

GREEN CONSTRUCTION: EMBRACING A SUSTAINABLE FUTURE FOR ALL STAKEHOLDERS

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ABSTRACT

The principle, idea and ideology behind sustainability is itself giving birth to other concepts, one of which is Green Construction. The potentials of and for green construction in developing economies such as Nigeria has been scarcely researched. Hence this study focuses on green construction as a strategy for sustainable growth and development in the construction sector (and by extension, the economy at large) of Nigeria. Nigeria is used as study area in this study. The aim of the study among others is to: *i.* determine the extent to which green construction would impact sustainability of environmental and natural resources in Nigeria, *ii.* determine the extent to which green construction would impact in overall sustainable development in Nigeria. Ten (10) states with a booming construction industry in Nigeria are identified for the purpose of this study. The states include Lagos, Ogun, Oyo, Edo, Delta, Anambra, Imo, Abia, Akwa-Ibom and Cross River. These states are used as strata for the study. Stratified Purposive sampling technique is employed to select communities and respondents for the study. A sample size of 350 is achieved for the study. Descriptive statistics is used to test the two formulated hypotheses in the study. Among others, the findings of the study show that green construction would make significant impact in sustainability of environmental and natural resources in Nigeria. Based on the findings of the study, recommendations were made which include that, to avoid perpetuating the status quo of continual increase in CO₂ emission from the construction sector, decisive action is needed by policymakers, developers, construction material producers, financiers, at the local, national and regional level in line with global goals of bringing the emission of greenhouse gases to the barest possible minimum.

Keywords: Green construction, Green building technologies, Sustainable development, Environment, Environmental resources, Natural resources.

INTRODUCTION

Sustainable development has been a mantra both in academia and industry in recent years globally. The idea behind sustainable development or sustainability is that resources (especially natural) should be used in ways that would not leave irreparable long-term damages to the environment as a result of the exploration and usage of those resources. The idea behind sustainability also holds that environmental resources should be explored in ways that leave the future generation non-disadvantaged as a result of the exploration and usage of natural resources by previous generations.

In other words, the idea behind sustainability is centered around fairness, equity, and sense of responsibility regarding the use of natural and environmental resources. The principle, idea and ideology behind sustainability is itself giving birth to other concepts, one of which is Green Construction. Green Construction refers to implementing technologies and strategies aimed at reducing the global-warming-associated emissions from activities of construction and its value chain. Globally, construction (and its value chains) is reported to account for about 40% warming-associated emissions. In this regard, with regards to the global warming challenge(s) faced by the global economy today, construction as a sector and activity deserves some mention and attention (American Concrete Institute ACI, 2022; Business Wire, 2022). You cannot discuss emissions (or its reduction) without mention of the construction industry (and its allied sectors)

Regarding emerging markets (such as Sub-Saharan African nations), the lofty goal behind Green Construction is to reduce carbon emissions in construction value chains (including the construction and operation of buildings and the production of construction materials such as cement and steel). Emissions are known to produce global warming, which has been known to be a global challenge in recent years. Notable academic, industry, government and governance reports are of the opinion that warming-associated-emissions from construction is major component of the total of

emissions observed globally. According to International Finance Corporation IFC (2023), the challenges from construction-related emissions are real and pronounce in emerging economies such as Nigeria (and other Sub-Saharan African nations).

There is twist to this, most of the emerging economies (such as Nigeria and other Sub-Saharan African nations) depend on a thriving construction sector for the next several years for them to have an overall thriving economy. However, IFC (2023) reports that emerging economies account for about two-thirds of global construction-related emissions. How can a desirable balance be achieved?

Emerging economies (such as Nigeria and some other Sub-Saharan nations) need their economy to thrive. Traditionally, a thriving economy depends on booming construction sector. A booming construction sector unchecked and without regards to the environment poses a threat to the environment on the medium- and long-term given that emissions from construction sector are reported to account for 40% of emissions-associated global warming. Global warming is a real and substantial threat and problem to the global natural environment.

According to IFC (2023), without additional mitigation efforts, global construction-related emissions would increase by about 13 percent between 2022 and 2035, according to this report's estimates. This 13 percent increase relative to today's levels, driven by increasing emissions from emerging markets would be equivalent to the total emissions from the construction value chain in the United States in 2022. Global climate goals are unlikely to be achieved without a reduction in emissions from the construction and operation of buildings.

All hands should be on deck to solve or contribute solution to the global warming issue. All avenues for mitigating the already observed problem should be explored. Ignoring the global warming issue is potentially a global disaster, this is attested by several academic and industry reports. The potential prolongment or worsening of the global warming issue as a result of

ignoring the contributions made to it (global warming) by construction-related emissions should be abated or reversed.

