Benefits and Barriers to the Implementation of Green Building Standards in Universities: What are Students' Views?

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Benefits and Barriers to the Implementation of Green Building Standards in Universities: What are Students' Views?

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Abstract

Embracing the principles of green building in development is crucial in creating a sustainable environment. However, research on its adoption in educational institutions is very low and students' opinions are not given priority in the few research that are available in Nigeria. This study therefore investigated the perception of built environment students on the need to embrace the principles of green building in Covenant University, Ota, Ogun State, Nigeria. 101 questionnaires were administered to students in the Departments of Architecture, Building Technology and Estate Management of the university and a response rate of 94% was achieved. The data collected was analysed using descriptive statistics such as percentage, weighted mean and relative importance index (RII) and the data was presented in tables. The study revealed that 88.42% of the students are aware of the concept of green building. According to the students, the degree of embracing green building standards in Covenant University is very low. Moreover, the benefits the students perceive the university can derive from adopting green building principles are: improved indoor air and water quality, reduction in pollution and environmental degradation, energy efficiency and water conservation. In addition, the students identified the following as the main barriers to green building adoption: ignorance on green building principles and their benefits (RII =0.91), high cost of green building technology (RII = 0.89), ignorance on professional knowledge and expertise on green building (RII = 0.89), ignorance on green building principles promotion by government (RII = 0.87) and ignorance on importance attached to green building principles by management of universities (RII = 0.87). The study recommended, amongst others, that there should be a forum where university management teams can be enlightened on the gains of embracing green building standards. This study is expected to broaden the knowledge of the Management of Covenant University on the importance of green development which will make the university environment to be conducive for learning, which will in turn aid better students' academic performance. The study concluded that green building principles are vital to the physical and aesthetic planning of any development as it will reduce the amount of raw materials used in construction.

Keywords: Green Building, Benefits, Barriers, Students, Universities

1. Introduction

Climate change and its disastrous consequences, industrialization and other environment-unfriendly issues are triggering the transformation towards sustainable development, which will increase economic efficiency, protect and restore the ecosystem and also improve the well-being and livelihood of the human race. As economic development and environmental sustainability are connected, the consciousness to preserve energy and resources has set in. All over the world, infrastructure and building construction use

up to 60% of the raw materials extracted from the Earth [1, 2].

Building and construction activities immensely impact urbanisation by establishing living and working spaces and also help to boost the national economy [3]. Nonetheless, building and other construction tasks can likewise have depressing outcomes on the natural environment inclusive of its resources. Development activities and demolition of buildings promote noise, dust, water pollution and waste. Also, buildings contribute to the biggest energy guzzling sector in the world totaling 35% of universal energy-consumption approximately. Moreover, they make a similarly considerable contribution to the emission of CO_2 (carbon dioxide) to the atmosphere [4, 3].

The population of the world is constantly increasing and is estimated to amplify to about 9.8 billion from 7.3 billion by year 2050 [5]. Undoubtedly, the growth in population will lead to increased demand for energy, water and natural resources fostering an overburden the ecosystem thus, depleting the environment. Worldwide resources are being exploited alarmingly, creating concern over increased greenhouse gas emission known to alter the environment for worse. Largely, the development of buildings has been blamed for this environmental degradation [6].

The livelihood of man depends on the development of buildings in which he will carry out his daily activities but the development of such buildings can be carried out in such a way that it will not only be fit for purpose, but it will also protect the environment from the negative impact of human development. Hence, the beginning of the twenty-first century has brought in the era of green buildings.

Green buildings are designed to reduce negative environmental impacts by operating efficiently and minimizing the discharge of pollution and waste. Decreased utilisation of energy and water, enhanced indoor air quality, improved well-being and productivity, superior property value, among others, are often cited advantages related to green building. According to [7], green building is the act of increasing the efficiency of buildings through their utilization of water, energy and materials and also involves lessening the effect of the building on human well-being and the environment. It also involves finding the balance between building development and the sustainable environment [8]. Awareness of green building is important if practitioners in the property development industry are to promote reduced building footprints adversely impacting the environment holistically.

