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Strategies for Green Building Material Adoption in Construction Industries in Anambra State

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ABSTRACT

This paper investigated the strategies for green building material adoption in construction industries in Anambra State. Three research questions guided the study. The descriptive survey research design was adopted for this study. The population of this study comprised 312 construction professionals in Anambra State. These professionals are registered Architects, Engineers, Builders and Quantity Surveyors practicing in both public and private organizations in Anambra State, Nigeria. The sample size was gotten with the formula from Morgan and Krejcie (1970) with a confidence level of 95%, and it found to be 172. Data for this study were collected by means of structured questionnaire developed by the researcher. The questionnaire is titled "Strategies for Green materials Adoption Questionnaire" (SGMAQ). The questionnaire is sub-divided into two sections; A and B. Section A contains information on the demographic profile of the respondents while section B is sub-divided into three clusters: I – III addressing the research questions. Descriptive statistics of frequency counts and percentages was employed to analyze the bio-data of the respondents while mean score was used to analyze the data to answer the research questions. The study found that construction professionals are highly aware of green building materials within the construction industry in Anambra State but the level of adoption is low. The finding also revealed that construction professionals agreed on the drivers and barriers of GBM adoption in the construction industry in Anambra State. Based on the findings, it was recommended amongst others that there should be provision of financial incentive to encourage green building uptake with adequate planning and budgetary provision should be made prior to mobilization and execution of green building construction.

KEYWORDS

green building; construction; construction industries; awareness and adoption

INTRODUCTION

Construction industry is one of the primary sectors of the Nigerian economy which account for its growth and development through provision of infrastructure that carters for the wellbeing of the society (Isa, 2017). The construction industry has been adjudged as one of the greatest and vital industries that strengthen the economic development of any nation which by virtue of its size, contributes greatly to environmental pollution and is among the world largest consumer of energy, material resources, water, land dereliction (Ajit & Pranesh, 2017). Fifty percent (50%) of non-renewable and renewable resources consumed by humans are used for construction work, especially housing, thus, constitute the least sustainable industries in the world (US Department of Energy, 2016).

The construction industry has a huge amount of effects on the natural environment and consideration for green building covers a bigger aspect of the construction industry (Rajesh, Vanita & Surinder, 2021). The construction industry consumes 12- 16% of all water available, an energy production totalling 40%, 40% of all raw materials, renewable as well as non-renewable resources making up 32, 25% of all timber and produce 30-40% solid waste and 35-40% of carbon dioxide (CO2) is emitted globally (Windapo, Albert & Omopariola, 2019).

This damaging effect of construction industry with regards to the balanced ecosystem has triggered a global outcry for the acceptance/application of sustainable practices in the industry (Wang, 2014). The demand for green building has over the past two decades experienced an increase in green building concepts and practices globally (Xue, Gou & Lau, 2016). Consequently, green building development is now the viable means for delivering building that are less harmful effect to the environments and one of the ways to achieving this, is the proper understanding of the issues relating to the acceptance of Green Building Material (GBM) in the Nigeria building industry (Abdulhafeez, 2022).

Green building can be conceptualized with regards to extending the concept of sustainability to building and construction activities and this can help achieve a state of sustainability as far as the construction industry is concerned (Aigbavboa, Ohiomah & Zwane, 2017). Green building can be referred to as the use of environmentally responsible process in maximizing the effective usage of resources like water and energy with the view of creating a healthy land, water and also the quality of air all over the building in question. According to Albino, Balice and Dangelio (2019), green building may be well-defined as the formation and responsible management of a healthy environment based on the efficiency of resources and principles of ecology. Green building materials are special materials for green building construction and the adaptation of this system is more sustainable compared to the conventional building (Sheth, 2016). Green building materials are environmentally friendly materials that helps to mitigate or limit issues that are potentially harmful to the environment (Greenomics, 2016).

Ideal building materials are materials with no negative/ harmful effect on the environment and such material ought to be substantially reusable or recyclable and also, the material should be considered as a friend to the environment. The Construction industry in Anambra State is not an exception to this challenge, as the level of carbon dioxide emission and environmental pollution is also on the increase (Onyegiri & Ugochukwu, 2016). Nigeria is a country (Anambra State inclusive) which mostly depends on Portland cement, sand and gravel for its building materials fulfilment and hydrocarbons for its energy need which are not sustainable (Sheth, 2016). This indicates the awareness levels of green materials vary among different segments of the construction industry.

