



## **ISSUES ON GREEN BUILDING DESIGN IN NIGERIA AND ITS EFFECT.**

**ANYANWU IGNATIUS; B. U OFOEGBU; K.O  
OPARAUGO; DIOKA MARVISE; ALLWELL ANABA;  
& UWAOMA BLESSING.**

*Department of Urban and Regional Planning Abia State Polytechnic Aba,  
Nigeria.*

### **ABSTRACT**

*A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green Building design is a concept developed to encourage sustainable development. A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life. It brings transformation to design and construction in both developed and developing economy. The study is to bring to limelight green buildings and design, the Nigerian perspective, its benefit and the linkage of traditional architecture to green architecture. It also identify, examine and assess the effects of design and factors that are hindering green building developments in the Nigeria's Built Environment. This analyses the nature of design and construction in Nigeria on the basis of green and sustainable practice through review of existing literature. The paper concludes that the concept of green building will affect the nature of architecture and design which depends on the choice of materials, the construction techniques, the calculated cost of construction and the climatic conditions in Nigeria. It posits that the developmental concept of green building in Nigeria will encourage sustainable development and environmental protection.*

**Keywords:** *Architecture, Building, Built Environment, Green buildings, Sustainable Building material, Traditional, sustainability.*

## **INTRODUCTION**

Green Building promotes the efficiency of buildings with regards to the use of water, energy and materials while reducing the building's impact on individual's health and the environment through better design, construction, operation, maintenance and removal. The ideal green building would be a building project that would allow you to preserve most of the natural environment around the project site, while still being able to produce a building that is going to serve a purpose.

The construction and operation will promote a healthy environment for all involved, and it will not disrupt the land, water, resources and energy in and around the building. This is the actual definition of a green building. *“Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building’s life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction.*

*This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high-performance building.”*

Environmental sustainability is a primary goal in green architecture and design. The designs of architects are very important in mitigating environmental problem. This calls for the concept of green or sustainable architecture and invariably form the major concern of architects in seeking sustainability in design. Bribian et al. (2011) asserts that the building and construction industry consumes great quantities of raw materials and energy that approximate to about 24% of global raw materials. Watson and Balken (2008) also believes that the construction and operation of buildings require more energy than any other human activity. The International Energy Agency released a publication that reveals that existing buildings are responsible for more than 40% of (Howe,2010), accounting for the world greenhouse gas emissions. the world’s total primary energy consumption and for 24% of global carbon dioxide emissions

Therefore the friendliest way to handle the environment is not to build. However, without construction, life can be miserable and threatening (Kolawole et al 2005). What is needed is a dynamic equilibrium without any form of threat especially to the environment. 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. 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; Green Buildings are those sensitive to the “Environment, Resource and energy consumption, Impact on people, Financial impact and the world at large (Greg Kats, 2003). The aim of the study is to bring to limelight green buildings and design, the Nigerian perspective, its benefit and the linkage of traditional architecture to green architecture. factors that are hindering green building developments in the Nigeria’s Built Environment.

### **GREEN ARCHITECTURE**

In the African context, this study views “Green Architecture” as the indigenous approach of building practices with the goal of sustaining the ecosystem. It is the design and construction with the environment in mind. It puts into consideration the easily affordable local resources and the development of concepts that sustain the socio-cultural value system within the building sector. Green Architecture approaches building construction (from design conceptualization and construction to its material usage all through its life-span) with the aim of minimizing harmful effect on human health and environment.

