Barriers to the Achievement of Sustainable Construction Project in Nigeria

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Abstract

Nigerian Construction industry (NCI) have significant effect on the Gross Domestic Product (GDP) of the country as well as on the immediate environment where its product (construction project) is to be or are currently situated, it also has some technical impact on the projects constructed and the environment wherewith the projects are situated, as well as affect the social well-being of the people within that locality. Since these are core areas of sustainability, then, efforts put forward to assessing sustainability of construction projects and the major setback for achieving same is of great importance in the Nigeria construction industry. The objective of this study is to examine the barriers to achieving Sustainable Construction Projects (SCP) and to identify them base on how severe each factor appears to be on sustainable construction. Review of related studies and summary of respondent's opinions were conducted to identify possible factors causing barriers. A total of 87 questionnaire were distributed to respondents who are professionals in the construction industry. The study reveals that the major barriers to achieving sustainable construction project are Client's Unawareness, overall management action, lack of fund and contractual procedures. Finally, this research recommended that there should be a platform for awareness to the public about sustainable construction and this should be well grounded by incorporating green building into the standard building code of Nigeria.

Keywords

Sustainable Construction, Construction Project, Barriers, Sustainable Assessment Tool

1. Introduction

The NCI has contributed immensely to the economy and social development of the nation, therefore, sustainability in the Nigerian Construction industry cannot be over-emphasized based on the assertion by Adetunji (2005), which confirms that sustainability of the industry is one major and most important challenges faced in our world nowadays especially in Nigeria, where less than twenty (20) construction projects are certified to be sustainable with a measure of universally acceptable sustainability tools like LEED, BREAM, GBCSA amongst others. This implies that there is need to corroborate and backup designs of more sustainable construction projects and to look into the collective performance of these sustainable construction projects.

The NCI being the major consumer of non-renewable resources, poses danger of land dereliction, waste, air and water pollution amongst other hazards. Overseeing sustainability comprehensively so as to eradicate or limit these hazards requires and demands a structure that coordinates social and environmental impact with technical and economic impact (Brochner, 1999; Boron and Murray, 2004, 2008). Accomplishing sustainable projects has turned in a new course for construction industry with increment in the utilization of innovation driven strategy as opposed to customary or traditional procedures (Oke, Aghimien, & Olatunji, 2015). The shortcomings of procuring construction projects traditionally solely based on the lowest and competitive tender have led to the increasing new

and innovative procurement methods such as cost-benefit analysis, prime contracting, design and build, strategic partnering among others. These form of procurement has facilitated into account, inclusion of economic, environmental, social and technical consideration in the delivery of construction projects.

This study is set to identify various barriers hindering the construction sector in Nigeria to achieving sustainable project through the examined and compared perception of various construction professionals who have been involved on a sustainable construction project with the aim of assessing the impact of these barriers as to how it affect delivery of sustainable construction project and how to mitigate such barriers.

2. Review of Related Studies

Sustainable Construction

The majority of the buildings in this nation in the year 2035 still can't seem to be constructed or remodeled. Between tearing down numerous more established buildings, renovating some that are fundamentally stable or architecturally noteworthy also, constructing new structures, the vast majority of our structure stock can be impacted by activities we take today to green the built environment" (Yudelson, 2007). Yudelson preceded by citing architect Edward Mazria. In the year 2035, seventy five percent of the assembled condition in the US will be either new or renovated (speaking to in excess of 300 billion square feet of construction). This change throughout the following 30 years speak to a notable open door for the engineering and building network to switch the most noteworthy emergency of present day time, environmental change. In 2009, an investigation was led by the Liverpool John Moores College with the reason for understanding what factors best advance or forestall sustainable construction rehearses and build up the consistency of how sustainability is estimated (Pitt, 2009). The examination verified that the fundamental drivers for supportable development are budgetary motivating forces and building guidelines. Moderateness was viewed as the greatest boundary to feasible development, demonstrating that sustainable construction is increasingly costly to execute contrasted with standard practices (Pitt, 2009).

