging down green wall	Complete vertical green belt on multi-storey buildings	Walls finishes and exterior decoration for multi - storey buildings	Wilmer (1990)
Module green wall	Latest concept on vertical green belt on multi - storey buildings	Wall finishes and exterior decoration for multi - storey buildings	Jonathan (2003)

Challenges of using green materials

The practitioners in the building construction sector must take into consideration the selection of high quality materials which are durable, aesthetics and with little maintenance during its life span. According to Bredennoord, (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 materials is associated with challenges of acceptability, low strength, high level of maintenance, deforestation and among other issues. Potentially relevant studies were retrieved from literature collections of published peer - reviewed research articles and report for the purpose of identify challenges of green materials for construction of building projects ascertained to be twenty six are as follows: human neglect, limited accessibility to relevant information, social economic influence, climatic and weather influence, client's preference, discontinuity of local labour, building code restriction, aesthetic less pleasing, uncertainty in the project outcome, lack of awareness, non availability of local materials, no standard for structural control of the green building, lack of adequate knowledge and technical know - how by professionals to handle the job, lack of interest in sustainable building development, lack of adequate research on green building, lack of green building cost and performance data, high cost of imported green building materials, data challenges, no enabling laws to promote its development, no market expectation for green building at present, divergent interests and views of professionals in built environment, high initial construction cost of green building, investors choose to remain simple, energy and environmental challenges, unsupportive environment and uncertain economic environment.



RESEARCH METHODS

This study deployed the survey methodology involving a combination of structured questionnaire and interviews as data collection tools. A total of 120 questionnaire were administered to five groups of construction professionals namely Architects, Builders, Quantity Surveyors, Civil Engineers, and land surveyors. The questionnaire comprises two sections namely A and B. Section A elicited background data about the respondents, while section B elicited data pertaining to the aim and objectives of the study. On the other hand, interviews were administered ___ clients with considerable experience of procuring the services of these construction professionals. For the analysis of data, combinations of quantitative tools were deployed. First was the frequency distribution tool for data classification (Salvatore and Regeale, 2002), comprising frequency distribution tables, percentiles, arithmetic mean. The study adopted a variant of arithmetic mean known as the mean item score to obtain a quantitative equivalent of the average response provided by respondents in accordance with a 5-Point Likert scale. This Mean item score were targeted at analyzing the specific challenges of green material factors identified in section 2.3 above. The formula for computing this variable is given as:

$$\text{Mean} = \frac{\sum fw}{\sum f} = \frac{(5 \times f_5) + (4 \times f_4) + (3 \times f_3) + (2 \times f_2) + (1 \times f_1)}{f_5 + f_4 + f_3 + f_2 + f_1}$$

Where $\sum fw$ is the sum of the product of all weights and $\sum f$ is the total number of actual respondents. Accompanying the mean item score as a tool of data analysis is the deployment of ranking of mean score. Hence, for the 5-point Likert scale where 5 is the highest score, and 1 being the lowest score, the ranking of the mean score was carried out using the criterion indicated below. The mean item score and ranking were used to address the objectives of this study.

- 4.90 < MIS ≤ 5.00 Very significant (or very high (impact), very easy, etc)
- 3.70 < MIS ≤ 4.89 Significant (or high (impact), easy, etc.)
- 2.50 < MIS ≤ 3.69 Neutral (or medium (impact), neutral, difficult, etc.)
- 1.30 < MIS ≤ 2.49 Insignificant (or low (impact), difficult, etc.)
- 0.00 < MIS ≤ 1.29 Very insignificant (or very low (impact), very difficult, etc)

DATA ANALYSIS AND DISCUSSION

Questionnaire response rate

A total number of 120 questionnaire were distributed, 20 out of the total survey show no response, total number of potential responses, was 100 and total valid responses received was 90. Hence, with an achieved response rate of 75%, the data analysis had to proceed in spite of the 8% defective questionnaires and the 17% void response rate.

Table 2: Background information about respondent's opinion on challenges of green materials.