In Anambra State, there is a growing awareness of green building materials among construction industry stakeholders. Government agencies, NGOs, and professional associations have organized seminars, workshops, and training programs to educate stakeholders about the benefits of green building materials (Onyeagam, Eze & Adegboyega, 2019). The incorporation of green building principles in building codes and regulations has also raised awareness among architects, engineers, contractors, and developers.

The adoption of green building materials in Anambra State is still relatively low due to various challenges and barriers. One significant barrier is the perceived higher cost of green building materials compared to conventional materials (Onyeagam, et al., 2019). Limited availability and accessibility of green building materials in local markets also pose challenges. Additionally, according to Onyeiri et al., (2016), the lack of regulatory incentives and enforcement mechanisms for green building practices hinders their adoption in Anambra State. Without proper incentives and regulations, stakeholders may be less motivated to invest in green building materials and sustainable construction practices.

It is important to note also that green building adoption is influenced by various drivers, which vary regionally and have positive effects on the adoption of green materials. These drivers include the recruitment and maintenance of key workers, marketing benefits for designers and building owners, utility cost investment funds for water and energy, cost of maintenance decreases, increased net working pay (NOI), increased occupier profitability due to improved occupant health, demonstration of responsibility to manageability and ecological, and public connection benefits for engineers, building owners, and directors (Darko, Zhang & Chan, 2017). These drivers influence the movement towards green building materials adoption in the construction industry. The drivers for green building materials include recruitment and maintenance of key workers, marketing benefits, utility cost investment funds, maintenance costs, increased net working pay, and public connection benefits (Ayarkwa, Acheampong, Wiafe & Boateng, 2017).

The adoption of green building materials is essential for promoting sustainable construction practices and mitigating the environmental impact of the built environment. However, despite the numerous benefits associated with green building materials, their widespread adoption within the construction industry in Anambra State, Nigeria, faces significant barriers. This review explores the key challenges and barriers hindering the adoption of green building materials in Anambra State and suggests strategies to overcome these obstacles. One major obstacle is the perception of higher costs compared to conventional alternatives. This fear stems from concerns about upfront costs and long-term affordability. Green building materials often require specialized manufacturing processes and may have higher initial purchase prices, causing apprehension among stakeholders. Another significant barrier is the limited availability and accessibility of green building materials in Anambra State. While there is growing demand for sustainable construction materials, the local market often lacks sufficient supply and variety of green building products (Ayarkwa, et al., 2017). This shortage forces stakeholders to rely on conventional materials readily available in the market, impeding the adoption of green building practices.

The adoption of green building materials in the construction industry in Anambra State is essential for promoting sustainable development and mitigating the environmental impact of construction activities. Various strategies can be implemented to encourage the use of green building materials, such as providing incentives for builders and developers, raising awareness about the benefits of green building, and enforcing regulations that mandate the use of environmentally friendly materials (Windapo, et a., 2019)

Empirical evidence from studies conducted in other regions has shown that the use of green building materials can lead to significant reductions in energy consumption, water usage, and greenhouse gas emissions (Srinivas, 2019; Windapo et al., 2019). For example, a study by the U.S. Green Building Council found that buildings constructed with green materials can reduce energy consumption by up to 30% and water usage by up to 50%. Succinctly, the adoption of green building materials in the construction industry in Anambra State is not only beneficial for the environment but also for the economy and the well-being of its residents. By implementing strategies to promote the use of green materials, the construction industry in Anambra State can contribute to sustainable development and create a more resilient and environmentally friendly built environment for future generations. This therefore informed the researcher to examine strategies for green building material adoption in construction industries in Anambra State.

