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Hindrances to Green Building Developments in Nigeria's Built Environment: "The Project Professionals' Perspectives"

¹S G Dalibi, ²J C Feng, ³Liu Shuangqin, ⁴Abubakar Sadiq, ⁵B. S. Bello & ⁶I.I. Danja

^{1, 2, 3, 4, 5}Business School, Hohai University, Nanjing, Jiangsu Province, China.

⁶MSc. candidate at Architecture Department, South East University, Nanjing, Jiangsu Province, China.

¹ salgidos@yahoo.com

Abstract. Developing countries like Nigeria are faced with the growth of residential housing sector accompanied by huge power, water, and material consumptions etc., which were due to the population growth, increased households and the increased urbanization. The construction industry is guilty of many practices because its activities have adversely affected the environment negatively. It responded with new initiative called Eco / green / sustainable buildings to ensure environmental sustainability. Despite all these glaring challenges green building developments and sustainable practices are embraced very slowly and practiced at slow pace in the Nigeria's construction industry. This is worrisome and is due to some factors hindering such pace. The aim of this paper is to identify, examine and assess the factors that are hindering green building developments based on the project professionals' perceptions. Reviewed literatures were used to identify the various factors that hindered the adoption of green measures and practices within the Nigeria's built environment. A questionnaire survey was conducted within the industry. The results showed the major factors hindering green building developments and practices in the Nigeria's built environment.

1. Introduction

1.1. Background to the study

The world's population continued growth has led to the implementation of resource-efficient measures in all areas of human activities especially in the built environment (BE) which has a significant impact on all resources while also affecting the air quality and transportation patterns of communities; both the present and the future generations. [1-3]. The friendliest way to handle the environment is not to build. However, without construction, life can be miserable and threatening [4], [5]. What is needed is a dynamic equilibrium without any form of threat especially to the environment [6]. The combination of these challenges gave birth to a new concept in design, construction/renovation, operation and maintenance of buildings in conformity with "sustainable practices for buildings" known as Green Buildings [7].

Green building (GB) is the foundation of sustainable construction and refers to a structure that is resource-efficient in terms of economy, utility, durability, and comfort [8], [9]; GBs are those sensitive to the "Environment, Resource and energy consumption, Impact on people, Financial impact and the world at large [10]; GBs are environmentally friendly which encompasses energy use, water use, and



storm-water and wastewater re-use [11]; GBs combine energy and water efficiency systems, Day Lighting strategies, Indoor Environmental Quality (IEQ) systems and efficient Building Envelope system to provide comfort and positive impact to the occupants and the environment[3]. Sustainability in construction is all about following suitable practices in terms of choice of materials, their sources, construction methodologies, as well as design philosophy so as to be able to improve performance, decrease the environmental burden of the project, minimize waste and be ecologically friendlier [12]. It enhances the environment against the negative side effect of construction activities [5]; a clear answer to health, economic and environmental challenges [13]; maximize the resource savings, protect the environment, reduce pollution, provide people with healthy, comfortable and high efficient space, and exist harmoniously with nature” [14-16]. The term “green building”, or “more sustainable building”, does not have an exact definition, but, nevertheless, these terms have been used frequently [17].

These clearly indicate that GB is a major response to ensure environmental sustainability globally within the construction industry. However, countries like China, USA, UK, Germany, Japan, Korea and other developed nations have embraced the concept fully; while other countries are prioritizing which feature to incorporate in to their buildings; whereas other countries are ignoring or slowly embracing the concept due to some reasons.

1.2. The Research Problem

Developing countries like Nigeria are faced with the growth of residential housing sector accompanied by huge power, water, natural and processed material consumptions due to increased urbanization. This increasing urbanization is associated with loss of arable land, material and water crisis, and serious environmental problems like air pollution, noise pollution and waste generated from buildings [18], [19]. The construction industry is guilty of many practices in this regard and it responded with a concept called GBs to ensure and promote environmental sustainability.

Despite all these glaring challenges and drastic measures, GB developments and sustainable practices are embraced very slowly and practiced at slow pace in the Nigeria’s construction industry. This is worrisome and may be due to some factors affecting the sustainable practices within its built environment. Such factors may also be attributed to project stakeholders or the concept itself etc.