A report issued by the United Nations Environmental Program (UNEP) 2009 has shown that the construction sector uses about 40% of widespread yearly energy consumption, 20% of universal yearly water usage, and furthermore adds to 40% of worldwide yearly total waste resulting from the construction of building and demolition activities. Following the growth in the construction industry globally, if there is nothing done now, it is evaluated that the development sector would be liable for the devastation of the natural floral as well as wildlife on more than 70% of the earth's exterior by 2032 [9].

Based on these reasons, several studies have been conducted on issues relating to green building/environment. For instance, in Indonesia, [10] identified the hindrances to green building embrace from the occupants' perspective. Another study by [11] in Israel analysed the cost, economic benefit and teachers' satisfaction with green building in schools. Moreover, a study in Zambia by [12] investigated the degree of awareness, perception of green building practices and principles amongst various professionals. Also in Nigeria, [13. 14] identified the prospects and challenges of green building practices. Although these studies form the basis of this study, however, they are not comprehensive enough to achieve the objective of the study. Moreover, a few researches have been executed in Nigeria on the adoption of green building standards in universities. Also, most of the studies in Nigerian universities focused on other stakeholders at the expense of students, who are the primary stakeholders and users of most of the

academic buildings [15].

Based on the foregoing, this research is carried out to investigate the views of students on the adoption the principles of green building in universities using Covenant University, Ota, located in Ogun State, Nigeria as case study.

2. Literature Review

In educational institutions, green buildings are purposeful structural developments that reduces the resources usage in its production. The objective is to reduce the emission of greenhouse gases, energy and water usage, while creating an atmospheric condition where students can be healthy and learn optimally. Since educational institutions are the place the world's future leaders are being educated and trained, they ought to be built to green principles so as to promote environmental stewardship in students [16]. However, the desire for a green institution or university may be unattainable if colleges are not decidedly ready for it. For instance, a few universities may endeavor to reduce energy consumption by decreasing the use of air conditioners. This would possibly work if the buildings are planned and built for natural ventilation and less reliance on air conditioners [17].

2.1 Concept of Green Building

In recent times, the term "green building" emerged in conjunction with a large group of similar terminologies. This was germane as the need to evolve environmental friendly buildings in fostering a sustainable nation became paramount. Nonetheless, the term is still imprecise which leads to difficulty and ambiguity in its execution [18]. “Sustainable construction” and “green building” are two terms which are used interchangeably and originate from the sustainable development concept. The green building concept represents the models generated for universal sustainability in the light of the occurrence of unrestricted and persistent environmental degradation and inevitable climate change effects on our society. Green building is therefore directed to minimize the influence buildings and development may have on human health and the environment and is presumed to lead to societal economic advantages. The “Green building” is thus, an answer from the building industry to promote sustainable demand on water, energy and other limited natural resources in ensuring improved well-being and environmentally friendly characteristics. Kibert [19] suggested that the phrase "green building" be employed in labeling buildings planned and built in conformity with the standards of sustainable development. The author proposed that green edifices are “healthy facilities planned and produced prudently, using ecologically based standards”.

Chatterjee [20] viewed the green building practice as a procedure that includes creating buildings and infrastructure in a particular manner that limits the resources utilised and the harmful consequences on the environment. Green practices in building pose an important ingredient in the realisation of sustainability in the construction industry. Green building exhibits a high level of environmental and economic performance. This includes conservation of energy, enhanced indoor air quality, resource management and tenants’ well being. “Green Buildings" and "Sustainable Development" are a necessity for continuous living as “Health and Comfort" is essential for the continuation of life. Additionally, we are confronting significant energy and natural resource scarcity, in which worldwide climate change is the issue which cannot be disregarded [21]. The Green Building ideology is being embraced by several countries as the ideal way of both utilising earth resources and maintaining the environment [22]. This is crucial as its advocacy limits man’s environmental degradation and building patterns in a bid to adopting best practices in delivering earth to the unborn generation cleaner and better than we inherited [23].

