Barriers to Green Building Project Implementation and Sustainability in the Nigerian Construction Industry

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Abstract— This study on the Barriers to Green Building Project Implementation and sustainability in the Nigerian Construction Industry was conducted in River's state to examine the inhibiting factors to the implementation of green building projects. Descriptive statistics, Factor analysis and Regression analysis were adopted to analyze the data that were established. Empirical findings of the study established significant relationship between the variables and the following barriers were revealed: ineffective government policies and programs focused on green construction, absence of locally established green building assessment or rating framework, little or no interest in sustainable development mantra, inconsistent interests and views of green building success rating criteria among various project stakeholders, cultural barriers, low stakeholders' demand, inadequate awareness, inadequate research on green building, absence of green building cost and performance data, contractual procedure and professional unconsciousness, inability to easily evaluate energy and environmental impact, unavailability of local green building materials, unavailability of indigenous green building technologies, high cost of construction, limited financial and human resources, difficulty in justifying green facility benefits and savings compare to conventional ones and low perceived benefits. The study recommends that government should increase the campaign on green building practice by setting up regulations and policies that will gear up the construction industry stakeholders to fully implement green buildings, stakeholders in the construction industry should promote indigenous knowledge and know-how that encourages the integration of available natural resources to actualize the implementation of the various principles of green building and government intervention in terms of monetary grants and non-monetary inducements will help produce positive results against the barriers of green building practice.

***Index Terms*— Construction Industry, Green Building, Sustainable Development.**

1. Introduction

The basic duty shouldered by the Nigerian construction industry in the development and maintenance of building and civil engineering projects such as roads, bridges, railways, private and commercial real estate cannot be overemphasized. The industry is pivotal to sustainable infrastructure development; as well as a medium of employment creation which promotes job securities to all level of workforce. In Nigeria, the three tiers of government; especially the federal and state have remained the backbone of this industry.

However, according to Abolore, (2012), owing to the existing economic substances of the Nigerian government, there will be need for a noteworthy private segment subsidization and collaboration in the procurement of satisfactory infrastructure while at the time securing maximum benefits and financial returns on ventures to the nation. These aspects of building processes and their attendant energy, water and material consumption results in issues bordering on air pollution, water pollution, noise, loss of resources and environment degradation. This follows the idea as opined by Iheme & Chiagorom (2018), that the construction industry has continued to witness environmental constraints which include factors concerning air pollution, excavation, noise, vibration, trees and wildlife preservation, etc. The provision of the basic human need in the form of shelter has a spillover effect on human settlement; hence the need for an environment – friendly construction projects. It is not specious to assert that the construction industry has continued to adopt and rely on the common conventional practice of infrastructure procurement. This practice of course, has contributed to environmental degradation. Green building project as a microcosm of sustainable development has undoubtedly become a direct panacea of global warming. Building construction and its bye products have continued to pose a humongous threat to the environment as the inherent land degradation and CO2 emissions have tremendously shared in the greenhouse gas proliferation. This is in consonance with the report by the U.S Division of energy; that buildings are mindful for nearly half (48%) of all greenhouse gas emanations and that 76% of all power produced goes to supply the building segment (Abolore, 2012).

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Leiringer, (2020) supports the view of Cole (1998) that the birth of "Green Building" surfaced within the 1990s as different industry practitioners began to identify solutions to mobilize in reaction to the non-stop external demand saddled on them to reduce the scourging negative results of construction activities on the habitat. The world at large is currently battling with the global warming; with its attendant negative consequences. According to Khan et al., (2019), the potential of green buildings has tremendously metamorphosed in quite an amazing manner to promote sustainability through integrated sustainable development goals. Though, it has also continued to face various hindrance to its full acceptance; especially in most developing countries like Nigeria. However, different researchers have identified some of the prevalent barriers and where possible, also proffered solutions. A major suggested solution to the barriers is to ensure complete institution of Green Building Council of Nigeria (GBCN) that will be capable for mindfulness creation, postulation of rules, devices and of course strategies that will propel green building ventures. Few among the hindrances identified by Alohan & Oyetunji, (2021) include inter alia: lack of awareness by the stakeholders, non-availability of neighborhood materials, no standard for auxiliary control of the green building.