It attempts to conserve environmental factors such as air, water and the earth by employing eco-friendly building materials and construction practices and focuses on saving energy production and consumption. Green building measures can lead not only to lower building operating expenses through reduced utility and waste disposal cost, but also to lower ongoing building maintenance cost ranging from salaries to suppliers. The emphasis is on efficiency. Green design is intended to develop more environmentally benign products and processes. The application of green design involves a particular framework for considering environmental issues, the application of relevant analysis and synthesis, methods and a challenge to traditional procedures for design and manufacturing (hendrichson, Conway – Schempt, Lave and McMicheal, Undated). The green approach to architecture is not something new as it has existed for years. What is new is the realization that

green approach to the built environment involves a holistic approach to the design of buildings; that all the resources that go into a building, be they materials, fuels or the contribution of the users need to be considered if sustainable architecture is to be produced (Brende and Vale 2007). In Nigeria some buildings embody one of the various verifiable characteristics of green design. Buildings with holistic approach are yet to be seen.

Green buildings are designed in such a way to reduce the overall impact on the environment and human health by:

- i. Reducing trash, pollution and degradation of the environment
- ii. Efficiently using energy, water and other resources.
- iii. Protecting occupant health and improving productivity.

### **Benefits of Green Building**

With new technologies constantly being developed to complement current practices in creating greener structures, the benefits of green building can range from environmental to economic to social. By adopting greener practices, we can take the maximum advantage of environmental and economic performance. Green construction methods, when integrated with eco-friendly design and construction, provide the most significant benefits. Benefits of green building include:

#### **Environmental Benefits**

##### *1. Reduces Wastage of Water and Energy*

Green buildings certified by the Indian Green Building Council (IGBC) results in water savings of 20 – 30% and energy savings of 40 – 50% compared to conventional buildings.

Green buildings achieving the Green Star certification have been shown to save 51% less potable water and produce 62% fewer greenhouse gas emissions than if they had been built to meet minimum industry requirements.

Green buildings achieving the Green Star certification have been shown to save between 20 – 30% potable water every year, and to save on average between 30 – 40% energy and carbon emissions every year, when compared to the industry norm. Green buildings achieving the LEED certification in the US and other countries have been shown to consume 11 percent less water and consume 25 percent less energy than non-green buildings.

## *2. Conserves Natural Resources*

The building sector has the largest potential for reducing greenhouse gas emissions significantly compared to other major emitting sectors.

This emissions savings potential is said to be as much as 84 gigatonnes of CO<sub>2</sub> (GtCO<sub>2</sub>) by 2050, through direct measures in buildings such as energy efficiency, fuel switching and the use of renewable energy.

The building sector has the potential to make energy savings of 50% or more in 2050, in support of limiting global temperature rises to 2°C (above pre-industrial levels) – UNEP, 2016.

## *3. Improves Air and Water Quality*

Research suggests that better indoor air quality that is low concentrations of CO<sub>2</sub> and pollutants, and high ventilation rates can lead to improvements in the performance of up to 8 percent.

## *4. Protects Biodiversity and Ecosystems*

Green building supports ecosystems by promoting the efficient use of energy, water and other resources. It also uses renewable energy, such as solar energy. Measures are usually taken for reducing pollution and waste and also enabling re-use and recycling of the materials. Materials that are used are non-toxic, ethical and sustainable

The environment is considered in design, construction and operation and enables adaptation to a changing environment.

## **Economic Benefits**

### *5. Reduces Costs and Increase Value*

These buildings lower construction costs and higher property value for building developers; global energy efficiency measures could save an estimated €280 to €410 billion in savings on energy spending. Green buildings, whether new or renovated – command a 7 percent increase in asset value over traditional buildings – Dodge Data & Analytics, 2016.

### *6. Improves Occupant Productivity*

Green Building focuses on creating buildings that are not only good for the environment but also support healthier, happier and more productive lives. These include cost savings on utility bills for tenants or households through energy and water efficiency.

### *7. Creates a Market For Green Product and Services*

Different countries and regions have a variety of characteristics such as distinctive climatic conditions, unique cultures and traditions, diverse building types and ages, or wide-ranging environmental, economic and social priorities, all of these shapes up the green building and make green buildings best suited to their own markets.