STATEMENT OF THE RESEARCH PROBLEM

The increasing demand for houses has led to increased consumption of energy, resources, and raw materials, resulting in a rise in air carbon content, which poses a threat to human wellbeing and the environment. Contemporary designs consume a significant amount of physical resources, including materials, energy, and money, but can also lead to negative effects like loss of amenity and biodiversity. Building construction activities globally consume up to three billion tons of raw materials annually, accounting for 40% of total global use (Ikechukwu & Ugochukwu, 2016). In tropical regions like Nigeria, preserving finite energy and ecological resources is crucial. That is why the construction industry in Anambra State is causing various environmental hazard that has call for the need to build with more sustainable materials also known as environmentally friendly materials, so as to help in the creation of an ecological environment for living.

Despite the awareness of green building, there is a lack of government incentives and regulations to promote the adoption of green building materials in Anambra State (Ikechukwu & Ugochukwu, 2016). Without supportive policies and financial incentives, builders and developers may not see the value in investing in green materials, leading to a slow uptake of sustainable construction practices. Furthermore, the researcher found that the availability and accessibility of green building materials in Anambra State is limited, making it challenging for construction companies to source these materials locally, resulting in higher transportation costs and logistical difficulties. This research gaps therefore prompted the researcher to examine strategies for green building material adoption in construction industries in Anambra State by raising the following research questions

(1) What is the level of awareness of green building materials (GBM) and its adoption within the construction industry in Anambra State?
(2) What are the drivers of GBM adoption in the construction industry in Anambra State?
(3) What are the barriers to the adoption of GBM in the construction industry in Anambra State?

THEORETICAL FRAMEWORK

Diffusion of Innovation Theory

The Diffusion of Innovation theory was first proposed by sociologist Everett Rogers in 1962 in his book "Diffusion of Innovations." The theory seeks to explain how new ideas, products, or technologies spread and are adopted within a social system.

Rogers identified four main elements that influence the rate of adoption of an innovation:

- ***Innovation:*** This is the new idea, product, or technology that is being introduced. Innovations can be tangible, such as a new building material, or intangible, such as a new construction technique.
- ***Communication Channels:*** These are the means through which information about the innovation is spread. This can include mass media, social networks, or personal interactions.
- ***Time:*** The rate at which an innovation is adopted can vary, with some innovations spreading quickly and others taking longer to be accepted.
- ***Social System:*** This refers to the network of individuals and groups that are involved in the adoption of the innovation. Different social systems can have different norms, values, and communication patterns that influence the adoption process.

Rogers also identified five categories of adopters based on their willingness to try new innovations:

- ***Innovators:*** These are the first individuals to adopt a new innovation. They are risk-takers and are willing to try new ideas.
- ***Early Adopters:*** These are opinion leaders who are respected within their social networks. They adopt innovations early and can influence others to do the same.
- ***Early Majority:*** This group adopts innovations after they have been tried by the early adopters. They are more risk-averse but are willing to adopt once they see the benefits.
- ***Late Majority:*** This group adopts innovations after the majority of the population has already adopted them. They are more skeptical and need more evidence of the benefits before adopting.
- ***Laggards:*** These individuals are the last to adopt innovations. They are traditional and resistant to change.

In relation to this study, the theory emphasizes the importance of communication channels in spreading information about innovations. In the context of green building materials adoption, the study can explore the most effective communication channels to reach different stakeholders in the construction industry in Anambra State. This could include leveraging industry associations, trade shows, workshops, social media, and government policies to promote the benefits of green building materials and encourage their adoption.

METHODOLOGY

Area of the Study: This study was carried out in Anambra State, Nigeria

Research design: The descriptive survey research design was adopted for this study.

Population of the Study: The population of this study comprised 312 construction professionals in Anambra State. These professionals are registered Architects, Engineers, Builders and Quantity Surveyors practicing in both public and private organizations in Anambra State, Nigeria.

TABLE 1: Population Frame of the Respondents.