Category	classification	Freq.	(%)
Academic qualification of respondents	MSC/MTech/MEng	10	11.11
	PGD	20	22.22
	BSC/BTech/BEng	35	38.89
	HND	25	27.78
	Total	90	100.00
Professional affiliation of respondents	Architect	25	27.78
	Quantity Surveyors	35	38.89
	Engineers	10	11.11
	Builders	11	12.22
	Land Surveyors	9	10.00
	Total	90	100.00



Table 2: Background information about respondents opinion on challenges of green materials contd.

Category	classification	Freq.	(%)
Years of experience in construction	1 - 5	5	5.56
	6 - 10	10	11.11
	11 - 15	20	22.22
	16 - 20	25	27.78
	21 - 25	30	33.33
	Total	90	100.00
	Mean	16.61	Years
Awareness of policy documents on green building.	Architect	35	38.89
	Quantity Surveyors	30	33.33
	Engineers	5	5.56
	Builders	15	16.66
	Land Surveyors	5	5.56
	Total	90	100.00
Advocate for green building materials.	Architect	30	33.33
	Quantity Surveyors.	35	38.89
	Engineers	4	4.44
	Builders	17	18.89
	Land Surveyors	4	4.44
	Total	90	100.00

Source: Authors' survey, 2022

Respondents' Background Data

Respondents in this study comprised the management or senior technical staff with reasonable number of years of experience in the construction industry. About 70% of the respondents that completed the questionnaire hold minimum of HND or BSC degree while an average number of them of them have attained profession registration. Majority of the respondents have a minimum of 17 years' experience in the construction industry and the responses on awareness of policy document on green building materials and advocate for green building materials in Abuja revealed that 38.89% of the respondents could not easily

differentiate between the two forms of construction and the result suggests that, in order to be more aware, there is the need to sensitize the professionals in the built environment. It is evident therefore, that the data collected for analysis are reliable to form good basis for this study, judging from the qualities of respondents' experience in the construction industry.



Table 3: Professionals' perceptions of the challenges associated with green materials

Challenges of green materials	QS	LS	ARCS	ENGRS	BLDRS	Aggregate
	Mean score	Mean score	Mean score	Mean score	Mean score	Rank
Limited accessibility to relevant information	4.96	4.00	4.89	4.57	4.37	4.56 1st
Lack of awareness by developers	4.88	4.02	4.90	4.12	3.67	4.32 2nd
Human neglect	4.22	4.01	4.82	4.15	3.87	4.21 3rd
Non availability of Local materials	4.88	3.98	4.57	4.10	3.45	4.20 4th
Social economic influence	4.77	4.00	4.53	4.12	3.40	4.16 5th
Climatic and weather influence	4.50	4.02	4.60	3.98	3.60	4.14 6th
No standard for structural control of the green building	4.60	3.80	4.77	3.88	3.50	4.11 7th
Client's preference	4.70	3.70	4.80	3.79	3.41	4.08 8th
Discontinuity of local labour	4.81	3.83	4.92	3.74	3.00	4.06 9th
Inadequate Knowledge and technical skill to handle the job	4.85	3.78	4.95	3.50	3.00	4.02 10th
Building code restriction	4.77	3.70	4.40	3.40	3.77	4.01 11th
Lack of interest in sustainable building	4.70	3.66	4.36	3.34	3.66	3.94 12th
Aesthetically less pleasing	4.50	3.50	4.77	3.30	3.60	3.93 13th
Uncertainty in the project outcome	4.44	3.40	4.60	3.20	3.71	3.97 14th
Lack of adequate research on green building	4.39	3.35	4.50	3.10	3.65	3.79 15th
Lack of green building cost and performance	4.30	3.27	4.41	3.08	3.57	3.73 16th

Source: Author's survey, 2022.