It has been established that most emerging countries like Nigeria must battle with the expansion of urban housing segment which is always accompanied by the attendant massive resources (energy, water, raw and finished materials) usage owing to growing influx of people into urban areas. Of course, the existing conventional construction achievement is accompanied by loss of arable terrestrial, material and water scarcity, large resources (energy and material) consumption, high operating cost and grave ecological challenges like global warming, air pollution, noise effluence and waste produced during and after erection. The notion of green building will be used to address the numerous behaviors that the construction industry is accountable for. This is in a bid to ensuring and promoting environmental sustainability and human wellbeing at large.

The study's objective is to assess the impediments to sustainability and the implementation of green building projects in the Nigerian construction sector. The study's goals are as follows: (i) to identify the barriers to green building project execution and sustainability (ii) to determine the extent of the effects of these barriers.The study confines itself around the entire selected construction companies in Rivers State, Nigeria. This is to ensure that the subject area is properly addressed to eliminate all forms of bias.

2. Theoretical Framework

Theoretically, the framework of this study is hinged on the 'sustainable development theory' with the prime purpose of unearthing and explaining various phenomena related to green building; in other words, this promulgated theory was seized to serve both as exploratory and explanatory tool throughout the study.

The extensively considered term "sustainability" is still deficient with regards to an unswerving meaning and a common framework. As was first mentioned in 1712 by Hans Carl von Carlowitz, in relation to wild exploitation of forests, "the idea of sustainability emerges in times of catastrophic events or shortages". The best-known definition of the concept comes from international law, which presented sustainable development as: "…development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Barral, 2012). Most users of this concept consider sustainability as being tripodal relating with regards to social, economic and environmental concerns. There is always a conspicuous connection between social, economic and ecological factors of sustainability; this manifests through social strife and economic fallouts when there is environmental (climate) damage. The world is accelerating in the direction of a global plan reinforced by the Sustainable Development Goals (SDGs) initiative. These goals suggest a direction of sustainability which has led to the concept of green construction, emerging as a new movement in the ground-breaking technological field of the construction industry (Khan et al., 2019). With snowballing global concerns over environmental degradation and resource depletion, architects are shifting attention toward design and construction approaches that guarantee absolute resource efficiency (Mansour & Radford, 2014). 'Green Buildings' are critical to addressing the challenges of climate change and global warming while preventing the degradation of natural resources (Khan et al., 2019).

A. Current state of GB Projects Adoption in the Construction Industry

To satisfactorily secure the prime target of this study as it seeks to identify the existing barriers to green building projects in the Nigerian construction industry, an overview of its current level of implementation becomes imperative. Nigeria has recently left on the advancement of strategies and plans for green structure during the most recent couple of years. For example, in 2014, it enlisted the Green Building Council of Nigeria with WGBC on a trial enrollment premise (WSP, 2014). The Green Building Council of Nigeria, which was recently founded, has not yet created an environmental grading instrument that would be utilized for office, retail, multi-unit residential, public, and educational building projects in Nigeria, according to Report, (2014). In their study, Komolafe & Oyewole (2018) found poor acceptance and implementation rates for green building projects as well as low levels of green building awareness. Conventional construction still dominates Nigeria and will do so for years to come. The construction sector is still more concerned with creating traditional structures. The current state of green projects in Nigeria appears to have just begun and is evolving leisurely (Olowosile et al., 2019). Despite the huge benefits of going green, it is shocking that the industry still witnesses low implementation of the green

building practices as Onososen et al., (2019) maintains that green building implementation has been evolving leisurely especially in most emerging economies like Nigeria.