S/N	Respondents	Population
1	Architects (NIA)	81
2	Builders (NIOB)	106
3	Engineers (NSE)	95
4	Quantity Surveyors (NIQS)	30
	Total	**312**

Sample Size: For this study, the sample size was gotten with the formula from Morgan and Krejcie (1970) with a confidence level of 95%, and it found to be 172

$$S = \frac{X^2\ NP\ (1-P)}{d^2\ (N-1) + \ X^2\ P\ (1-P)}$$

where:

s = sample size
p = estimated variance of the population (i.e 0.5 for this study)
X = based on confidence level (i.e 1.96 for 95% confidence level was used for this study)
N = total population
d = precision desired, expressed as a decimal (5% used for this study)

$$S = \frac{1.96^2\ \times 312\ \times 0.5 \times\ (1-0.5)}{0.05^2\ (312-1) + \ 1.96^2\ \times 0.5\ \times (1-0.5)}$$

$$S = \frac{299.6448}{0.7775 + 0.9604}$$

$$S = \frac{299.6448}{1.7379}$$

$$S = \ 172$$

Based on the sample size gotten, a total of 172 questionnaires were circulated as the study progressed, and all copies were retrieved.

Data Collection Instrument: Data for this study were collected by means of structured questionnaire developed by the researcher. The questionnaire is titled "Strategies for Green materials Adoption Questionnaire" (SGMAQ). The questionnaire is sub-divided into two sections; A and B. Section A contains information on the demographic profile of the respondents while section B is sub-divided into three clusters: I – III addressing the research questions. The response option was structured on a 4-point Likert scale of Strongly Agree (SA); Agree (A); Disagree (D); and Strongly Disagree (SD) with values 4, 3, 2 and 1 respectively.

Procedure for Data Collection: The direct delivery strategy was utilized to administer the questionnaire. Using this method, the researcher, assisted by two research assistants, personally delivered copies of the questionnaire to the respondents.

Tools for Data Presentation Analysis: Descriptive statistics of frequency counts and percentages was employed to analyze the bio-data of the respondents while mean score was used to analyze the data to answer the research questions. The benchmark of 2.50 mean score was set for the decision rule for the mean scores. Any mean score below 2.50 is adjudged disagreed while any mean score above 2.50 is rated agreed.

RESULTS

Demographic Profile of the Respondents

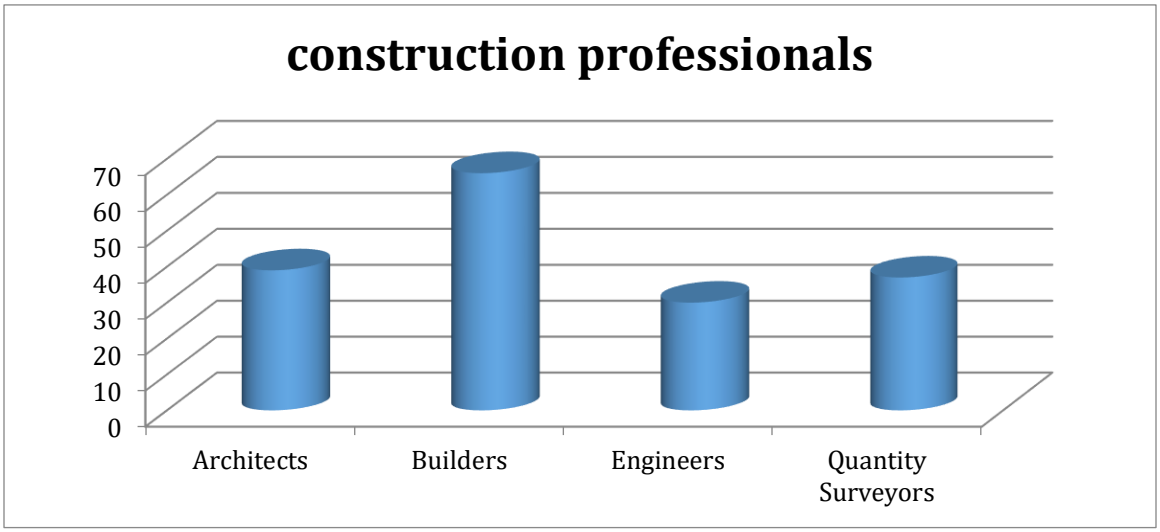

FIGURE 1: Distribution of Respondents by Professionals.

Data presented in Figure 1 show the percentage distribution of the respondents on construction professionals. Figure 1 reveals that 39 of the respondents (representing 23%) were Architect; 66 of the respondents (representing 38%) were Builders; 30 of the respondents (representing 18%) were Engineers; and 37 of the respondents (representing 22%) were Quantity Surveyors.