Perhaps the most serious danger of sustainable construction is cost. The most widely recognized reason referred to in concentrates for not consolidating SCP into structure plans is the increment in initial cost (Morris, 2007). The additional costs, and those related with green building compliance and certification, frequently expect proprietors to include a different line item to the project budget. The risk is that over the span of development the executives, when costs must be managed, the manageability detail is one of the first to be "esteem designed" out of the undertaking (Kibert, 2008).

A commonly noted challenge in construction projects is the absence of viable correspondence among different specialized specialists who will, in general, utilize their own instruments and industry models for settling on choices and following data. Architects, engineers, furthermore, builders will, in general, be profoundly particular and deliver services in technical isolation (Robichaud, 2011). Communication will be improved if all exchanges cooperate as contradicted to the "storehouse" impact where subcontractors just fret about their own degree and practically zero joint effort and coordination with different exchanges (Robichaud, 2011). Robichaud keeps on talking about moderation to such dangers by expressing that the LEED program spans both the innovation and the correspondence hole that can happen on a sustainable construction project. A LEED undertaking will incorporate increasingly forthright making arrangements for all equalities to be fruitful. LEED isn't exclusively implied for better communication, yet it has that effect (Robichaud, 2011).

Each sustainable project needs to put a few accentuations on a fitting determination of materials (Yudelson, 2009). Instances of appropriate materials privately sourced, reused content, quickly renewable, rescued, and volatile organic compound content inside the materials. As they obtain more involvement with new sorts of sustainable projects, a significant number of these concerns steadily vanish (Yudelson, 2007). Undertaking groups frequently think that it's valuable to develop a spreadsheet network posting materials against the natural criteria being considered with the goal that materials choices can be thought about in a basic configuration (Reed, 2008).

The Davis Langdon Cost of Green Returned to concentrate tended to the cost worries of sustainable materials and resources (Matthiessen, 2007). The investigation reasoned that the reused substance isn't hard for most projects, up to a specific edge; be that as it may, if the venture has an objective of over 20% (by estimation) of reused content, there should be a concentrated exertion to recognize high reused substance materials to supplant increasingly standard items. Territorial and quickly sustainable materials present difficulties to ventures since it tends to be hard to discover adequate appropriate materials to qualify as economical materials. There is extra documentation

necessities should the proprietor wish to exhibit consistence with LEED criteria identified with reasonable materials and assets (Matthiessen, 2007).

3. Research Methods

3.1 Research design

Quantitative survey method was adopted for the purpose of this study. Primary data used for this research were retrieved through the help of a structured designed questionnaire.

3.2 The Study Area

Nine Construction projects was selected as case study for this research. These construction projects adopted sustainability tool as at the time of construction in Nigeria.

3.3 Study Population, Sample Size and Sample Technique.

The case study projects are; Nest Oil Tower Project Lagos, The Heritage Place Tower Project Lagos, Nox Building Project Abuja, P & G Nigeria MDO Warehouse Project Ogun State, No 4 Bourdilon Street Building Project Lagos, Convention Centre Project Uyo State, Wing Tower Project Lagos, AfDB Nigeria Field Office Building Project Abuja and Alliance Place Tower Project Lagos.

For One Case Study, respondents are:

Client or Client representative	= 1
Project Manager	= 1
Architect	= 1
Consultant Quantity Surveyor	= 1
Consultant Structural Engineer	= 1
Consultant Electrical Engineer	= 1
Consultant Mechanical Engineer	= 1
Contractor Quantity Surveyor	= 1
Builder or Civil Engineer	= 1
Contractor Electrical Engineer	= 1
Contractor Mechanical Engineer	= 1
TOTAL	11

Therefore, for 9 Case study projects, number of respondent (R) will be

R = 11 x 9 = 99

3.4 Data Collection Approach

The questionnaire were administered by direct contact to professionals in the construction industry, they are: project manager, architect, quantity surveyor, mechanical engineer, electrical engineer, builder/structural/civil engineer. Ninety Nine questionnaires were distributed to respondents but Eighty Seven (89) questionnaires out of 99 were returned in which 87 were found suitable for the purpose of analysis for this study, this represent 87.87% of the response rate which is considered adequate for the study

3.5 Data Analysis Techniques

The data collected in this study were analysed with severity index and mean item score through SPSS package and Microsoft Excel software and Quadrant Analysis.