According to Onososen et al., (2019), "the quest for stakeholders to adopt the sustainable building approach in developmental projects is not without hindrances".To enhance sustainability in the built environment, knowledge of the barriers to the adoption of green projects becomes a matter of necessity. It is therefore, important to x-ray the barriers from different viewpoints in order to secure a down-to-earth understanding of the impediments that professionals face in providing practical suggestions about green practice. Onososen et al., (2019) in his research identified the following to include the basic hindrances to the implementation of green building: "inadequate awareness, low client demand, absence of incentives and poor knowledge of green building methods among professionals". In the findings of Toriola-Coker et al., (2021), the following green building barriers were highlighted: "poor sustainability education in academic institutions; lack of incentives for designers to facilitate sustainable design, etc. Olowosile et al., (2019) maintains in addition to existing barriers that "overall management actions, contractual procedure and professional unconsciousness" kicks against wide green project ventures. Some of the identified barriers are considered below.

B. Inadequate Awareness

Isa et al., (2013) opines that the effectiveness of built environment infrastructure is contingent on meeting the demands of varying stakeholders, which is often, hinged on their exposure to construction practice.

Observation has shown that in the case of client who is deficient in the knowledge of green building, little or no incorporation of sustainable materials/components is noticed during the design stage since most times architects design based on client's test and specification. In the view of Ivanova et al., (2016), "inadequate knowledge and information regarding the economic benefits and prospects of green architecture also serve as a barrier to the utilization of green building". Dahiru et al., (2014), argues that the general public are not satisfactorily conscious of the green building practices.

C. Low Stakeholder Demand

Stakeholders' reluctance in going green constitutes a major threat to successful implementation of green building. However, this resistance to using new green technologies over traditional ones, according to Nikyema & Blouin, (2020) is frequently the result of a lack of knowledge about the advantages and properties of green technologies and materials, as well as worries about legal action. This hesitance is additionally exacerbated assuming partners feel that they must be prepared in its utilization. Dahiru et al., (2014) maintains that the industry, its clients, and other stakeholders obviously lack interest in the sustainability mantra.

D. High Cost

Chan, Darko, Olanipekun and Ameyaw (2017) postulate that researchers found that the materials used during project execution tend to have higher cost implications their traditional counterparts both in their initial costs and in their integration cost, regardless of the fact that they possess high pay-back potentials. This cost can skyrocket more when the materials are not locally produced (Nikyema & Blouin, 2020). One of the reasons potential green building clients showcase a high-level resistance to it is the high initial financial outlay (Ujwary-gil, 2016). Ivanova et al., (2016) postulates that "the added cost of incorporating green building features into building projects, which mainly depends on local factors such as climate, building customs, and labor skill levels, often serves as a significant barrier to having green buildings in most developing countries like Nigeria".

E. Absence of Incentives

According to Nikyema&Blouin, (2020), most developed countries have made effort to furnish developers with mouth-watering incentive. The number of GB continues to accelerate in these countries owing to the conscientious provision of these incentives. Ivanova et al., (2016) opines that "in order to encourage the utilization of sustainable building practices, the government needs to establish effective financial incentives and non-financial incentives schemes that would help to ease the high initial costs associated with green architecture".

F. Unavailability of Local GB Materials

In the view of Nikyema & Blouin, (2020), research has found that in emerging countries limited or lack of access to locally manufactured green project materials and technologies affects the adoption of green building practices, this is worsened when the developing country has to import them. Ivanova et al., (2016) holds a similar view as he opines that construction materials that promote sustainability are not easily available.

G. Cultural Barriers

According to Ahn, Pearce and Wang, (2013), most construction stakeholders showcase more interest in erecting traditional facilities that are not sustainable. Du Plessis (2002) maintains that imbibing green culture in the industry most times suffers utmost neglect by various stakeholders such as the consultants, client and even design regulatory and approving establishments. They also argued that the industry in most emerging nations is saturated with participants that are not interested in green technological; especially as it involves extra dangers and cost. Base on this ideology, the industry continues to patronize non-green ventures.