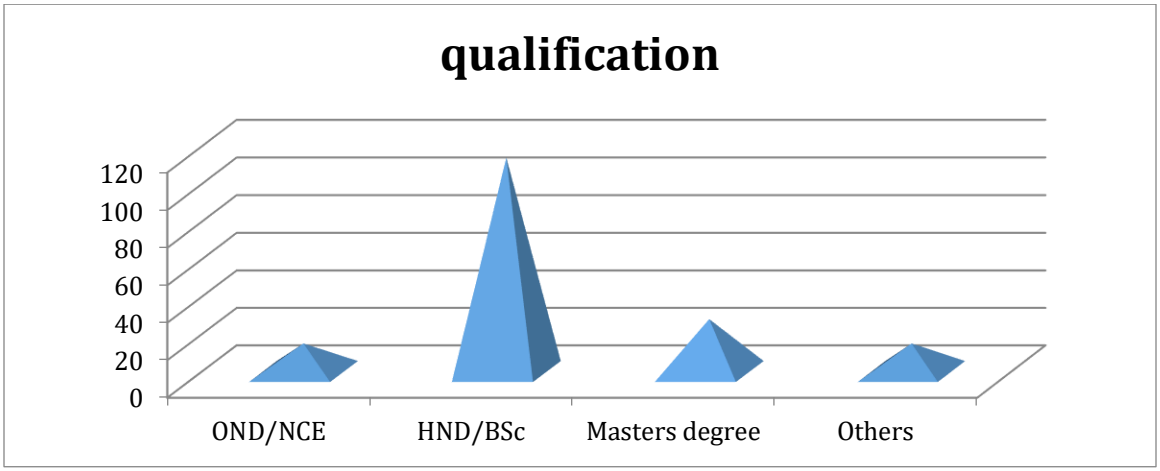

FIGURE 2: Distribution of the respondents by Educational Qualification.

Data presented in Figure 2 show the percentage distribution of the respondents by professional qualification. The result revealed that 15 of the respondents (representing 9%) possessed OND/NCE; 114 of the respondents representing 66% were HND/BSc holders; 28 of the respondents representing 16% were masters' degree holders; and 15 of the respondents representing 9% had other qualifications.

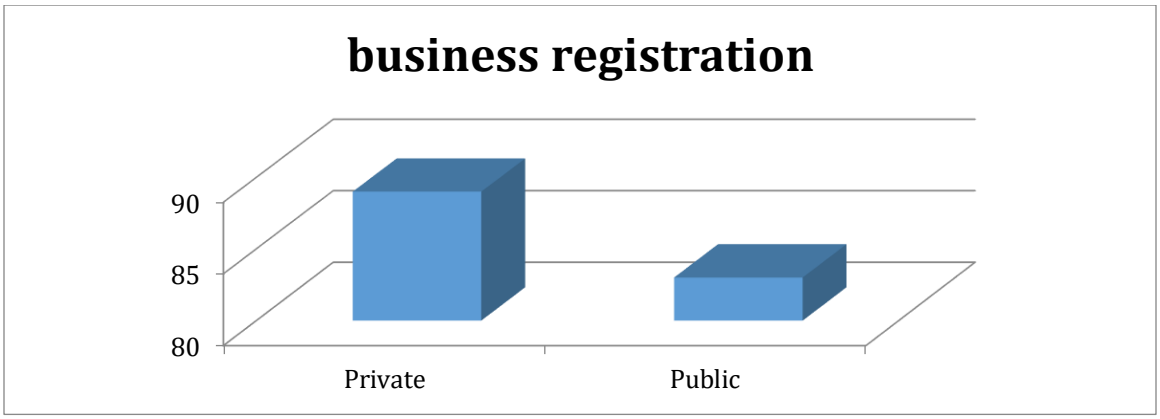

FIGURE 3: Distribution of the respondents by business registration.

Figure 3 reveals that 89 of the respondents (representing 52%) were from public organization while 83 of the respondents (representing 48%) were from private organization.