Though, universally performance objectives for green building have not been stipulated, several nations have made several criteria and strategies in evaluating green building performance. In tandem to the

criteria referred to as Building Environment Assessment Methods (BEAM), a building is regarded as "green" if it aligns with acceptable green rating system benchmark [24]. These benchmarks consist of the British Research Establishment Environmental Assessment Method (BREEAM) and the American Leadership in Energy and Environmental Buildings (LEED) [16]. The ideology of "zero energy building" is premised on the opinion that buildings can be powered by other sources energy or a combination of sources - sun, wind, geo-thermal avenues other than fossil fuels to promote sustainability in energy utilisation within buildings.

2.2 Green Principles in Buildings

There are principles adopted in green building practices and these principles govern the application of "Green" characteristics in building construction or redevelopment. Alam and Haque [25] stated that there are five noteworthy components of green building design- sustainable location design; indoor environment; water preservation and quality; energy and environment; and conservation of materials and resources. Table 1 shows the authors' description of the green building principles.

Table 1. Green Building Design.

S/N	Design	Description
1	Sustainable site plan	This principle limits urban spread and unnecessary ruination of profitable land, habitat and green space which occurs from low-density development and also to conserve key environmental assets through vigilant inspection of each site
2	Water preservation and value	This principle preserves the existing natural water cycle.
3	Energy and environment	This principle limits unfavorable effect on the environment (air, water, land) through upgraded building siting, improved building plan, fabric determination and forceful utilisation of energy protection procedures
4	Indoor environment	This principle gives a solid, comfortable and profitable indoor condition (indoor air quality, ventilation, thermal comfort, access to regular ventilation and day lighting, and effective control of acoustics) for building occupants and guests
5	Preservation of materials and resources	This principle minimizes the use of non-sustainable materials and different resources. E.g. water and energy via effective design, arranging and development and also reusing of development debris

Source: Adapted from Alam and Haque (2016)

However, the BREEAM as well as LEED streamlined green principles in buildings to liveable communities, energy efficiency, indoor air quality, resource and water preservation.

2.3 Relevant Empirical Studies

Dahiru, Dania and Adejoh [13] investigated the possibilities of green building practices in Nigeria. Descriptive survey was employed involving faculties in higher institutions, 40 experts in the building profession and the potential recipients of such services. Structured questionnaires utilising closed-ended questions with suggested answers quantified using a Likert scale formed the research instrument. An

interview with a segment of the respondent was executed. The study found that presently, the green building ideology, is not practiced though its need exists. Additionally, ignorance was major in abhorring the production of green building and the nonexistence of enabling environmental laws in ensuring prospective clients to use green building.

Kasai and Jabbour [26] identified and analyzed the primary hindrances to green building at two engineering schools in Brazil. Several isolated cases were examined to analyze the fundamental hindrances to introducing green buildings in these schools. Interviews were also carried out involving 7 individuals, 5 from school A and 2 from school B. The research revealed that the goal of the schools in embracing greener building standards was observed. However, the hindrances to its adoption are obvious, particularly those of a specialized and cultural origin. These hindrances include lack of money for minimising building repair costs, absence of pin-pointers for assessing building feasible, high start-up capital outlay, the technological level and novelty amongst architects, planners and engineers.

A study by [14] focused on the measures to be undertaken by adopting green concept for Nigerian public institutions towards effective administration of public properties such as military and police barracks and stations. The researcher observed the properties to gather information because the military and police headquarters in Anambra State refused to grant interviews. Secondary data sources were also used. The study revealed that their management is not green conscious in building design and environmental management. The rampant use of generators both at the Headquarters and military quarters - the majority of which are sub-standard rather than the embrace of regular ventilation and lighting in their design is a practical sign of a country which is not aware of the connection between environment, good health and economic development. The author suggested the need to reduce to the absolute minimum the use of non-inexhaustible resources, manage sustainable resources to achieve sustainability and reduce toxic and harmful emissions to the environment.

In Israel, [11] analysed the costs, economic advantages and teacher satisfaction concerning building green schools. The study was the first attempt at analyzing some of the first green sustainable schools in Israel. The study relied on secondary data from the findings of previous research and also a well-developed questionnaire. The research revealed that schools built with conventional construction methods have an average cost of 14.5% lower than comparing green sustainable schools. The authors discovered a wide scope of expenses of green schools, some of them built with a particularly high budget. Also, it was revealed that economic benefits are direct benefits, associating with energy and water consumption of the school buildings analyzed. Finally, of all the four schools examined, 92 staff members showed outstanding satisfaction with the green school classrooms.