1.3. Research Aim

The aim of this paper is to identify, examine and assess the factors that are hindering green building developments based on the project professionals’ perceptions with a view of exposing the impacts of such hindrances on the Nigeria’s BE.

1.4. Research Hypotheses

The following hypotheses were formulated for this research; T-test statistical tool was used in testing these formulated hypotheses:

- *Null hypothesis (H_0);* Green building developments **are not** hindered significantly by some factors in the Nigeria’s Built Environment.
- *Alternative hypothesis (H_A);* Green building developments **are** hindered significantly by some factors in the Nigeria’s Built Environment.

1.5. Research Scope and Limitations

This research work is limited to the perception of various practicing professionals working in the Nigeria’s Built Environment. Such professionals include the Architects, Quantity Surveyors, Civil Engineers, Building Engineers, Mechanical and Electrical Engineers, Project Managers, Construction Managers, Land surveyors, Town planners and Estate Surveyors.

2. Review of Literature

2.1. Green Building: Developments & Hindrances

Construction of GB entails tailoring a building and the site to the local climate, site conditions, cultural and community in order to reduce resource consumption, augment resource supply, and enhance the quality and diversity of life, while optimizing all these in an integrated design [5]. In other words, it is a total quality management approach to building so as to ensure the achievement of synergistic design through interdisciplinary teamwork [5]; it is neither, an assemblage of 14 environmental' components nor a piecemeal modification of an already designed standard building, rather, it is a building philosophy in which natural and resource efficient features are incorporated in a building [13]. To achieve synergy in GB, all the professionals that would be involved in the planning, design and construction of such building must be brought early (at the design stage), for professional input in the design of GB from the beginning to undertakes Site Analysis and Environmental Impact Assessments etc. [5].

Every project or development comes with its unique benefits, challenges and factors that hindered its success; GB developments in Nigeria are not an exception. "To be sustainable, buildings should usefully last for many generations. This requires some knowledge of the future climate and the resources available to maintain the operations, in particular the energy consumption, of buildings" [20]. This practice is a two-three decades old trend, but with insufficient data about the costs and absence of measured building performance data from currently operating sustainable designed buildings [21], [22], [23]. Industry professionals, in both the design and construction disciplines, are generally slow to change, tend to be risk-adverse, lack sound knowledge, experience, and understanding of how to apply ecology to construction design; moreover, environmental or economic benefit of some green building approaches has not been scientifically quantified [24].

Lisa and Morris (2004); opined that the first question often asked about sustainable design is: *what does "green" cost? Typically meaning does it cost more? This raises the question: More than what? More than comparable buildings? More than the available funds? Or more than the building would have cost without the sustainable design features?* The answers to these questions have been thus far elusive, due to the lack of hard data [25]. Morris (2007); argued that "The most common reasons cited in studies for not incorporating green elements into building designs is the increase in first cost" [26]. While a Davis Langdon Report in 2007 stated that "*there is no one size that fits all answer to the question of the cost of green*" [27].

However, the appreciation of the significance of non-technical issues (soft issues) has grown, giving recognition to Economic and Social sustainability concerns as well as Cultural heritage of the BE as being equally important and provide further challenges[12]. Many housing estates developments in the Abuja FCT, Nigeria do not reflect the desired housing needs of the end-users, the developers'/ clients' lack of comprehensive data about the financial obligations with regards to incorporating green features into renovation or proposed projects which has impact on the total development cost which in turn affects end-users / occupants in terms of Rental value, Sales value, Envisaged savings due to green elements, Future asset value of the green building etc. [28].

Incompatibility of interests amongst stakeholders caused conflicts and disputes in construction [29]. Incorporating the various interests of stakeholders should be extremely important for the preparation of green specifications, construction and maintenance [30]. GB projects design and construction is new in Nigeria and is characterised by the problem of lack of shared perception and agreement on the objectives and success/failure of the green building projects by stakeholders [31]; also Different Set of Criteria for success/failure for the project [32] etc. As such, each stakeholder perceives the success according to a hierarchy of dimensions, which comply with their personal agenda.

The initial emphasis of sustainability was on Technical issues such as materials, building components, construction methodologies and energy related design concept [8], [9]. However, recognition of (soft issues) Economic and Social sustainability concerns as well as Cultural heritage of the built environment as being equally important [12]; Sustainable world progress is dependent upon

continued Economic, Social, Cultural, and Technological progress [33]. These four main factors; Economic, Social, Cultural and Technological factor, each of which is found to have a significant effect towards adopting Green Building Technology [34].