3.5.1 Severity Index (SI). The barriers of SCP in Nigeria were analysed using severity index by ranking the barriers according to how severe each factor appears to be. 5-point likert scale was employed for the collection of data and to calculate the weighted indexes for the barriers of SCP in Nigeria, the research employed the methodology used by Abd El-Razek et al. (2008) and Le-Hoai et al. (2008). The barriers were ranked according to their Severity Index which is the product of Importance Index and Frequency Index. Mathematically, this can be expressed below:

$$\text{Importance Index I. I} \quad = \quad \frac{\sum_1^5 W}{A \times N} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

$$\text{Frequency Index F. I} \quad = \quad \frac{\sum_{K=1} a \times n}{\sum_{K=1}^5 P_K} \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$\text{Severity Index S. I} \quad = \quad \text{I. I} * \text{F. I} \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

a = constant represents weight assigned to the scale (ranges from 5 for Very High to 1 for
　　Very Low)
n = the frequency of each response.
N = the total number of responses.
W = weighting given to each factor by the respondents and ranges from 1 to 5 where '1' is
　　'Very Low' and '5' is 'Very High',
A = highest weight (i.e. 5 in this case).

3.5.2. Mean Item Score (MIS). Mean Item score was used to analyse impact of barriers identified on sustainable construction projects. Mean score equation used for the calculation as stated below;

$$\text{MIS} = \frac{5(FX5) + 4(FX4) + 3(FX3) + 2(FX2) + (FX1)}{X5 + X4 + X3 + X2 + X1} \quad \ldots\ldots\ldots \quad (4)$$

X = range 1 – 5 with 1 being the lowest and 5 being the highest
F = Frequency of respondent in each factor

3.5.2. Quadrant Analysis. A 2x2 Quadrant Analysis was used to measure the factors causing barriers in achieving Sustainable Construction Projects in Nigeria. This tool was used to determine in a 2x2 matrix form, High Impact – High Occurrence, High Impact – Low Occurrence, Low Impact – High Occurrence, and Low Impact – Low Occurrence of key barriers factors in achieving Sustainable Construction Projects.

4. Data Analysis and Result

Table 1.Demographic Information

Categories	Classification	Number	%
Profession	Client	9	10.34
	Project Manager	8	9.20
	Architect	9	10.34
	Quantity Surveyor	15	17.24
	Civil Engineer	6	6.90
	Structural Engineer	4	4.60
	Electrical Engineer	16	18.39
	Mechanical Engineer	15	17.24
	Builder	5	5.75
Projects involved that used Sustainable Assessment Tool	Few of the projects	53	60.90
	Almost half of the projects	13	14.90
	Most of the projects	10	11.50
	All of the projects	8	9.20
	None of the projects	3	3.40
Current Situation of Green Building	Just started and developing slowly	70	80.50
	Just started and developing fast	10	11.50

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in Nigeria	Haven't started yet	7	8.00
	Almost matured, but still fall behind western countries	0	0.00
	Very matured and takes the lead	0	0.00
Sustainable tools Respondents have used before	LEED (United State)	30	34.50
	LEED (United State) and BREEAM (UK)	26	29.90
	GBCSA (South Africa)	12	13.80
	LEED (United State) and GBCSA (SA)	12	13.80
	BREEAM (UK)	7	8.00
	GBCN (Nigeria)	0	0.00
	GBAS (China)	0	0.00
	HKBEAM (Hong Kong)	0	0.00
	CASBEE (Japan)	0	0.00