Research Question 1: What is the level of awareness of green building materials (GBM) and its adoption within the construction industry in Anambra State?

TABLE 1: Respondents' ratings on the level of awareness of green building materials (GBM) and its adoption within the construction industry.

S/N	GBM and criteria for selection	Awareness			Adoption		
A	**Materials from building and industrial waste**	**X**	**Ranks**	**Remarks**	**X**	**Ranks**	**Remarks**
1	Empty plastic bottles	3.44	1st	High awareness	2.12	3rd	Low adoption
2	Worn out tires	3.08	2nd	High awareness	2.32	2nd	Low adoption
3	Fly ash	2.02	5th	Low awareness	-	-	-
4	Cow dung	2.35	4th	Low awareness	-	-	-
5	Rice husk	2.71	3rd	High awareness	2.44	1st	Low adoption
B	**Natural materials**						
6	Grasses	3.01	4th	High awareness	1.99	4th	Low adoption
7	Clay and mud	3.98	1st	High awareness	2.05	3rd	Low adoption
8	Bamboo	3.51	2nd	High awareness	2.19	2nd	Low adoption
9	Leaves	3.11	3rd	High awareness	2.22	1st	Low adoption
C	**Earth materials**						
10	Stone	2.86	2nd	High awareness	3.16	1st	High adoption
11	Timber	2.54	3rd	High awareness	2.25	3rd	Low adoption
12	Trees	3.13	1st	High awareness	2.38	2nd	Low adoption
D	**Criteria for materials selection**						
13	Available and naturally sourced	3.23	1st	High awareness	2.11	4th	Low adoption
14	Waste reduction and durability	3.28	2nd	High awareness	2.23	3rd	Low adoption
15	Recyclability and reusability	2.68	3rd	High awareness	2.33	2nd	Low adoption
16	Energy efficiency	2.56	4th	High awareness	2.43	1st	Low adoption

Table 1 revealed that construction professionals had low awareness in fly ash and cow dung as green building materials while they had high awareness on the remaining items of green building materials. Also, construction professionals rated that they highly adopted stone as one earth materials in green building while other items had low adoption.

Items with low awareness or high adoption had mean scores below 2.50 while items with high awareness and high adoption had mean scores above 2.50. In summary, the result revealed that construction professionals are highly aware of green building materials within the construction industry in Anambra State but the level of adoption is low.

Research Question 2: What are the drivers of GBM adoption in the construction industry in Anambra State?

TABLE 2: Respondents' ratings on the drivers of GBM adoption in the construction industry.

S/N	Items on drivers of GBM adoption in the construction industry	X	Remarks
17	Resource efficiency	2.78	Agree
18	To reduce the lifecycle costs of building	2.79	Agree
19	Legislation/legal requirement	2.67	Agree
20	Financial incentives	2.86	Agree
21	Cost reduction	2.72	Agree
22	Reputation/image	2.87	Agree
23	Competitive advantage	3.41	Agree
24	Construction standards	2.88	Agree
25	Client demand	2.62	Agree
26	Green design guidelines	3.07	Agree
	Grand Mean	**2.87**	**Agree**

Table 2 revealed that items 17 – 26 had mean scores between 2.62 to 3.07; these mean scores are above the threshold of 2.50 benchmark. The cluster mean of 2.87 summarized that construction professionals agreed on the drivers of GBM adoption in the construction industry in Anambra State.

Research Question 3: What are the barriers to the adoption of GBM in the construction industry in Anambra State?

TABLE 3: Respondents' ratings on the barriers to the adoption of GBM in the construction industry.

S/N	Items on the barriers to the adoption of GBM in the construction industry	X	Remarks
27	Higher expenses of Green buildings construction	3.41	Agree
28	Nonexistence of professional knowledge & expertise on green buildings	2.88	Agree
29	Nonexistence of importance committed by the senior administration to green building technology	2.82	Agree
30	Absence of funding systems (e.g., bank loans)	3.07	Agree
31	Absence of government enticements	3.18	Agree
32	Implementation of technology of green building consumes time and causes project interruptions	2.98	Agree
33	Application of GBTs leading to high rental charges and market prices of green buildings	2.51	Agree
34	Absence of green building labelling programs and rating schemes	2.74	Agree
35	Users of traditional technologies resisting change to GBT	2.87	Agree
36	Absence of local facilities and institutes for study and development of Green building	2.55	Agree
	Grand Mean	**2.90**	**Agree**

Table 3 revealed that items 17 – 26 had mean scores between 2.51 to 3.41; these mean scores are above the threshold of 2.50 benchmark. The cluster mean of 2.90 summarized that construction professionals agreed on the barriers to the adoption of GBM in the construction industry in Anambra State.