The awareness of green building by the general public will form the market-driven power for such developments especially in the urban area. However, the difficulties include: Lack of basic data of using GB assessment system, Lack of professionals, Lack of interest from real estate developers and Difficulty of having a unified GB assessment standard etc. [35].

Building materials have been playing an important role in the construction industry, no field of engineering is conceivable without their use [36], [37]. The cost of building materials poses a significant threat to both the construction industry and people aspiring to own houses [38], [39], [40], [41]. The setback witnessed in housing efforts in Nigeria was hinged on the high cost of imported materials used for construction [42], [43], [44]. A report of UNCHS (1993) found that building materials remain the most significant input in project development; with GBs, most of the material components are not locally produced / manufactured in Nigeria e.g. solar panels, Switchable glazing, water conserving appliances and grey water systems etc. [45], [46].

2.2. The Green Building Hindrances.

The hindrances to GB developments identified from the reviewed literature above were listed in the table 1.

Table 1. Hindrances to GB developments

S/N	HINDRANCES TO GB DEVELOPMENTS	SOURCES
1	GB Technical Know How (GB requisite knowledge among the Built environment Professionals & the scarcity of GB certified professionals)	[5], [13], [20], [24], [25].
2	Lack of GB cost data and other performance related Data	[21], [22], [23], [25], [26], [27], [28].
3	The Perception of GB as Expensive Concept (Perceived Increased cost for incorporating GB features etc.)	[21], [25], [26].
4	GB as a new change (which comes with its associated risks)	[24]
5	Cultural, Economic, Social and Technological (CEST) barriers.	[8], [9], [12], [33], [34].
6	Divergent interests and views of success factors and success criteria of GB developments among stakeholders	[28], [29], [30], [31], [32], [35]
7	GBs awareness	[35]
8	Lack data for using GB assessment systems	[35]
9	Lack of Locally or a single unified/standard GB assessment system	[35]
10	In-availability of local GB material and other components and High cost of Imported GB materials	[8], [9], [36], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46].

Source: Authors' review of literature.

3. The Research Methodology

Secondary sources of data such as journals, conference / seminar / workshop papers, textbooks, newspapers, magazines and internet sources etc. were used to review literatures on the GB field, which helps in identifying and narrowing the various factors that hindered GB developments. These identified hindrances form the main body of the Questionnaire which was manually distributed to the various professionals working in Nigeria's Built Environment; selected randomly. A **5-point Likert scale** Questionnaire format (Strongly Agree =5, Agree=4, Neutral/Undecided=3, Disagree=2, strongly Disagree=1) was used to obtained the various perceptions of the professionals working in the Nigeria's Built Environment. Frequency and percentage count tables, Mean item score and T-test statistics were used for data analyses.

4. Data Presentation, Analysis and Results

4.1 Results from the Administered Questionnaires

The Primary data for this research work was obtained through manually distributed questionnaires to professionals working in the Nigeria's Built Environment and the responses obtained were shown in the table 2.

Table 2. The Questionnaires (Qns) Responses by Professional Disciplines

S/N	PROFESSIONAL DISCIPLINES	Nr. Of Qns Distributed	Nr. Of Qns Returned	Percentage (%) of Total Qns returned per discipline
1	Architects	80	51	10.63%
2	Quantity Surveyors	40	31	6.46%
3	Civil Engineers	40	33	6.88%
4	Building Engineers	40	21	4.38%
5	Mechanical Engineers	40	20	4.17%
6	Electrical Engineers	40	27	5.63%
7	Project Managers	40	29	6.04%
8	Construction Managers	40	22	4.58%
9	Land surveyors	40	14	2.92%
10	Town planners	40	24	5.00%
11	Estate Surveyors	40	30	6.25%
	TOTAL	480	302	62.92%

Source: Authors' Field work

From the table 2 above, the following observations and deductions were made:

- i. 480 numbers of questionnaires were distributed randomly to various professionals in the Nigeria's built environment. 302 numbers of questionnaires were returned while 172 were not returned. This puts the response rate at 62.92% which is good.
- ii. All the professionals were administered equal number of questionnaires (40nr. each) with the exception of the Architects (80nr.). This is because as the Main design professionals they have much more relevance in GB design, specification and construction.
- iii. The Architects have the highest total responses (10.63%), followed by Civil engineers (6.88%), Quantity surveyors (6.46%), Estate surveyors (6.25%) and Project managers (6.04%); while land surveyors (2.92%) have the least.