From Table 1, respondents who were involved in filling of questionnaires and answering of interview questions are Clients or Client representative, Project Managers, Architects, Quantity Surveyors, Structural Engineers, Electrical Engineers, Mechanical Engineers, and Builders. The use of Sustainable Assessment Tool for construction projects in Table 1 above shows statistics of about 61% believes that few of sustainable projects they were directly or indirectly involved executed in Nigeria have used Sustainable Assessment Tool, about 15% argues that almost half of the projects they have been involved have put in place a measure of Sustainable Assessment Tool. From statistics it was discovered that stakeholders who have only participated in Sustainable Construction exists but quite few. The level of usage of Sustainable Assessment Tools in Nigeria with LEED (United State) being the most used ranking about 34.5% among lists of sustainable assessment tools and those who have together with LEED used BREAM ranks 29.90%, followed by GBCSA (South Africa) with about 14%, and thereafter BREEAM (United Kingdom) with 8%. This study shows that other sustainable tools like GBCN (Nigeria), GBAS (China), HKBEAM (Hong Kong) and CASBEE (Japan) have really not been used in Nigeria for measuring sustainable construction within the nation. About 81% from the taken statistics of situation of green building in Nigeria revealed that more and greater measure needs to be put in place to improve the current situation of green building in the nation. Just about 12% have the same opinion as to the fact that the situation of green building in Nigeria is just starting.

Table 2. Occurrence of identified Barriers on Sustainable Construction Projects

Occurrence of Barriers on SCP	Occurrence of Barriers	
	Mean	Ranking
Client Unawareness	3.46	1
Lack of fund	3.31	2
Professional unconsciousness	3.17	3
Overall management actions	3.07	4
Contractual procedure	2.98	5
Construction materials constraint	2.82	6
Technology constraint	2.60	7
Economic environment	2.46	8
Contractor failure	2.44	9
Insufficient timeframe	2.14	10
Government policy	1.99	11

In the attempt to identifying the occurrence of each barriers identified on sustainable construction projects, it was found that one of the most important criteria to consider is Client unawareness of the existence of SCP which ranked 1st and has a mean value of 3.46; thereafter, we can consider lack of fund or what can be termed as higher capital outlay of the sustainable project as this ranked 2nd with a 3.31 mean value. Another barrier to sustainable construction project to consider is professional unconsciousness, this factors is ranked 3rd with a mean value of 3.17. The least of the criteria to consider for attractive projects have mean value of 1.99, 2.14 and 2.44 which are government policy, insufficient timeframe and contractor failure with 11th, 10th and 9th ranking respectively.

Table 3. Barriers to Achieving Sustainable Construction Projects.

Impact of Barriers to Achieving SCP	Barriers to Achieving SCP	
	Severity Index	Ranking
Client Unawareness	0.35	1
Overall management actions	0.31	2
Lack of fund	0.31	3
Contractual procedure	0.31	4
Technology constraint	0.29	5
Professional unconsciousness	0.28	6
Government policy	0.22	7
Economic environment	0.22	8
Contractor failure	0.21	9
Insufficient timeframe	0.18	10
Construction materials constraint	0.18	11