DISCUSSION OF FINDINGS

The finding in research question one revealed that construction professionals are highly aware of green building materials within the construction industry in Anambra State but the level of adoption is low. These results support the findings of Waniko (2014) affirmed that the Nigerian professionals in the construction industry are cognisant of the practices and concepts of green building. However, the findings discovered are not in conformity with the finding of Susilawati and Al-Surf (2011) that contented that a good percentage of the masses lack knowledge and the awareness of the existence of green construction. Also, Glavic and Lukman (2007) reported that the adoption level of green construction alongside sustainability is still at the "moderate to good" range especially in the Kuwait Construction industry. The study of Nduka and Odunsanmi (2015) remarked that construction professionals in both private and public are still far from actualizing overall adoption of green building material in their construction processes.

The finding in research question two revealed that construction professionals agreed on the drivers of GBM adoption in the construction industry in Anambra State. The study revealed that the top most significant drivers of green structure or building materials adoption during construction includes; cost reduction, to reduce the lifecycle costs of buildings, legislation / legal requirement, financial incentives, resource efficiency, reputation / image, economic incentives, thermal comfort, competitive advantage, and client demand. This finding is in support of reports by (Darko et al., 2017; Oke, Aighimien, Aigbavboa & Musenga, 2019; Windapo, et al., 2019). Oke et al., (2019) found that the major drivers of green and sustainable construction include; legislation / legal requirement, linking research to implementers, evolving regulatory mechanisms, building guidelines /regulations, advocacy and awareness as well as client's demand. Oke et al., (2019) identified that financial incentive is one of the drivers to mitigating the challenges confronting the adoption of Sustainable construction.

Research question three revealed that construction professionals agreed on the barriers to the adoption of GBM in the construction industry in Anambra State. These results are inclined towards the discoveries made by (Rodriguez-Nikl, Kelley, Xiao, Hammer & Tilt, 2015; Darko et al., 2017;). Ahn, Pearce, Wang and Wang (2013) identified high expenses of green materials and products as one of the five main obstacles to green building. Chan, Darko, Olanipekun and Ameyaw (2018) reported that the most serious barriers affecting Green building technology adoption are lack of knowledge and awareness, hostility towards change, high expenses of green buildings, absence of expertise, and absence of government incentives.

CONCLUSION

The successful adoption of green building materials in the construction industry in Anambra State hinges on the implementation of strategic initiatives aimed at overcoming existing barriers and promoting sustainable construction practices. This paper concluded that construction professionals are highly aware of green building materials within the construction industry in Anambra State but the level of adoption is low. This paper highlighted the drivers of GBM and multifaceted challenges hindering the widespread uptake of green building materials, including cost concerns, limited availability, lack of awareness, regulatory barriers, and resistance to change.

RECOMMENDATIONS

This research therefore, makes the ensuing recommendation from the results and deduction

(1) There should be rigorous green building advancement by both state/leader and private sector and individuals to see that empty plastic bottles, worn out tyres, clay and mud, grasses, bricks, stone and timbers are incorporated in some parts/sections of every public building of commercial/industrial nature.
(2) The management of construction key players (clients/investors/developers) and even construction firms should attach importance to the concept of green building and lend their support to ensure their adoption and implementation.
(3) There should be provision of financial incentive to encourage green building uptake with adequate planning and budgetary provision should be made prior to mobilization and execution of green building construction.
(4) Continuous seminars and workshops should be organized by professional bodies so that the benefits and importance of green building can be communicated to the masses to further grow the awareness level and to reduce or even eliminate resistance to new construction techniques and materials.

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