

BOOK OF PROCEEDINGS

For the

**ENUGU STATE UNIVERSITY OF SCIENCE &
TECHNOLOGY, AGBANI**

FACULTY OF ENVIRONMENTAL SCIENCES (FES)

1ST Research Conference –RECONFES 001

Theme:

ONLY One Earth

On Wednesday, 8th June, 2022

At ESUT Business School, Enugu

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FORWARD

World Environment Day (WED) is an annual programme instituted 50 years ago in 1972 at Stockholm. It was formed to take place on the 5th June every year. It is aimed at living sustainably in harmony with nature, bringing transformative changes through policy and our choices towards cleaner and greener lifestyles.

The faculty organized this conference being our own way of joining the moving train and the good intentions of the proponents of WED. The conference is a gathering of intellectuals across the academic landscape of the faculty of environmental success in various universities.

In the quest to add value to our academic pursuit, this year's theme "Only One Earth" drew a lot of articles from across the universities contributing to the growth of environmental sustainability.

The conference would not have been such a resounding success without the support of eminent professors, erudite scholars; men and women who have the interest of our common good (the earth) at heart. And of course our LOC ably led by Dr E. Nnadi. A conference provides a veritable meeting ground for paper presentation, discussions and socializing.

The quality papers presented in this conference will be published in our faculty journal "African Research Journal of the Environment", after they have been thoroughly reviewed.

We thank all the participants for their invaluable contributions

Arc Dr. Augusta Emenike
Ag Dean Fes

Acknowledgement

Our sincere appreciation goes to the visitor and the governor of Enugu state, Rt. Hon. Ifeanyi Ugwuayi who gave ESUT a dynamic, digital and hardworking Vice Chancellor at this critical time. The academic and body language of Prof Michael-Aloysius Okolie gave us confidence to embark on this huge task. We have confidence that the university's performance shall be applauded in the next NUC ranking.

We commend the humble and focused dean of the most online friendly faculty in ESUT, A/Prof Augusta Emenike for her strong will and teaming up with the right minds towards moving the faculty forward. We specifically appreciate the keynote speaker in person of Prof Kingsley Ogboi, the dean of Faculty of Environmental Sciences, UNEC. Thanks for making it to this event despite your tight schedule.

Appreciation also goes to the Professors in our faculty, the scientific committee members, the LOC, the authors, the delegates and most remarkably, the faculty staffs and the postgraduate students for their cooperation and contributions towards the success of this conference.

Finally we are grateful to the Director and staff of Esut Business School for perfect logistics and necessary supports provided. Any error found in this work is unintended and therefore highly regretted. Be free to send your comments to reconfes@esut.edu.ng as we look forward to future events. Kindly accept our best within the national constraints.

Thanks

Dr Ezekiel Ejiofor Nnadi

For: Editorial/LOC Team

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Geopolymer technology involves production of cementless, environmental-friendly concrete which is synthesized from agriculture by-products such as Rice Husk Ash (RHA), Cassava Peel Ash (CPA) and earth explore product like Metakaolin (MK) with merits to decrease the enormous amount of agricultural waste and earth explore materials as well as the contribution in carbon footprint annually. The study therefore explored the development of alkali-activated CPA-SHA-MK ternary blended geopolymer mortar (GPM) using sodium silicate (Na_2Si_3) and sodium hydroxide (NAOH) solution with 9M constant concentration as alkaline activators under both the aggressive and ambient-temperature curing media. The mass ratio of sodium silicate to sodium hydroxide (NS:NH) and as well as the binder to fine aggregate were fixed to 2.5 and 0.8 respectively. It also analysed the extent to which the Supplementary Cementitious Materials (SCMs) improves the durability performance of the product. The durability of the ternary blended geopolymer mortar was examined through water absorption test, acid resistance test and sulphate resistance test using 50 mm cubes after 28, 56 and 90 days of curing. The results revealed that the setting time prolonged as the replacement levels of RHA-MK increased at a decrease in replacement levels of CPA. The results also showed that the mortar cured in sulphate solution as well as the sulphuric acid showed white precipitate on the reference specimen (PCM) with rounded edges and the GPM incorporated SCMs and activators (C90M7R3, C70M20R10, C50M33R17, C30M47R23 and C10M60R30) showed a little dark colour at all ages. The GPM discovered to be more resistance to water absorption as compared to PCM while it was observed that the absorption increases as the hydration periods increases. Furthermore, both the PCM and GPM samples studied suffered mass and strength losses in both the acid and sulphate solution and the loss increases at an increase in the hydration periods while the loss as caused by sulphuric acid is more pronounced. The losses were observed to be higher in PCM as compared to the GPMs while the mix incorporated 50% CPA, 33% MK and 17% RHA (C50M33R17) was observed to be better compared to other mixes in durability behaviour and the study therefore recommends C50M33R17 for good durability performance.