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Table 3: Professionals' perceptions of the challenges associated with green materials continued

Challenges of green materials	QS	LS	ARCS	ENGRS	BLDRS	Aggregate	
	Mean score	Mean score	Mean score	Mean score	Mean score	Mean score	Rank
High cost of imported green building materials	4.40	3.33	4.30	3.10	3.44	3.71	17th
Data challenges	4.35	3.25	4.22	3.09	3.33	3.65	18th
Lack of the enabling laws to promote its development	4.41	3.17	4.30	3.01	3.10	3.60	19th
No market expectation of green building at present	4.30	3.10	4.24	2.99	3.08	3.54	20th
Divergent interests and view of professionals in the built environment	4.27	3.03	4.17	2.89	3.01	3.47	21st
High initial construction cost of green building	4.10	2.93	4.05	2.77	2.81	3.33	22nd
Investors choose to remain simple	3.81	2.63	3.85	2.51	2.77	3.11	23rd
Uncertain economic environment	3.50	2.42	3.65	2.44	2.61	2.92	24th
Energy and environment challenges	3.33	2.21	3.41	2.22	2.45	2.72	25th
Unsupportive environment	3.10	2.09	3.11	2.00	2.21	2.50	26th

Source: Author's survey, 2022.



Table 3 above illustrates the results of the respondent's perception towards the challenges to green materials and ranked according to the mean value. This was done following the method adopted by Liu et al (2012). The results demonstrate that the topmost eleven challenges factors are 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, and 11th respectively were ranked with mean values of 4.56, 4.32, 4.21, 4.20, 4.16, 4.14, 4.11, 4.08, 4.06, 4.02, and 4.01 took precedence over others. It can be deduced therefore, that all the identified factors hinder sustainability of green materials but the topmost eleven among them are limited accessibility to relevant information, lack of awareness by developer, human neglect, non availability of local materials, social economic influence, climate and weather influence, no standard for structural control, client's preference, discontinuity of local labour, lack of adequate knowledge and technical know - how by professional to handle the job and building code restriction. The findings are in line with those of Alohan et al.(2021), where it was noted that the perception of green materials being expensive, non availability of local materials and other components, lack of awareness by developer, social economic influence, no standard for structural control, lack of adequate knowledge and technical know - how by professional to handle the job. This study corroborates with findings of shogo et al. (2019), who argued that limited accessibility to relevant information, human neglect, client's preference, climate and weather influence, discontinuity of local labour, building code restriction, aesthetic less pleasing and uncertainty in the project outcome.

Based on the study, the result from 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th and 21st, respectively were ranked with mean values of 3.94, 3.93, 3.87, 3.79, 3.73, 3.71, 3.65, 3.60, 3.54 and 3.47 were identified as factors hinder the challenges of green materials among them are lack of interest in sustainable

building, lack of adequate research on green building, lack of green building cost and performance data, divergent interest and view of professionals in built environment, high cost of imported green building materials, data challenges, no enabling laws to promote its development, and no market expectation for green building at present. The present findings are in line with those of Dahiru et al.(2014),who argued that lack of interest in sustainable building, lack of adequate research on green building are factors that militate against the practice of green materials. Similarly, Uwazie, et al. (2015), also identified that challenges confronting the green materials is data challenges. Dalibi et al.(2017),noted that lack of green building cost and performance data, high cost of imported green building materials, divergent interest and view of professionals in built environment and among others are major challenges confronting the green economy.

The results from 22nd,23rd ,24th ,25th and 26th were ranked with mean values of 3.33, 3.11, 2.92, 2.72 and 2.50 are hindrances to green materials, high initial construction cost of green building, investors choose to remain simple, energy and environment challenges and unsupportive environment. Williams and Dair (2007) identified that high initial construction cost of green building and among others are the limiting factors confronting the green materials. Dahiru et al. (2014) also identified that the problems facing the practice of green building implementation to include an unsupportive environment, an uncertain economic environment are factors hinder the sustainability of green materials.

CONCLUSION

There is no any enabling environment in the form of legislation or policy on green building practice, the overall perception of green building from all the groups of respondents has revealed that



most of professionals in the built environment need more sensitization to raise the level of accessibility to relevant information about the green materials. similarly, the study discovered that the perception of green building being expensive, there is lack of level of awareness by developers and non availability of local green building materials and other components, human neglect, social economic influence, the high cost of imported green building materials, divergent interests and view among stakeholders are hindrances to green building development in the built environment.

RECOMMENDATIONS

Based on the results of this study, the following are recommended.

- Government should create enabling law or policy to promote its development and provision of market expectation for green building at present.
- Manufacturer of construction materials should use life cycle consideration as the basis of product development and should cooperate with designers in creation of new recycling of materials. Also, they should form partnership with research firms by providing funds for research and development and implementation.

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