## **Social Benefits**

### *8. Improves the Quality of Life*

In green buildings, the quality of life of occupants is considered in design, construction and operation. It Improves occupant health and comfort. Research suggests that better indoor air quality (low concentrations of CO<sub>2</sub> and pollutants and high ventilation rates) can lead to improvements in the performance of up to 8 percent.

Workers in green, well-ventilated offices record a 101 percent increase in cognitive scores (brain function). Employees in offices with windows slept an average of 46 minutes more per night – American Academy of Sleep Medicine.

### *9. Minimizes Strain on Local Infrastructure*

Green buildings work with local governments and utilities to provide training and incentives for green building and energy efficiency. They also offer free classes, public forums and technical training that can minimize strain on local infrastructure.

These provide opportunities for existing homes to easily and affordably go green, becoming truly sustainable, non-toxic, zero water and zero energy buildings.

## **SUSTAINABLE BUILDING MATERIALS**

Buildings impact on the environment during their whole life cycle and the choice of materials used will impact on their overall performance. They are used in various stages, from initial construction through to the operation stage when the buildings are maintained and refurbished to preserve their normal functioning until the end of their service life. Traditional building materials including steel, concrete, aluminium and glass are high energy content materials. According to Franzoni (2011) the selection of building materials

plays an important role in achieving the goal of sustainable development in the construction industry.

Choosing materials with high contents of embodied energy entails an initial high level of energy consumption in the production process, which associated with high levels of GHG emissions (Bribian et al., 2011). Thormark (2006) further states that more attention should be given not only to the operating energy of a building but also to the material choice. There are a number of research studies addressing the problems with materials selection.

However, most of these studies have failed to properly and adequately establish the definition for guidelines that enable sustainable building materials to align with the 'sustainable building materials'. This makes it very difficult to establish principles and principles and goals of sustainable development in construction. Sustainable building materials are often regarded as materials that are natural and offer specific benefits to the users in terms of low maintenance, energy efficiency, the improvement of occupant health and comfort, the increase of productivity whilst being less harmful to the environment.

However, according to Franzoni (2011) natural materials are not necessary green materials such as asbestos, radon and turpentine. Therefore, sustainable building materials refer to materials that are environmentally friendly or environmentally responsible materials (Spiegel & Meadows, 1999; Franzoni, 2011). They must also be sustainable during their whole life cycle and requires the use of less energy in the manufacturing process. During the life cycle, these materials must not release pollutants or other emissions that impact on human health and comfort.

### **Goals of green building**

- Life cycle assessment.
- Siting and structure design efficiency.
- Energy efficiency.
- Water efficiency.
- Materials efficiency.
- Indoor environmental quality enhancement.
- Operations and maintenance optimization.
- Waste reduction.

## **GREEN BUILDING CONCEPT**

A green building is one **which uses less water, optimises energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants**, as compared to a conventional building. The Indian green building council (IGBC) is the leading green building movement in the country.

## **MAJOR CHALLENGES OF GREEN BUILDING**

**Lack of knowledge about benefits and pricing** myth associated often leaves real estate developers in ignorant towards green homes.

**Awareness In The People:** Most of the people are still not aware of the benefits of green architecture and sustainable living, making them disinterested in the idea.

## **GREEN BUILDING AND SUSTAINABILITY IMPERATIVE**

A building project can be regarded as sustainable only when all the various dimensions of sustainability (environmental, economic, social, and cultural) are dealt with. The economic point deals with growth, efficiency and stability. The social aspect is concerned with poverty, cultural heritage and empowerment while the environmental aspect deals with biodiversity/resilience, natural resources and pollution (Nwafor, 2006).

The various sustainability issues are interwoven, and the interaction of a building with its surroundings is also important.