H. Technological Barriers

Continuous focusing on transferred technologies hinders the autonomous development of indigenous ones. Nigeria needs technological advancement that are better adapted to its peculiar and available resources than those migrated from industrialized nations. "For example, the use of earth and timber

construction that predated colonialism has been abandoned and no longer popular" (Dahiru et al., 2014).

A similar view on technological barriers was upheld by Ivanova et al., (2016) who further maintains that promoting indigenous technology has a spillover effect with regards utilization of available local sustainable products.

I. Lack of Government Policies/Support

Nikyema&Blouin, (2020) opine that "the prevalent government-related barriers include the following: ineffective government programs focused on green construction, ineffective government policies concerning green construction, lack of government tax incentives available for green construction geared towards the public, and international sustainable design policies and standards not being adapted to fit local needs". In the view of Dahiru et al., (2014), "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 revealed that most professionals are aware of the new trend (Green Building) and enormous benefits derived from it and they see green building as a basis for appealing livable homes and preserving natural resources while taking care of their health". Lack of enforcement of sustainable building codes has posed major challenges to the introduction of green building concepts (Were et al., 2015).

From the review of related works, the barriers to the implementation of green building project in the Nigerian construction industry were categorized into: government related barriers, human related barriers, knowledge related barriers, market related barriers and cost and risk related barriers.

3. Methodology

The study used survey design and the target population comprised of Fifteen (15) selected construction companies in Rivers State. The Fifteen (15) construction companies were selected using judgmental sampling technique. Eight (8) respondents each was chosen from the fifteen (15) construction companies in Rivers State, making a total of 120 respondents from the fifteen (15) selected construction companies. Taro yamen was utilized in order to establish the study sample size due to the nature of the selected population. Therefore, a size of 93 respondents was sampled. The data obtained from the respondents were careful analyzed and results presented using tables. Descriptive and inferential statistics were adopted to analyze the data that were established.

4. Presentation Of Research Data, Analysis and Discussion of Results

Data demonstration, interpretation and discussion of findings are contained in this section. The data retrieved from questionnaires were analyzed and their results explained. This is in a bid to address the aim of the study as comments on the findings for clarity were made in details.

Table 4.1 depicts a comparison between the distributed and retrieved questionnaires.

Table 4.1 The Questionnaires (Qns) Responses by Professional Discipline

S/N	Professional Disciplines	Nr. of Qns Distributed	Nr. of Qns Returned	Percentage (%) of total Qns returned per discipline
1	Architects	28	26	27.96%
2	Builders	12	9	9.68%
3	Engineers	28	25	26.88%
4	Quantity Surveyors	20	19	20.43%
5	Town Planners	5	5	5.38%
	Total	**93**	**84**	**90.33%**

Source: Field Data 2024.

From the table 4.1, the following observations and deductions were made:

- 93 numbers of questionnaires were distributed randomly to several professionals in the Nigerian construction industry. 84 copies of questionnaire were returned while 9 were not and it puts the response rate at 90.33% which is satisfactory.
- Architects, Engineers and Quantity Surveyors were administered high number of questionnaires: 28, 28 and 20, respectively. This is hinged on the premise that they are considered as the prime design consultants that command high significance in Green Building design, specification, and costing and eventual project execution.
- Highest total responses (27.96%) were obtained from the Architects, this was followed by the Engineers with a response rate of 26.88%, other response rates from respective professionals are in the following order Quantity surveyors; 20.43%, Builders; 9.68% and Town Planners; 5.38%.

A. Data Analysis

The demographic analysis used frequency and percentage in the distribution of the demographic characteristics of the sample employed for the study. These attributes include; Professionals' discipline, Education attainment and Work experience.