Keywords: Durability, Geopolymer, Rice Husk Ash (RHA), Cassava Peel Ash (CPA) and Metakaolin (MK).

GREEN BUILDING STRATEGIES: THE WAY FORWARD FOR EBONYI STATE, NIGERIA

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Abstract

Green Building Strategies: The Way Forward for Ebonyi State, Nigeria” was a study carried out to determine the feasibility for the adoption of green building strategies in Ebonyi State. It has two specific objectives as follows: to identify the benefits of green buildings over conventional buildings; and to evaluate the challenges of green buildings over conventional buildings. Two research questions and two null hypotheses guided the study. The study used descriptive survey design. The area of study was Ebonyi State in Southeast Region, Nigeria. The population of the study was 56 architects who were members of the Nigerian Institute of Architects, Abakaliki Branch. There was no sample size as the whole population was used for the study. The two research questions were analysed using mean and standard deviation while the two null hypotheses were tested using Chi-square statistic at 0.05 level of significance. The results of the study showed that there are significant benefits of green building over conventional buildings for its adoption in Ebonyi State ($\chi^2=46.08$ at $P<0.05$); and there are significant challenges or problems of green buildings over conventional buildings for their adoption in Ebonyi State ($\chi^2=32$ at $P<0.05$). The conclusion of the study was that green buildings have significant benefits as well as significant problems or challenges. The study recommended that the Ebonyi State should not adopt green building strategies until the identified challenges have been fully mitigated.

Key Words: Green Building, Strategies

INTRODUCTION

Background of the Study

The green building concept has gained momentum recently in developed and developing nations because of the negative impact of carbon dioxide and other dangerous gases' emissions into the atmosphere from conventional buildings which have resulted in global warming and their negative impacts worldwide especially changes in weather and

climate on Earth. Green Building (GB) was defined by the Organisation for Economic Co-operation and Development (OECD, 2003) as those buildings that have minimum adverse effects on the built and natural environment, in terms of the buildings themselves, their immediate surroundings and the broader regional and global setting. According to OECD, a green building is designed to minimize the total environmental impact of its materials, construction, operation and deconstruction while maximizing opportunities for indoor environmental quality and performance. Green buildings are constructed and operated in ways that enhance their impact on the building occupants while reducing impacts on the environment.

Jain (2009) defined green building as one which adopts the best practices of environmental technology for optimizing the use of natural resources for providing clean and cost effective working ambience. Green buildings minimize the consumption of materials and maximize their reuse; create quality buildings that are commercially viable; minimize energy consumption and greenhouse gas emissions; adopt environmentally sound and healthy work practices during and after construction. Green building is also known as sustainable building. It is both structure and the application of processes that are environmentally responsible and resource-efficient throughout a buildings life-cycle: from planning to design, construction, operation, maintenance, renovation and demolition (Wiki, 2021). A sustainable building is a structure that is designed, built, renovated, operated or reused in an ecological and resource efficient manner. Consequently, a green building has these attributes: it has eco-friendly structure and environment; it utilizes minimum natural resources; it is sustainable-has internal means of generating resources; it conserves energy by means of smart devices and uses recyclable materials. It is designed to use the standard elements of building-walls, windows and floors to collect, store and release energy from the sun for heating, lighting and cooling (Jain, 2009).

The need to evaluate the usefulness of green building concept with a view to adopting it in Ebonyi State at this time of her socio-economic development cannot be overemphasized. The study therefore, sought to determine the way forward for green buildings over conventional buildings in Ebonyi State, using the benefits and challenges. In this study, strategy is defined as a plan intended to be used to achieve a given task or goal (Hornby,2015).

Statement of the Problem

Conventional buildings consume too much energy in terms of electricity and this affects the finances of occupants negatively. The problem of rising energy charge in Nigeria is affecting both the rich and poor in urban centres especially residents of Ebonyi State. Monthly electricity bills from Enugu Electricity Distribution Company (EEDC) for a three bedroom flat in Abakaliki hovers between N15000 and N18000 and that is impacting negatively on people's meager incomes. Aside high energy costs, maintenance and operational costs increase as the buildings get old. Residents of major towns in Ebonyi State are in dire need of environmentally friendly houses that can lower energy and maintenance costs. Before green building strategies can be considered for adoption in Ebonyi State, there is need to provide answers to the following

nagging questions: What are the benefits of green buildings? What are the problems or challenges of green buildings? Given the above situation, and the need to properly evaluate the new concept of green building before its adoption in the state, it became imperative to undertake the study on “Green Building Strategies: The Way Forward for Ebonyi State, Nigeria.”