Wang and Baniotopoulos (2023) conducted a study titled “Green Construction and Sustainable Development”. They explained that Green construction in civil engineering can play an important role in addressing the issue of reducing contamination of the natural environment and ecosystem. Green construction in civil engineering can be embraced and deployed as a strategy to decrease contamination, decrease waste of energy, and increase utilization ratio of resource. According to Wang & Baniotopoulos (2023), evidence suggests that green construction in civil engineering is among the most important factors for saving energy. Green construction is believed to enhance sustainable development.

Sinha, Gupta and Kutnar (2013) explained that Global sustainability goals have led to the development of the green building movement. They stated that Sustainable development and green buildings are often used interchangeably. Although, sustainable development and green buildings are related, they are not the same. Sustainability also governs decisions concerning building materials.

These studies can be said to have made remarkable contribution to the green construction literature, however, they do not address in specific terms the situation in the construction sector of Nigeria (and perhaps other Sub-Saharan African nations). There is thus the need for development and deployment of Green Construction techniques and technologies in emerging economies (who are reported to account for two-thirds of global-warming-associated emissions globally). This has given rise to carrying out such a study as this.

Aims and Objectives

The paper investigated the potentials of green construction for bringing about sustainable growth and development in Nigeria. However, specific objectives of the study are:

1. To determine the extent to which green

construction would impact sustainability of environmental and natural resources in Nigeria

2. To determine the extent to which green construction would impact in overall sustainable development in Nigeria

Literature Review

The Concept of Green Construction

Green Construction refers to construction of buildings in ways that reduce the environmental impacts of buildings to the barest minimum, while the building is productive for living in and/or work. It focusses on technology related to energy use in buildings as well as technologies responsible for indoor environmental quality within the building. The concerns regarding human-induced global warming, climate change, and other related challenges facing the environment (and earth at large) led to green construction as a possible mitigation or abatement (Cao, 2021; Caramichael & Rapp, 2022).

Green construction indeed could have the potential to save the day regarding these challenges. It is noteworthy that green construction is often referred by some scholars/authors as Green Building Technologies. The ideology and principle behind the two terminologies are largely the same. It is important to note that green technologies must not only support the primary role of buildings but also, where possible, support valuable secondary roles. In addition, to ensuring that they support their primary and secondary functions, the building must ensure that internal environmental conditions within the building are conducive to health and productivity (IPCC, 2015; Nielson, 2009).

According to Kamal (2020), the ideals of Green Construction are captured as follows: The goals that satisfy developments in green construction (technology) field include:

1. Sustainability: meeting the needs of society in ways that can continue indefinitely into the future without damaging or depleting natural resources.

2. “Cradle to cradle” design: ending the “cradle to grave” cycle of manufactured products, by creating products that can be fully reclaimed, reused or recycled.
3. Source reduction: reducing waste and pollution by changing patterns of production and consumption.
4. Innovation: developing alternative technologies rather than those that have been demonstrated to damage health and the environment.
5. “Safe environmental monitor”: applying digital energy-saving technologies for disaster prevention, caused by climate change.
6. Viability: creating a center of economic activity around technologies and products that benefit the environment, speeding their implementation and creating new careers that truly protect the planet.

STUDY AREA AND METHODS

Study Area

Nigeria is used as study area in this study. Nigeria is often called the "Giant of Africa." This name comes from the vastness of its land, the diversity of its peoples and languages, its huge population (the largest in Africa), and its oil and other natural resources. Six (6) geopolitical zones exist in the country, namely, North-West, North-Central, North-East, South-West, South-East and South-South

Nigeria lies within the tropical rain forests and savannas of West Africa. Much of Nigeria is covered with plains and savannas. These tropical grasslands spread out as far as the eye can see and are interrupted here and there by trees and shrubs. The southwestern plains are home to the Yoruba people, who have lived there for thousands of years.

At least 60 percent of Nigerians live below the poverty line, existing on less than a dollar a day. Unfair distribution of the country's oil wealth, as well as political, ethnic, and religious conflicts have put a strain on Nigerian society.