Table 4.2 Profession of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Architects	26	31.0	31.0	31.0
	Builders	9	10.7	10.7	41.7
	Engineers	25	29.8	29.8	71.4
	Quantity Surveyors	19	22.6	22.6	94.0
	Town Planners	5	6.0	6.0	100.0
	Total	84	100.0	100.0	

Source: Field Data 2024. (SPSS Version 20.)

Table 4.2 represents a concise distribution of the profession of the respondents. It can be deduced that the response rates of Architects, Engineers, Quantity Surveyors, Builders and Town Planners are 31%, 30%, 22%, 11% and 6% respectively. The high response rate from the first three professionals is suggestive of their high relevance in green construction as they are directly involved in the design, specification, costing and eventual construction of green projects.

Table 4.3 Education attainments of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HND/B.Sc	48	57.1	57.1	57.1
	M.Sc.	28	33.3	33.3	90.5
	Ph.D.	8	9.5	9.5	100.0
	Total	84	100.0	100.0	

Source: Field Data 2022. (SPSS Version 20.)

Table 4.3 illustrates the data distribution on the educational qualification of selected respondents in the target study sample. From the representation, respondents with HND/B.Sc. qualification constitute 57% while those with M.Sc. and Ph.D. are 33% and 10% respectively. The education attainments by the respondents are satisfactory and hence, the justification of the reliability on their response.

Table 4.4 Work experience of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5yrs	6	7.1	7.1	7.1
	5yrs - 15yrs	41	48.8	48.8	56.0
	16yrs - 25yrs	23	27.4	27.4	83.3
	More than 25yrs	14	16.7	16.7	100.0
	Total	84	100.0	100.0	

Source: Field Data 2024. (SPSS Version 20.)

Respondents' year of experience in construction sector is another essential factor to be considered while reviewing respondents' background. Thus, table 4.4 illustrates the working involvement of respondents. From the distribution, it can be deduced that those between 5yrs – 15yrs of work experience has the highest response rate of 49%; while those in the bracket of 16yrs – 25yrs, more than 25yrs and 5yrs are in the following order: 27%, 17% and 7%. This suggests that the respondents have enough work experience hence the justification of their qualification for the survey

Table 4.5 EFA loading of barriers of adoption to GB

	Component	
	1	2
GRB3	.743	
GRB4	.935	
HRB1		.867
HRB4		.872
HRB5		.866
HRB6		.934
KRB1	.822	
KRB4	.855	
KRB5	.924	
KRB6	.879	
KRB7	.856	
MRB1		.883
MRB2		.895
CRRB1	.833	
CRRB3	.910	
CRRB8	.929	
CRRB9	.933	

"Extraction Method: Principal Component Analysis".
"Rotation Method: Varimax with Kaiser Normalization."

Table 4.5 represents the loadings of result of an EFA which was performed using a principal component analysis and varimax rotation. The significant result; $x2(n=84) = 5925.779$ ($p < 0.001$), clearly suggests its suitability for factor analysis. KMO was 0.919 and three factors were obtained which represented about 91.46 per cent of the difference in the data.

The result of repeated evaluation with a KMO of 887 indicates two dimensions which explained a total of 89.10 per cent of the variance among the items in the study. The five factors identified as part of this EFA are as follow: Factor 1 includes items GRB3 with a loading of 0.743 (17th) and GRB4 with a loading of 0.935 (1st), referring to Government Related Barriers (GRB). Factor 2 gathers items HRB1 with a loading of 0.867 (11th), HRB4 with a loading of 0.872 (10th), HRB5 with a loading of 0.866 (12th) and HRB6 with a loading of 0.934 (2nd) which represents Human Related Barriers (HRB). Factor 3 includes items KRB1 with a loading of 0.822 (16th), KRB4 with a loading of 0.855 (14th), KRB5 with a loading of 0.924 (5th), KRB6 with a loading of 0.879 (9th) and KRB7 with a loading of 0.856 (13th), referring to Knowledge Related Barriers (KRB). Factor 4 includes items MRB1 with a loading of 0.883 (8th) and MRB2 with a loading of 0.895 (7th), referring to Market Related Barriers (MRB). And finally, Factor 5 gathers items CRRB1 with a loading of 0.833 (15th), CRRB3 with a loading of 0.910 (6th), CRRB8 with a loading of 0.929 (4th) and CRRB9 with a loading of 0.933 (3rd), referring to Cost and Risk Related Barriers (CRRB).