Aims and Objectives of the Study

The main aim of the study was to determine green building strategies-the way forward for Ebonyi State, Nigeria. The specific objectives of the study were:

- To identify the benefits of green building over conventional building for its adoption in Ebonyi State; and
- To appraise the challenges of green building over conventional building for its adoption in Ebonyi State.

Scope of the Study

This study covers the following:

- Academic scope- benefits and challenges of green buildings.
- Geographical scope- Ebonyi State, Southeast Region, Nigeria.

Research Questions

The following research questions guided the study:

- What are the benefits of green building over conventional building for its adoption in Ebonyi State?
- What are the challenges of green building over conventional building for its in Ebonyi State?

Research Hypothesis

The study tested the following null hypotheses at 0.05 level of significance:

H₀₁: There are no significant benefits of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria.

H₀₂: There are no significant challenges of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria.

2.0 LITERATURE REVIEW

2.1 Conceptual Review

Benefits of Green Buildings

On the other hand, studies by Davies (2006), Sarma (2014) and Dahiru, Dania and Adejoh (2014), showed that green buildings have these benefits: reduce energy consumption, reduce water consumption. They are cost efficient to run, reduce operational costs, preserve natural resources, reduce greenhouse emissions and improve the quality of life and health of occupants. Other benefits of green buildings according to experts (Jain, 2009; Giduthuri and Vanakuru, 2017 and Ismaila, et al, 2021) are as follows:

- Green buildings have lower running costs by using natural ventilation, energy saving lighting, heating and cooling systems resulting in savings.
- They have lower maintenance costs by using intelligent and sophisticated technology for monitoring all devices installed in the building and so can alert the occupants of imminent faults thus, saving more costly maintenance at a later date.
- Increased productivity-by providing an environment that is capable of adapting to individual or collective requirements thereby producing a comfortable work environment that help people to raise their productivity at work.
- It adapts to changes in the environment because of its robust design and so can respond to personal or group changing requirements, mood and taste.
- Economically, a green building may cost more up front but saves costs through lower operating costs over the life of the building.
- Other benefits are that they improve the health of the occupants, comfort, reduce pollution and landfill wastes.
- They minimize the consumption of materials and maximizes their reuse; creates a quality building that is commercially viable; minimizes energy consumption and greenhouse gas emissions; adopts environmentally sound and healthy work practices, during both construction and occupancy.
- They have higher occupancy rate and lower tenant turnover; they protect and conserve the environment; average increase in building value is about 7.5% (McGraw Hill, 2006). According to Green Building Council of Australia (2006), green buildings have higher relative return on investment (minimum of 14%).

Given the financial and economic benefits of green building in other parts of the world especially in developed nations as revealed by literature, there is a need to examine the challenges that may militate against its adoption in Ebonyi State. Studies in the United States of America have found that every conventional building is producing 40% of carbon dioxide in the environment. Carbon dioxide produces green house effects by depleting the ozone layer (Shabrin and Kashem, 2017).

Challenges of Green Buildings

Production of green buildings has many challenges or problems despite the benefits. The major challenges are: design difficulties; scarcity of materials; how to minimize energy usage; how to minimize external pollution; how to reduce embodied energy and resource depletion; how to reduce internal pollution and damage to human health (Jain, 2009). Other researchers and experts such as Onyia, Chime, Nnam, Ifeanyi and Agbatah (2019); Giduthuri and Vanakuru, 2017; Ismaila, Egbo, Kigun and Ayoola (2021); Dahiru, Dania and Adejoh (2014) identified other challenges facing the adoption of green building strategies in developing countries including Nigeria as follows: lack of enabling environment; lack of technology to produce green building materials; lack of interest in the issue of sustainability; uncertainty in economic environment; lack of awareness of the existence of green building concepts and lack of green building materials. On the other hand, conventional buildings do not face those problems that green buildings are associated with and besides technologies and materials abound everywhere.