The table below shows the assessment of the various GB Hindrances by the professionals based on the structured 5-point Likert scale.

Table 3. An Assessment of the Hindrances to GB developments by the Respondents

S/N	HINDRANCES TO GB DEVELOPMENTS	Strongly Agreed	Agreed	Neutral	Disagreed	Strongly Disagreed	TOTAL	Mean Item Score	Rank
		5	4	3	2	1			
1	GB Technical Know How (GB requisite knowledge among the Built environment Professionals & the scarcity of GB certified professionals)	53	27	192	19	11	302	3.3	7th
2	Lack of GB cost data and other performance related Data	106	78	92	24	2	302	3.87	4th
3	The Perception of GB as Expensive Concept (Perceived Increased cost for incorporating GB features etc.)	187	104	11	0	0	302	4.58	1st
4	GB as a new change (which comes with its associated risks)	88	67	44	102	1	302	3.46	6th
5	Cultural, Economic, Social and Technological (CEST) barriers.	39	111	33	90	29	302	3.14	8th
6	Divergent interests and views of success factors and success criteria of GB developments among stakeholders	188	12	77	17	8	302	4.18	3rd
7	GBs Awareness	25	87	101	66	23	302	3.08	9th
8	Lack data for using GB assessment systems	10	173	79	38	2	302	3.5	5th
9	Lack of Locally or a single unified/standard GB assessment system	3	37	177	77	8	302	2.83	10th
10	In-availability of local GB materials and other components and High cost of Imported GB materials	203	67	5	6	21	302	4.41	2nd

Source: Authors' statistical computations

From the table 3 above, the following observations and deductions were made:

- i. The respondents strongly agreed with "The Perception of GB as Expensive Concept" as a major Hindrance to GB developments; ranked 1st.
- ii. In-availability of local GB materials and other components and High cost of Imported GB materials (2nd), Divergent interests and views of success factors and success criteria of GB developments among stakeholders (3rd), Lack of GB cost data and other performance related Data and Lack data for using GB assessment systems (4th) were also agreed as GB development Hindrances by the respondents.
- iii. Lack of locally or a single unified/standard GB assessment system (10th), GBs Awareness (9th) and Cultural, Economic, Social and Technological (CEST) barriers (8th) were the GB Hindrances with the least impact on GB Developments in Nigeria.

4.2. Testing of Hypotheses

The hypotheses formulated for this research work was tested using T-statistics. The values of the mean item scores in table 3 above were used as the data for the statistical computations with the result shown in the table 4.

Table 4. T-Test statistical computation result

Professional Perceptions	MEAN	Standard Deviation	Standard Error	N	DF	Alpha (Significance level)	P value	Tcal	Ttab _{0.05, 9}
GB Hindrances	3.6351	0.5957	0.1884	10	9	5%	0.0001	6.3514	-1.8331

With 9 degrees of freedom (DF) and 5% level of significance, the T-test calculated (Tcal = 6.3514) is greater than T-test tabulated (Ttab_{0.05, 9} = 1.8331) the As such, the Alternative hypothesis was accepted; which states that "*Green building developments are hindered significantly by some factors in the Nigeria's Built Environment*".

5. Conclusions

This study identified ten hindrances to GB developments in the Nigeria's Built Environment, out of which: The Perception of GB as Expensive Concept is the major Hindrance to GB developments; which ranked 1st; followed by In-availability of local GB materials and other components and High

cost of Imported GB materials (2nd), Divergent interests and views of success factors and success criteria of GB developments among stakeholders (3rd). Whereas, Lack of locally or a single unified/standard GB assessment system (10th), GBs Awareness (9th) and Cultural, Economic, Social and Technological (CEST) barriers (8th) were the GB Hindrances with the least impact on GB Developments in Nigeria. The impact of these GB hindrances is significant which is further attested by the T-test statistical test of the research hypotheses by accepting the Alternative hypothesis; which states that “*Green building developments are hindered significantly by some factors in the Nigeria’s Built Environment*”.

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