Table 4.6 EFA loading of categorized barriers of adoption to GB

	Component
	1
Government-related barriers	.929
Human-related barriers	.987
Knowledge-related barriers	.967
Market-related barriers	.939
Cost and Risk-related barriers	.985

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

From table 4.6, the results of the analysis indicate one dimension which explained a total of 92.53 per cent of the variance among various items in the study. The Kaiser-Meyer-Olkin MSA was 0.847. The five factors identified as part of this EFA are as follow: Factor 1, referring to Government Related Barriers (GRB) with a loading of 0.929 (5th), Factor 2 which represents Human Related Barriers (HRB) with a loading of 0.987 (1st). Factor 3, referring to Knowledge Related Barriers (KRB) with a loading of 0.967 (3rd). Factor 4, referring to Market Related Barriers (MRB) with a loading of 0.939 (4th). And finally Factor 5, referring to Cost and Risk Related Barriers (CCRB) with a loading of 0.985 (2nd).

B. Presentation of Results on the Test of Hypothesis

This study seeks to assess the barriers to green building project implementation and sustainability. The barriers identified were reduced using factor analysis and the outcome of factor analysis were subjected to further analysis using regression analysis in order to determine the extent of effect of these barriers on green building implementation and sustainability which is the basic concern of the hypothesis below.

- H01: Green building projects implementation and sustainability are not hindered significantly by government, human, knowledge, market and cost and risk related barriers.

Table 4.7. Model Summaryb

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.975[a]	.950	.947	.76253

a. Predictors: (Constant), CRRB, HRB, MRB, GRB, KRB
b. Dependent Variable: GREENBUILDING AND SUSTAINABILITY

Table 4.8: ANOVAa

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	860.206	5	172.041	295.879	.000[b]
	Residual	45.354	78	.581		
	Total	905.560	83			

a. Dependent Variable: GREENBUILDINGANDSUSTAINABILITY
b. Predictors: (Constant), CRRB, HRB, MRB, GRB, KRB

The dependent variable (green building project implementation and sustainability) was regressed on predicting variables of GBR, HRB, KRB, MRB and CRRB. From table 4.8, the independent variables significantly predict green building project implementation and sustainability, $F(5, 78) = 172.041$, $p < .001$, which depicts that the five factors under study have significant impact on green building project implementation and sustainability. Moreover, the $R2 = .950$ in table 4.6 suggests that the model explains 95% of the variance in green building project implementation and sustainability.

Furthermore, coefficients were analyzed to determine the influence of each of the factors on the dependent variable (green building project implementation and sustainability). H01evaluates whether the factors significantly and positively affect green building project implementation and sustainability. The results revealed that the five factors (government, human, knowledge, market and cost and risk related barriers) have a significant and positive impact on green building project implementation and sustainability as presented in table 4.8 hence, H01 was supported.

Table 4.9: Hypothesis Results

Hypothesis	Regression Weights	B	T	p-value	Results
H_{01}					
F_1	GRB → GBS	.179	.97	.035	Supported
F_2	HRB → GBS	.22	.23	.020	Supported
F_3	KRB → GBS	.95	1.33	.050	Supported
F_4	MRB → GBS	1.375	11.857	.000	Supported
F_5	CRRB → GBS	.194	1.977	.020	Supported
R	0.950				
F(5, 78)	172.041				

*Note: *p < 0.05. GRB: Government Related Barriers, HRB: Human Related Barriers, KRB: Knowledge Related Barriers, MRB: Market Related Barriers, CRRB: Cost and Risk Related Barriers, GBS: Green Building and Sustainability*

C. Discussion of Findings

The empirical findings showed significant relationship between the dependent and independent variables. The evaluated barriers captured in the findings of the study also support the findings of other studies previously conducted as buttressed below.