From Table 3 above, the most severe barrier to achieving sustainable construction project is Client unawareness of sustainable construction with severity index of 0.35, followed by overall management actions, lack of fund, contractual procedure which are all with the same severity index of 0.31. The least of the barriers is construction materials constraint and insufficient timeframe both with 0.18 severity index.
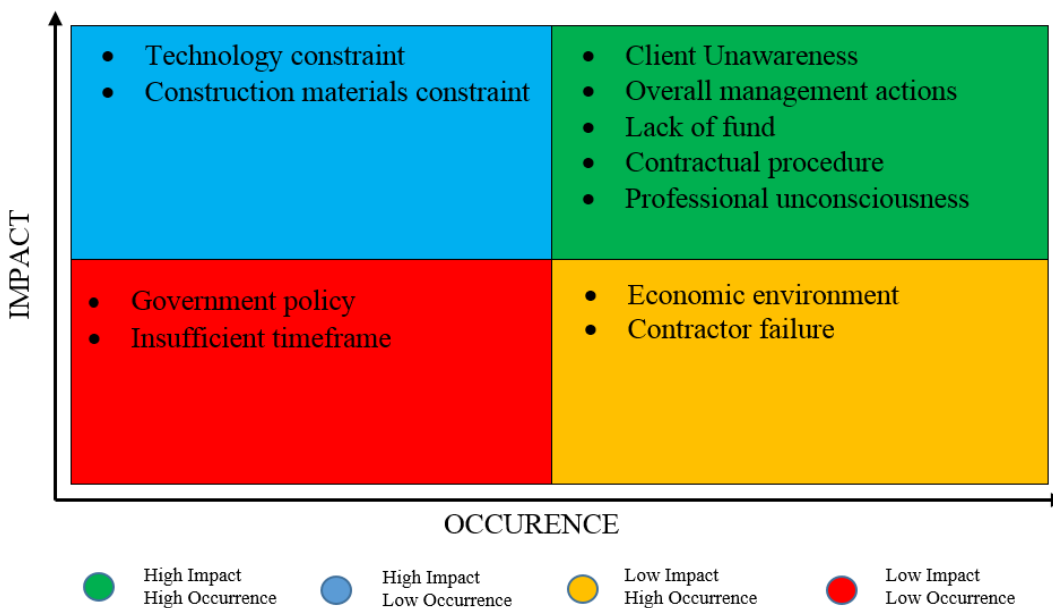

Figure 1. Impact and Occurrence Quadrant for Barriers to achieving SCP

From the quadrant analysis in figure 1 above, it was noticed that occurrence and impact of barriers in achieving SCP were categorized under different quadrant to show clearly the most critical factors which happen to cause greater barrier to achieving Sustainable Construction Project. These have been revealed to be client unawareness, overall management actions, lack of fund, contractual procedure and professional unconsciousness. These factors have high occurrence and at the same time have high impact in affecting successful achievement of Sustainable Construction Project in Nigeria. As for government policy and having insufficient timeframe for the completion of a construction project, they are seemingly negligible as they do not occur very frequently as to causing barriers for Sustainable Construction Project

5. Discussion of Findings

From statistics it was discovered that stakeholders who have only participated in Sustainable Construction exists but quite few. This study shows the level of usage of Sustainable Assessment Tools in Nigeria with LEED (United State) followed by GBCSA (South Africa), and thereafter BREEAM (United Kingdom). Other sustainable tools like GBCN (Nigeria), GBAS (China), HKBEAM (Hong Kong) and CASBEE (Japan) have really not been used in Nigeria for measuring sustainable construction within the nation.

The current situation of green building in Nigeria seems to just have started and happens to be developing slowly, About 81% from the taken statistics of situation of green building in Nigeria revealed that more and greater measure needs to be put in place to improve the current situation of green building in the nation. Just about 12% fact shows that the situation of green building in Nigeria is just starting but this percentage as well claim that the green building is developing as fast as it could in Nigeria. In the middle of this wide range from two different opinion, another sect of about 8% claim that green building have not even started at all in Nigeria, this should call for a greater concern, even though with some few projects who have attained sustainable rating from sustainability tools like LEED, GBCSA and others exist but very scarcely in the country. It is fascinating and saddening at the same time to discover that no opinion was given to the fact that green building is matured in Nigeria and this should be a major concerned to the nation as to how green building can properly develop to a matured state in earnest.