2.2 Empirical Review

Ismaila, Egbo, Kigun and Ayoola (2021), conducted a study on “The Challenges and Prospects of Green Building Construction for Sustainable Urbanisation in Jos Metropolis, Nigeria.” They found that green building was not being adopted and constructed in Jos Metropolis despite the need because there was no awareness on green building concept and developers preferred conventional buildings to green buildings. The study also identified the benefits of green buildings as preservation of natural resources and increase in health and productivity of occupants.

Zhao, Wang, Qiu, Qu and Zhang (2018), carried out a study titled, “Research on the Application of Green Building Materials in China.” The study found that companies and individuals that wanted to apply green building materials faced challenges of lack of enough green building materials; high cost of technological inputs and raw materials for the production of green building materials; and lack of government support to those that want to construct green buildings.

Ogbonna, Obinka and Aguguo (2017), carried out a study on “Property Development and Land Use Planning Regulations in Nigeria.” The area of study was Abia State in Nigeria. The study found that the level of compliance to building regulations was insignificant and that the level of compliance to building regulations between buildings constructed in urban areas and those constructed in sub-urban areas was significant. They recommended that Abia State Government should prepare up-to-date land use plans for various categories of towns in urban and rural areas of the state.

Dahiru, Dania and Adejoh (2014), conducted a study on “An Investigation into the Prospects of Green Building Practice in Nigeria,” and found that green building was not practiced in Nigeria due to lack of awareness; harsh economic conditions and lack of enabling environment in form of government policy or legislation. It identified health and increase in productivity as benefits of green building.

The study by Sarma (2014) on “Problem, Progress and Prospect of Green Building as a means of Sustainable Urbanization with special reference to Guwahati City of Assam, India,”

found that green building construction would benefit Guwahati City by reducing energy consumption, bring economic and financial growth and gains; reduce wastes and would make buildings cost efficient to run.

3.0 METHODS

The study used survey design. The area of study was Abakaliki Metropolis of Ebonyi State, Southeast Region in Nigeria. The population of study was 56 architects who were members of Nigerian Institute of Architects, Abakaliki Branch. There was no sample size as the whole population was used. The instrument for data collection was a questionnaire containing two sections with 8 items per section making it 16 items. It was structured on a five point Likert Type scale of Strongly Agree (SA), Agree (A), Undecided (UD), Strongly Disagree (SD) and Disagree (D). They were assigned weights of 5,4,3,2 and 1 respectively. The research questions were analysed using mean and standard deviation while the null hypotheses were tested using Chi-square statistic. 56 copies of the questionnaire were distributed to the respondents but only 50 copies were returned. The return rate was 89.29%. Analysis of the research questions were based on 50 copies. Criteria for accepting that respondents agreed on an item was that the calculated mean value should be equal to or greater than 3.00 while standard deviation score should be less than 1.0. In the test of hypothesis, null hypothesis or H_0 , was accepted if the Chi-square table value was greater than Chi-square calculated value at 0.05 significant level and at appropriate degree of freedom.

4.0 RESULTS

Presentation of Data Relating to Research Questions

Research Questions 1: What are the benefits of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria?

Table 4.1: Summary of respondents' views and mean scores of significant benefits of green building showed that there were eight benefits of green building, namely: lowers running and maintenance costs; improves health of occupants; reduces environmental pollution and landfills; minimizes consumption of materials and maximizes their reuse; increases productivity of occupants; minimizes energy consumption and green house emissions; have higher occupancy rate and lower turnover; have higher relative return on investment. Mean score for each benefit was greater than 3.0 and were 4.52, 4.46, 4.38, 4.36, 4.24, 4.60, 4.52 and 4.36 respectively. Grand mean value was 4.88. Standard deviation value for each benefit was less than 1.0. It

ranged from 0.60 to 0.68. Grand standard deviation value was 0.64. The standard deviation values clustered about the mean, showing homogeneity in agreement by the respondents. They agreed that green building had the eight (8) benefits.

Table 4.1: Summary of respondents' views and mean scores on significant benefits of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria

S/N	Benefits of Green Building	SA	A	UD	SD	D	Total	X	SD	Rmk
1	Lowers running and maintenance costs	26	24	0	0	0	50	4.52	0.66	Agree
2	Improves health of occupants	25	23	2	0	0	50	4.46	0.64	Agree
3	Reduces environmental pollution and landfill wastes	25	24	1	0	0	50	4.80	0.65	Agree
4	Minimizes consumption and maximizes reuse of materials	20	28	2	0	0	50	4.36	0.62	Agree
5	Increases productivity of occupants	18	26	6	0	0	50	4.24	0.50	Agree
6	Minimizes energy consumption and green gas emissions	30	20	0	0	0	50	4.60	0.68	Agree
7	Have higher occupancy rate and lower turnover	26	24	0	0	0	50	4.52	0.66	Agree
8	Have higher relative return on investment	20	28	2	0	0	50	4.36	0.62	Agree

	Grand Total								35.54	5.13	
	Grand Mean								4.88	0.64	Agree

Source: Field Survey, 2021

Research Questions 2: What are the challenges of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria?