1) Category 1: Government-related barriers

The study pointed out the following prevalent government-related barriers: ineffective government policies and program streamlined to facilitate the adoption of green construction and absence of locally established green building assessment or rating system. The absence effectiveness of these basic drivers of green building have continued to pose a threat to the Nigerian construction industry. This finding however, concretizes the opinion of Nikyema & Blouin, (2020) who maintains that the prevalent government-related barriers have orchestrated hindrances toward the implementation of green building and sustainability in the Nigerian construction industry. The finding

also, is in consonance with the view of Dahiru et al., (2014), who postulates that there is lack of adequate enabling environment with regards to legislation or policy on green building practice. According to World green building council, there exists a proliferation of rating, and certification framework to encourage and foster efforts towards green project delivery. However, Nigeria is still faced with the challenge of domesticating local standards and programs based on peculiarity of needs and purpose, even though they are to be developed and benched-marked with global standards. The Nigerian construction industry has not yet attained the peak of its potentials due to little or no interest on the part of government in establishing and implementing policies and programs that encourage green building development; hence the proliferation of conventional structures.

Therefore, there is need to promulgate and implement local programs and rating mechanism in order to drive green developments in the Nigerian building industry.

2) Category 2: Human barriers

This study also revealed most common human-related barriers of adoption to green building project. These include: Lack of interest in sustainable building development, inconsistent opinions with regards to GB success rating criteria among various project participants, cultural barriers and low stakeholders' demand. The reason for low stakeholders' demand is not farfetched; many respondents maintain that low demand for green building projects is contingent on other barriers which include high initial building cost implications, absence of government readiness to establish policies and programs that gear toward the full acceptance of green construction practice and the risk related aspects of new technologies of green construction. This finding agrees with the assertion of Dahiru et al., (2014) who maintains that there is little or no interest in the sustainability mantra by stakeholders. The divergent interest in green developments among construction stakeholders as revealed by this study is suggestive of the fact that cultural barriers are overbearing factors in the Nigerian construction industry. This is from a point of view of a distinctive cultural resistance i.e., cultural beliefs which are very difficult to change in relation to construction style and technology utilized and nature of construction materials integrated. It can be deduced that not only does cultural barrier hamper the indoctrination of international technologies that would promote the implementation of green practice, but it also discourages the development and proper implementation of indigenous technology. This of course is prevalent in Nigerian construction industry which is highly dominated by stakeholders who maintain status quo in the construction of conventional facilities as against green construction which has received a global embrace. This position agrees with the postulation of Ahn, Pearce, Wang and Wang, (2013), who argued that "there is a common lack of concern about green building and the high tendency of maintaining conventional construction practices by the various stakeholders of the construction industry in most developing countries". The position of the researcher of this study on cultural barrier also supports and upholds the assertion of Du Plessis, (2002) that "the construction industry in most developing countries is dominated by contractors and developers that are not interested in green technological changes that involve risks and extra costs. In such cases, construction favors the use of conventional practices and discourages other alternatives like the use of green building construction methods".

3) Category 3: Knowledge-related barriers

The most dominating knowledge related barriers as revealed by in study include: Inadequate awareness, inadequate research on green building, lack of green project cost and performance data, contractual procedure and professional unconsciousness and the inability to easily evaluate energy and environmental impact. These knowledge related barriers share a common causal factor; which is inadequate responsiveness to the general concept of going green in the industry. The findings of this study are in consonance with the view of Ivanova et al., (2016), who maintains that "inadequate knowledge and information regarding the economic benefits and other prospects of green architecture also serve as a barrier to the utilization of green building". Therefore, there is need to improve on the campaign on the adoption of green construction over the conventional and traditional approach.