Based on the above empirical reviews, it is obvious that some studies have been conducted in schools/educational institutions on the adoption of green buildings in Nigeria. However, majority of the studies focused on lecturers and property development practitioners at the expense of students, who are the primary users of buildings in educational institutions. Therefore, this study is expected to bridge this gap in literature by extending the body of knowledge in Nigerian universities particularly in Ogun State.

3. Methodology

This study adopted the survey method by administering questionnaires to 101 final year students of the Departments of Estate Management, Building Technology and Architecture in order to ascertain their perception on green building embrace in universities. Data was processed using the Statistical Package for Social Scientists (SPSS), descriptive statistics was then used to analyse the data. Specifically, percentages, weighted mean and Relative Importance Index (RII) were adopted for the analysis. The mean and RII were measured using a five-point Likert scale of 5 – Strongly Agree, 4 - Agree, 3 - Undecided, 2 - Disagree and 1 - Strongly Disagree. Five variables in line with the recommendation of the BREEAM and LEED were used to measure the degree of adoption of green building standards. Inclusively, twelve

variables formed the crux by which students' perception of the benefits and barriers to green building adoption in universities were measured.

4. Results and Discussion

Out of the one hundred and one (101) questionnaires administered on the final year students of the Departments of Estate Management, Building Technology and Architecture, a response rate of 94% was achieved. The analyses to achieve the aim of the research are contained in the sections below.

4.1 Bio-data of Respondents

The analysis on the demographic factors of the students revealed that a greater percentage (37.89%) of the respondents are from the Department of Architecture, male (51.58%) and between the age range of 20-30 years old (85.26%).

4.2 Knowledge of Green Building

The students were requested to quantify their level of knowledge on green building and its principles. Table 2 depicts their responses.

Table 2. Knowledge of Green Building Principles.

Knowledge of Green Building	Frequency	Percentage (%)
Excellent	17	17.89
Very Good	37	38.95
Good	30	31.58
Fair	10	10.53
Poor	1	1.05

Table 2 shows that 88.42% of the respondents have a good or better knowledge of green building, This is only logical because they are final year students of the built environment, therefore they are suitable to give reliable opinions on the subject matter.

4.3 Students' Perception on the Degree of Covenant University's Adoption of Green Building Principles.

The students were asked to state their perception on the degree of Covenant University's adoption of green building standards on a 5-point Likert scale rating. The variables used were based on the recommendations of the BREEAM and LEED. The analyses of Table 3 show their responses.

Table 3. Degree of Covenant University's Embrace on Green Building Principles. (Students' Perception).

S/N	Green Building Principles	5	4	3	2	1	Mean	Rank
1	Livable communities - Covenant University community is good and secure, has affordable and proper accommodation and transportation choices, and offers steady community features and services	48	43	3	1	0	4.45	1st
2	Energy efficiency - Covenant University uses less energy to perform the same task e.g use of a compact fluorescent bulb than a traditional incandescent bulb, well located windows that aid ventilation e.t.c	29	14	42	5	5	3.6	2nd
3	Indoor Air Quality (IAQ) - The quality of indoor air within Covenant University is healthy and comfortable for students and staff	5	35	45	7	3	3.34	3rd
4	Resource conservation - Valuable resources such as trees, minerals, wildlife, water and others are ethically used and protected in Covenant University	3	4	40	43	5	2.55	5th
5	Water conservation - There is adequate preservation, control and development of water resources in Covenant University i.e. both surface and groundwater.	1	30	41	14	9	3.00	4th

Analyses in Table 3 reveal students' views on the degree of Covenant University's adoption of green principles in building. The students strongly agree that the university is safe and secure, has affordable and proper accommodation and transportation choices, and offers steady community features and services. Also, with a mean score of 3.6, they agree that the university adopt the principle of energy efficiency. However, they are not sure of the extent to which the university adopts the principles of indoor air quality (mean score = 3.34), water (mean = 3.00) and resource conservation (mean score = 2.55).