Table 4.2: Summary of respondents' views and mean scores of challenges of green buildings over conventional ones showed that there were seven of such challenges, namely: lack of government policy legislation at federal and state levels for its adoption; lack of technology for the production of green building materials in Nigeria; lack of interest on issue of sustainability by most Nigerians; lack of awareness of the existence of green building concept by the public; . lack of experience on design of green buildings by Nigerian architects; uncertainty in Nigerian economic environment; and lack of green building materials. Mean score for each challenge of green building was greater than 3.0 and were 4.56, 4.60, 4.46, 4.53, 4.56, 4.40 and 4.56 respectively. Grand mean value was 4.52. Standard deviation value for each challenge was less than 1.0. It ranged from 0.63 to 0.68. Grand standard deviation value was 0.66. The standard deviation values clustered about the mean, showing homogeneity in agreement by the respondents. They agreed that there were eight challenges of green building strategies over conventional buildings.

Table 4.2: Summary of respondents' views and mean scores on challenges of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria

S/N	Challenges of green buildings	SA	A	UD	SD	D	Total	X	SD	Rmk
1	Lack of government policy legislation at federal and state levels for its adoption	30	18	2	0	0	50	4.56	0.67	Agree
2	Lack of technology for the production of green building materials in Nigeria	32	16	2	0	0	50	4.60	0.68	Agree
3	Lack of interest on issue of sustainability by most	25	23	2	0	0	50	4.46	0.64	Agree

	Nigerians									
4	Lack of awareness of the existence of green building concept by the public	26	24	0	0	0	50	4.53	0.66	Agree
5	Lack of experience on design of green buildings by Nigerian architects	28	22	0	0	0	50	4.56	0.67	Agree
6	Uncertainty in Nigerian economic environment	22	26	2	0	0	50	4.40	0.63	Agree
7	Lack of green building materials	28	22	0	0	0	50	4.56	0.67	Agree
	Grand Total							31.66	4.62	
	Grand Mean							4.52	0.66	Agree

Source: Field Survey, 2021

Testing Hypotheses

Hypothesis 1

HO₁: There are no significant benefits of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria.

Hypothesis 1 was tested using data from Table 4.1 above and table 4.3 below. Table 4.1 showed that the grand mean score for respondents was 4.88 with standard deviation score of 0.64 while Chi-square calculated value was 46.08 (see table 4.3 below). With 15 degrees of freedom at 0.05 level of significance, Chi-square critical value is 24.996. Since Chi-square calculated value of 46.08 was greater than Chi-square critical value of 24.996, HO was rejected while Hi was accepted, showing that there were significant benefits of green buildings over conventional buildings for adoption in Ebonyi State. The result is statistically significant. The evidence was that “there are significant benefits of green buildings over conventional buildings for adoption in

Ebonyi State.” In other words, adoption of green building strategies in Ebonyi State will bring significant benefits to the adopters, occupants and users compared with conventional buildings.

Table 4.3: Observed and Expected Frequency for Testing Hypothesis 1

Response	Observed O	Expected E	O – E	(O -E) ²	Σ(O-E) ²
Yes	49	25	24	576	23.04
No	1	25	-24	576	23.04
Total	50	50	-	χ^2	46.08

Source: Field Survey, 2021

Hypothesis 2

HO₂: There are no significant challenges of green buildings over conventional buildings adoption in Ebonyi State, Nigeria.

Hypothesis 2 was tested using data from Table 4.2 above and table 4.4 below. Table 4.2 showed that the grand mean score for respondents was 4.52 with standard deviation score of 0.66 while Chi-square calculated value was 32 (see table 4.4 below). With 15 degrees of freedom at 0.05 level of significance, Chi-square critical value was 24.996. Since Chi-square calculated value of 32 was greater than Chi-square critical value of 24.996, HO was rejected while Hi was accepted, showing that there were significant challenges of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria. The result is statistically significant. The evidence was that “There are significant challenges on green buildings for adoption in Ebonyi State, Nigeria.” In other words, there are challenges or problems which green buildings have that militate against adoption in Ebonyi State.