4) Category 4: Market-related barriers.

Unavailability of local green building materials and unavailability of indigenous green building technologies have been confirmed by this study to be the common market-related barriers witnessed in the industry. The unavailability of these propellants of GB have contributed to the high dependency on imported technology and material. However, it has been established that there is peculiarity of any construction venture and so is technology and material adoption for it. It therefore means that autonomous establishment and implementation of indigenous technology should be encouraged in the Nigerian construction industry. This opinion supports the view of Dahiru et al., (2014) that "Nigeria needs knowledge and technology that are better adapted to its natural resources than those which are obtained from industrialized countries. For example, the use of earth and timber construction that predated colonialism has been abandoned and no longer popular". Similarly, Ivanova et al., (2016) maintains that built environment stakeholders should embrace knowledge and technology that are better adapted to their natural resources to actualize the implementation of the various principles of green building.

5) Category 5: Cost and Risk related barriers

The study revealed the following cost and risk-related barriers: high cost of construction, limited financial and human resources, the long run benefits and savings accruable from building green tend to be difficult to justify and low perceived benefits. The cost and risk-related barriers share a common factor; 'cost' since risk itself is measured mostly on monetary bases. The results reveal that respondents maintained that green building practice is characterized with high initial cost outlay; and hence the high reluctance of its full acceptance. Not only

do the findings rhyme with the proposition of Nikyema & Blouin, (2020); who arguably postulate that researchers argue about the high cost implication of green materials over the locally available material and technologies despite the assurances of quick investment returns and long term financial savings due to green material and fittings/fixtures efficiency but also measure up with the view of Ivanova et al., (2016), who maintains that "the added cost of incorporating green building features into building projects, which mainly depends on local factors such as climate, building customs, and labor skill levels, often serves as a significant barrier to having green building practice in most developing countries like Nigeria".

5. Conclusion And Recommendations

A. Conclusion

The quest for minimizing the adverse impact on the environment of construction activities and its bye product has prompted the incorporation of resource efficient and environment friendly constructions across the globe. Green building is considered as an answer to the weaknesses of the conventional construction practice. Its implementation in the industry is highly contingent on mitigating factors as seen from our findings. This study evaluated the barriers to green building project implementation and sustainability in the Nigerian construction industry.

The empirical findings of the study reveal a significant relationship between the dependent variable and the variables. The study also revealed the following barriers to green building implementation and sustainability: ineffective government policies programs focused on green construction, absence of locally established green building rating framework, little or no interest in sustainable development mantra, inconsistent interests and views of green building success rating criteria among various project stakeholders, cultural barriers, low stakeholders' demand, inadequate awareness, inadequate research on green building, absence of green building cost and performance data, contractual procedure and professional unconsciousness, inability to easily evaluate energy and environmental impact, unavailability of local green building materials, unavailability of indigenous green building technologies, high cost of construction, limited financial and human resources, difficulty in justifying green facility benefits and savings compare to conventional ones and low perceived benefits.

From the analyses of categories of barriers, human-related barriers are perceived to have the most effect on the implementation of green building project. This is followed by cost and risk, knowledge, Market and government related barriers respectively. While on individual barrier bases, GBR4 – "lack of locally or a single unified/standard GB assessment system is perceived to have the most effect on the adoption of green building project in the Nigerian construction industry, this is followed by other barriers as ranked respectively above.

B. Recommendations

The recommendations of this study emanate as a result of the empirical findings and conclusions drawn. Therefore, the following recommendations are hereby made: (1) The government should increase the campaign on green building practice by setting up regulations and policies that will gear up the construction industry stakeholders to fully implement green buildings. (2) Stakeholders in the construction industry should promote knowledge and technology that are better adapted to the natural resources to actualize the implementation of the various principles of green building. (3) Government intervention in terms of financial grants and non-financial incentives would help yield positive results against the barriers of green building practice.

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