According to this study, the most severe barrier to achieving sustainable construction project is Client unawareness of sustainable construction with severity index of 0.35 as also revealed by Enshassi Mohammed and Madi (2005) in his study which describes it as lack of knowledge about the concept of sustainability, followed by overall management actions, lack of fund, contractual procedure. The least of the barriers is construction materials constraint and insufficient timeframe. Heidi Tomkiewicz (2011) study shows that lack of information that would allow practical implementation of practices is the greatest barriers to implementation of sustainability. The following question was asked "In your opinion, is Nigeria still very much behind as far as sustainability construction is concerned? If yes, can you outlined some barriers to achieving sustainable construction projects in Nigeria aside the barriers listed above? The response gotten can be categorised under the following heading:
  i. *Cultural barriers:* This is from a point of view of a typical change resistance i.e traditions which are very difficult to change in relation to construction method practiced and kind of construction materials used as well. Williams and Dair (2006) completely agrees with this and noted that measures are not taken by stakeholders on each construction project to imbibe sustainability on their projects.

  ii. *Steering barriers:* This is from a point of view of not having a solid building codes, supports and sustainable assessment tools among other currently been used in Nigeria. Hakkinen and Belloni (2011) stated that lack of methods is a barrier but the impact of this method will solely depends on its implementation.

This study revealed that client unawareness, overall management actions, lack of fund, contractual procedure and professional unconsciousness are the major barriers to achieving sustainable construction project in Nigeria. These factors have high occurrence and at the same time have high impact in affecting successful achievement of Sustainable Construction Project in Nigeria. Ahn (2013) in his study discovers that there is serious need for the Client or developer to be in full and total support before the implementation of sustainable construction can be successful. The Toronto Green Development Standard (2006) also key into this assertion as it believes that public awareness about sustainable construction has to be on an increased percentage to have an increase demand of sustainable construction. Meanwhile, Hakkinen and Belloni (2011) major concern was on lack of fund or something it called fear of higher investment cost, this factor scares most investors away and make them shy completely away

from sustainable construction. It is very important for these factors to be put into serious consideration and appropriately mitigated so as to increase the chance of achieving more Sustainable Construction Projects in Nigeria. The other factor which also have high impact in achieving Sustainable Construction Project in Nigeria are technological constraint and construction material constraint, even though these factors have serious impact on SCP, they seem not to occur very frequently which makes them less threatening than the earlier mentioned factor. In term of occurrence as well, economic environment and contractor failure seems to be occur very frequently but as frequent as they seems to occur, they do not seem to have much impact as to achieving a Sustainable Construction Project.

As for government policy and having insufficient timeframe for the completion of a construction project, they are seemingly negligible as they do not occur very frequently as to causing barriers for Sustainable Construction Project likewise as they do not have much impact in affecting successful delivery of a Sustainable Construction Project. Susan, John and Eric (2013) in line with the findings in this study in their study found out that lack of demand for sustainable buildings, lack of public awareness, lack of government support, higher initial cost among others are the major barriers to sustainable construction project..

6. Conclusion and Recommendation

The major barriers in achieving sustainable construction project in Nigeria are client's unawareness, overall management action, lack of fund and contractual procedures. As well as it is important to enlighten clients in every way possible of the great advantage of sustainable construction project over the conventional or traditional construction project, it is also paramount to take into consideration management action and decision which also can greatly affect the choice of executing sustainable construction project. Lack of fund is also found to scare clients away from opting for sustainable construction, this is very much believed that if green building is incorporated in construction industry contractual procedure, there will be limited chance of professionals in the construction industry executing non-sustainable construction project..

Finally, this research recommended that there should be a platform for awareness to the public about sustainable construction and this should be well grounded by incorporating green building into the standard building code of Nigeria. Sustainability of construction project in Nigeria is a key factor to consider at the design stage of any construction project for both the designer and the regulatory agencies, and these factors are to be monitored throughout the construction process since they are vital in measuring the performance of any sustainable construction project to infer a more desirable and satisfactory sustainable building.

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