4.4 Students' View on the Gains of Adopting Green Principles in Buildings within the University.

This section analyses the advantages of green building as perceived by the students. Table 4 illustrates students' perceived gains of embracing green standards in the university's edifices.

Table 4. Students' View on the Gains of Adopting Green Principles in Buildings within the University.

S/N	Benefits	5	4	3	2	1	Total	RII	Rank
1	Reduction in pollution and environmental degradation	43	48	3	0	1	95	0.88	2nd
2	Energy efficiency & water conservation	38	50	6	1	0	95	0.86	3rd
3	Improve indoor air and water quality	48	44	3	0	0	95	0.89	1st
4	Protect biodiversity and ecosystems	43	38	13	1	0	95	0.86	3rd
5	Minimize strain on local infrastructure	21	40	17	16	1	95	0.73	11th
6	Protect students' health and comfort	14	42	29	10	0	95	0.76	9th
7	Improve quality of life	28	40	23	4	0	95	0.79	7th
8	Set a standard for future design and construction	18	46	25	6	0	95	0.73	11th
9	Facilitate a culture of best practice sharing	23	40	26	4	2	95	0.76	9th
10	Reduce operation cost	29	41	23	1	1	95	0.80	6th
11	Improve occupants' productivity	25	38	27	4	1	95	0.77	8th
12	Lower utility cost of building	36	43	16	0	0	95	0.84	5th

Table 4 indicates the students' perspective on the gains of adopting green principles in buildings. From the analysis, the five major gains were: to improve indoor air and water quality, to reduce pollution and environmental degradation, to conserve energy and water, to protect biodiversity and ecosystems and to lower utility cost of building. However, they are not convinced that adopting green building can minimize strain on local infrastructure and set a standard for future design and construction.

4.5 Students' View on the Obstacles to the Adoption of Green Principles in Building

The views of the students were sought on the impediments to the adoption of green principles in university. Table 5 shows the perception of the students.

Table 5. Students' View on the Obstacles to Adopting Green Principles in Buildings within the University.

S/N	Obstacles	5	4	3	2	1	Total	RII	Rank
1	Enormous price tag of green building technology	52	36	6	0	1	95	0.89	2nd
2	Ignorance on expert knowledge and mastery on green buildings	48	44	2	1	0	95	0.89	2nd
3	Ignorance on green building principles and merits	54	39	2	0	0	95	0.91	1st
4	Green technology in building is time consuming	19	36	31	9	0	95	0.74	12th
5	Resistance to change from the use of traditional principles/absence of interest	38	49	4	3	1	95	0.85	6th
6	Complex and strict requirements involved in adopting green standards in building	31	55	8	1	0	95	0.84	7th
7	Ignorance on green building principles promotion by government	38	53	4	0	0	95	0.87	4th
8	Risk and uncertainty involved in adopting green building principles	24	53	15	3	0	95	0.81	11th
9	Ignorance on demonstration projects	39	44	7	3	2	95	0.84	7th
10	Ignorance on information on green building principles	35	45	7	8	0	95	0.83	10th
11	Conflicts of interests among various stakeholders in adopting green building	37	44	10	4	0	95	0.84	7th
12	Ignorance on importance attached to green building principles by management of universities.	46	38	7	4	0	95	0.87	4th

Table 5 reveals what students identified as obstacles to adopting green principles in buildings within the university. According to them, ignorance on green building principles and their benefits ranked 1st with RII of 0.91, enormous price tag of green building technology and ignorance on expert knowledge and mastery on green building ranked 2nd with RII of 0.89, ignorance on green building principles promotion by government and ignorance on importance attached to green building principles by management of universities ranked 4th with RII of 0.87.

5. **Conclusion and Recommendations**

This study investigated students' views on the embrace of green principles in buildings within Covenant University, Ota, Ogun State, Nigeria. Findings signified that the level of adoption in the university is very low and the likely hindrance to its adoption is ignorance. This outcome supports the work of [13, 14, 27, 28]. Based on the results of this research, the authors recommend promotion of consciousness to the benefits of green building within the university environment and among the university management. Also, to make green building adoption attractive, its high cost should be reduced. Finally, government should promote the use of green building principles particularly in educational institutions.

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