Table 4.4: Observed and Expected Frequency for Testing Hypothesis 2

Response	Observed O	Expected E	O – E	(O -E) ²	Σ(O-E) ²
Yes	45	25	20	400	16
No	5	25	-20	400	16

Total	50	50	-	χ^2	32
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Source: Field Survey, 2021

Discussion of Findings

Test of Hypothesis I

Test of hypothesis 1 found that “there are significant benefits of green building over conventional buildings for adoption in Ebonyi State, Nigeria.” Eight (8) benefits were identified in analysis of Research Question 1 as follows: lowers running and maintenance costs, improves health of occupants, reduces environmental pollution and landfills, minimizes consumption of materials and maximizes their reuse, increases productivity of occupants, minimizes energy consumption and green house emissions; have higher occupancy rate and lower turnover; and have higher relative return on investment. The finding was in line with the findings of Ismaila, Egbo, Kigun and Ayoola (2021), in their study on “The Challenges and Prospects of Green Building Construction for Sustainable Urbanisation in Jos Metropolis, Nigeria.” The study identified the benefits of green buildings as preservation of natural resources and increase in health and productivity of occupants. The study by Dahiru, Dania and Adejoh (2014), on “An Investigation into the Prospects of Green Building Practice in Nigeria,” found that green building improved health and increase in productivity of occupants. The study by Sarma (2014) on “Problem, Progress and Prospect of Green Building as a means of Sustainable Urbanization with special reference to Guwahati City of Assam, India,” found that green building construction would benefit Guwahati City by reducing energy consumption, bring economic and financial growth and gains; reduce wastes and would make buildings cost efficient to run.

Test of Hypothesis 2

Test of hypothesis 2 found that “There were significant challenges of green buildings over conventional buildings for adoption in Ebonyi State, Nigeria. The challenges were seven, namely: lack of government policy legislation at federal and state levels for its adoption; lack of technology for the production of green building materials in Nigeria; lack of interest on issue of sustainability by most Nigerians; lack of awareness of the existence of green building concept by the public; . lack of experience on design of green buildings by Nigerian architects; uncertainty

in Nigerian economic environment; and lack of green building materials. This finding is consistent with the findings of Zhao, Wang, Qiu, Qu and Zhang (2018) in their study titled “Research on the Application of Green Building Materials in China.” They found that companies and individuals that wanted to apply green building materials faced challenges of lack of enough green building materials; high cost of technological inputs and lack of raw materials for the production of green building materials; and lack of government support to those that wanted to construct green buildings. The study by Dahiru, Dania and Adejoh (2014) titled “An Investigation into the Prospects of Green Building Practice in Nigeria,” found that green building was not practiced in Nigeria due to lack of awareness; harsh economic conditions and lack of enabling environment in form of government policy or legislation. Also the study by Ismaila, Egbo, Kigun and Ayoola (2021) titled “The Challenges and Prospects of Green Building Construction for Sustainable Urbanisation in Jos Metropolis, Nigeria” found that green building was not being practiced in Jos Metropolis despite the need because there was no awareness on green building concept and developers preferred conventional buildings to green buildings.

Conclusion

Two conclusions can be drawn from the study. Firstly, there are eight significant benefits of green buildings, namely: it lowers running and maintenance costs; improves health of occupants; reduces environmental pollution and landfills; minimizes consumption of materials and maximizes their reuse; increases productivity of occupants; minimizes energy consumption and green house emissions; have higher occupancy rate and lower turnover; and have higher relative return on investment. Secondly, there are also seven significant challenges or problems that face green building concepts, namely: lack of government policy legislation at federal and state levels for its adoption; lack of technology for the production of green building materials in Nigeria; lack of interest on issue of sustainability by most Nigerians; lack of awareness of the existence of green building concept by the public; lack of experience on design of green buildings by Nigerian architects; uncertainty in Nigerian economic environment; and lack of green building materials.

Recommendations

The study recommended that Ebonyi State should not rush to adopt green building strategies until all the identified seven problems or challenges have been mitigated fully. Secondly, the

Federal Government of Nigeria should organize seminars in all the states in Nigeria to create awareness of the existence of the concept and benefits of green building. Thirdly, Nigerian architects and builders should be trained on design and production of green buildings. Fourthly, the Federal Government of Nigeria should fund research on green building materials and the technology for their production in cooperation with private businesses.

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