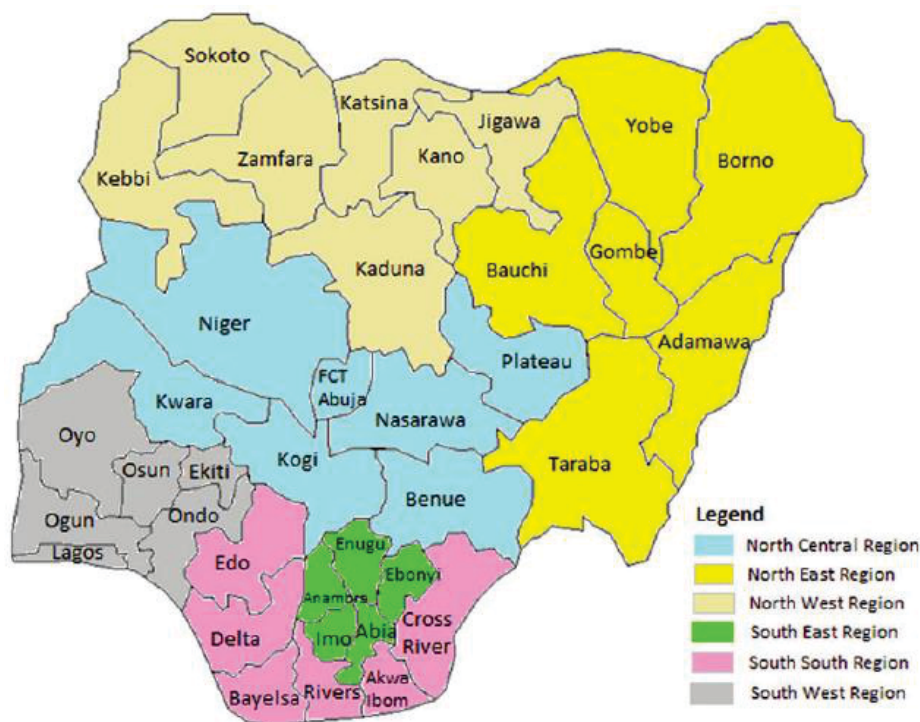


Figure 1: Map of Nigeria

Sampling

Data

The main research instrument to be used for data collection shall be 15-item structural questionnaire which is tagged "Questionnaire of Green Construction for Sustainable Future". The questionnaire is divided into 2 main sections. Section 'A' deals with the respondent's bio-data, section 'B' captures the situational variables reflecting the two (2) formulated hypotheses. The questionnaire was simply and carefully worded and designed for the purposes of not only easy understanding, comprehension and free flow communication with the respondents, but also to tackle the research problem under study. The instrument was subjected to 'face' and 'content' validation. Also, it measured the variables using the five Likert Scale as illustrated as follows: Strongly Agree =5, Agree=4, Undecided=3, Disagree=2, Strongly Disagree=1 respectively.

Ten (10) states with a booming construction industry in Nigeria are identified for the purpose of this study. The states include Lagos, Ogun, Oyo, Edo, Delta, Anambra, Imo, Abia, Akwa-Ibom and Cross River. These states are used as strata for the study. Stratified Purposive sampling technique is employed to select communities and respondents for the study. Purposive sampling in this case means identifying the very right set of persons who are in the best position to serve as sources of data for the study. In this case, this will be practitioners and/or researchers of construction or environment-related disciplines, jobs or vocations.

Therefore, in each of the states (strata) mentioned above, thirty-five (35) persons, who are practitioners and/or researchers of construction or environment-related disciplines, jobs or vocations will be interviewed as sources of data regarding the subject-matter being investigated. Thus, a sample size of 350 is achieved for the study.

Data Analysis

Descriptive statistics is used as statistical technique for this study. Descriptive statistics are

brief informational coefficients that summarize a given data set, which can be either a representation of the entire population or a sample of a population. Descriptive statistics are broken down into measures of central tendency and measures of variability (spread). Measures of central tendency include the [mean](#), [median](#), and [mode](#), while measures of variability include [standard deviation](#), [variance](#), minimum and maximum variables, [kurtosis](#), and [skewness](#).

RESULTS

Hypothesis One

Ho: Green construction would not make significant impact in sustainability of environmental and natural resources in Nigeria ($x \leq 3$)

Hi: Green construction would make significant impact in sustainability of environmental and natural resources in Nigeria ($x > 3$)

Table 1 shows that the descriptive statistics analysis on the Variable, Green construction Impact on sustainability of environmental and natural resources in the study area. Mean = 4.25, Median = 4.25, Mode = 4. Since the Mean is greater than the hypothetical mean (3.0, which represents indecision regarding the variable being measured), we do have enough evidence to reject Ho, which states that Green construction would not make significant impact in sustainability of environmental and natural resources in Nigeria. We therefore reject H_0 , accept H_1 , and conclude that Green construction would make significant impact in sustainability of environmental and natural resources in Nigeria

Table 1: Descriptive Statistics for Green Construction on Sustainability

Mean (x)	4.25
Median	4.25
Mode	4.00
Standard deviation (s)	0.954
Count (n)	350
Standard error of Mean (SEM)	0.051
Degrees of freedom (df)	349
Hypothesized mean (u)	3
alpha	0.05

Source: Field Work (2024).

Hypothesis Two

Ho: Green construction would not make significant impact in overall sustainable development in Nigeria ($x \leq 3$)

Hi: Green construction would make significant impact in overall sustainable development in Nigeria ($x > 3$)

Table 2 shows that the descriptive statistics analysis on the Variable, Green construction Impact on sustainability of environmental and natural resources in the study area. Mean = 4.0, Median = 4.00, Mode = 4.00.

Since the Mean, 4.0, is greater than the hypothetical mean (3.0, which represents indecision regarding the variable being measured), we do have enough evidence to reject Ho, which states that Green construction would not make significant impact in overall sustainable development in Nigeria. We therefore reject H_0 , accept H_1 , and conclude that Green construction would make significant impact in overall sustainable development in Nigeria

Table 2: One-sample t-test for Green Construction on Development

Mean (x)	4.0
Median	4.0
Mode	4.0
Standard deviation (s)	0.954261001
Count (n)	350
Standard error of Mean (SEM)	0.051007396
Degrees of freedom (df)	349
Hypothesized mean (u)	3
alpha	0.05

Source: Field Work (2024).

Discussion of findings

The findings of the first hypothesis show that Green construction would make significant impact in sustainability of environmental and natural resources in Nigeria. This indicates that deployment of green construction will make positive impact upon sustainable use of environment and natural resources. Thus, it could be said that embracing and deploying green construction (or building technologies) is a welcome development, and therefore good.

Sustainability of environment and natural resources is at the core of development goals in the modern era. Sustainability of environment, earth and natural resources have to be embraced at all levels and sectors of human endeavour. With regards to environment, earth and natural resources, Kamal (2020) explained sustainability as meeting the needs of society in ways that can continue indefinitely into the future without damaging or depleting natural resources. This is the core ideal behind green construction technologies. Kamal (2020) further explained that green building is financially healthy, and most importantly environmentally responsible idea that more people need to adopt

The findings of the second hypothesis show that Green construction would make significant impact in overall sustainable development in Nigeria. This indicates that deployment of green construction will make positive impact upon overall sustainable development. Thus, it could be said that embracing and deploying green construction (or building technologies) is good for individuals, households, communities, society and the economy at large.

The findings of this study is supported by IFC (2023) Report. It is noteworthy that most of the reluctance to embracing green construction technologies lie in thought that accepting and deploying them would slow down economic growth being enjoyed by several countries among the emerging markets which is closely tied with a booming construction sector. No country or region wants to jeopardize their economic growth. According to IFC (2003), economic growth can be maintained while

embracing, adopting and deploying green construction technologies. IFC (2023) Report explained that with the right mix in deployment of green technologies, they would likely have only a limited impact on economic growth rates by 2035 while carrying along all other benefits to humanity and society that a better and sustainable environment promises. These benefits include reduced damages from climate change to infrastructure, growth, and human welfare.

CONCLUSION

The adoption and deployment of green construction is a potential positive development for the construction sector (and possibly other sectors of the economy) of Nigeria. Green construction would make significant impact in sustainability of environmental and natural resources in Nigeria. Sustainability of environmental and natural resources is a global standard today. All hands should be on deck to achieve this objective at local, national, regional and global levels. Adoption and deployment of green construction is one of the ways in achieving this.

Also, Green construction would make significant impact in overall sustainable development in Nigeria. In other words, the benefits of green construction would potentially go beyond the environmental and natural resources. It will by extension impact other sectors of life such as health, finance, agriculture, education, to mention but a few. This is understandable because a healthy environment would breed healthy people. Healthy people can make productive contribution to the economy, which ripples and spirals into every sector of the economy and endeavour of human life.

Recommendation

1. It is possible to reduce total (global) emissions from the construction sector below today's level by 2035. To avoid perpetuating the status quo of continual increase in CO₂ emission from the

construction sector, decisive action is needed by policymakers, developers, construction material producers, financiers, at the local, national and regional level in line with global goals.

2. The private sector and academia should be got involved in this goal. The policy interventions needed to channel private investment into mitigation and adaptation efforts in emerging markets should be explored and adopted as fit for the local economy.
3. Emerging economies such as Nigeria have the largest stock of brown buildings (not adapted for energy or emissions reduction). These economies use relatively more carbon-intensive construction methods and materials, and their investment in construction is likely to grow faster than in high-income economies. Deliberate and concerted mitigation and adaptation to the current and prevalent construction-associated emissions have to be tangibly embraced
4. Technologies that already exist can significantly reduce construction's environmental footprint with moderate economic costs. These technologies should be embraced in Nigeria and other developing economies. These strategies include investments in electrification of brown buildings with cleaner energy, energy-efficient new buildings, and low-emission materials, and the adoption of adequate policy frameworks could reduce global construction value chain emissions

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