To achieve the sustainable building design goals of building functionality and appeal for the occupants while reducing the environmental footprint, a highly organized framework that emphasizes the integration of or at least understanding of all building components is required. The framework developed (and used) should consists of four primary categories that must be addressed sequentially, yet requiring that an overall comprehension of their integrated nature be applied during each step. The four categories, listed in the order that they should be addressed are:

**1. Building Use and Occupant Needs** :Assess the occupant's needs and expected building use to determine the functional design priorities of the building;

**2. Climate Analysis** : Conduct a local climate analysis to determine climactic needs and to assess the potential for passive design strategies;



**3.Site Plan Development** : Perform the preliminary site plan development and landscape design, while considering strategies that can improve occupant comfort, reduce building loads, and further enable passive design strategies;

**4.Building Design** :Proceed with the building design working to meet the occupants' needs and functional requirements of the facility, while incorporating passive design strategies, and being cognizant of the life cycle costs and impacts of material selection and energy use.

It is important to stress that although these are listed in order, the holistic design approach is more like an interconnected web, with each of the categories being addressed continually throughout the design process. Intimate knowledge of the design strategies and interrelated impacts of each category on one another is critical to effectively achieve green building design and beyond.

## **NIGERIAN TRADITIONAL ARCHITECTURE AND ITS LINKAGE TO GREEN DESIGN**

Nigeria is a country that parades numerous traditional building design concepts at different regions of climatic conditions, socio-economic and cultural background. Rikko & Qwatau (2011), referred to traditional as a cultural heritage gained from generation to generation accepted and practiced by the people. Therefore designs in traditional architecture reflect the cultural lifestyle of the people and represent the symbols of the heritage of the residents. Hence response to the material, spiritual, and social design of the society cannot be over-emphasized (Olotuah, 2001). Consequently, creation of an intimate relationship to the entire system, considered as important in their housing reinstated the values and customs accepted by residents' social groups. In addition, the form and functions of housing vary with people customs and culture, as an aftermath of what the populace considered as important in their housing. Detailed analysis by Rapoport (1969) emphasized that every building is first a product of cultural phenomenon; hence the environmental and climatic factors must be given pre-eminence. Over the years, it has been recognised that cultural rituals have evolved to adapt to climate conditions and vernacular architecture embodies some of these adoption in their plan and design features

(Hawkes, 1996 in Bay and Ong, 2004). Thus, cultural components in line with climate condition will encourage green architecture.

Nigeria and tropical traditional architecture before the invasion of foreign concepts of architecture at most times were using mostly sustainable green construction materials in its operations. Except that the now architecture in tropics like Nigeria are now unadulterated transplants from temperate countries in the name of international style (Bay and Ong, 2004). This has incorporated mostly unsustainable construction materials in its operations as compared to the old tropical traditional concept of architecture that were practiced.

Green architecture supports mostly green construction materials for its operation. These are materials that tend to be derived from the earth that are more safely and naturally assimilated by the earth at the end of their service lives (Milani, 2005). Therefore, traditional building materials such as stone, earth, bamboo and wood commonly used in tropics such like Nigeria are essential for green construction. These materials because of capillary effect could absorb water which can then evaporate from their surfaces and thus hinder the interior air from being re-warmed by convection (Salam, 2003). It was concluded that effective building forms have emanated overtime that facilitates the attainment of high level of comfort both within and outside of built environment without recourse to artificial methods.

In recent years, Nigerian Architecture is characterised by the post-modern buildings of the imported from china 1990's and a sprawling new design concept and engrossed with new building materials mainly

The question at this juncture is why architects, designers and government policies have frivolously jettisoned the traditional architecture to modern architecture in recent time? Why is little attention focuses on intertwining between modern environment and traditional architecture (cultural heritage), in Nigeria? These and many other question are yet unanswered.

## **GREEN ARCHITECTURE AND COURTYARD SYSTEM**

Green architecture entails adequate natural ventilation systems designed for efficient heating and cooling, appropriate energy-efficient lighting and appliances, adequate and appropriate landscapes that ensures maximum passive solar energy. Generally green architecture ensures minimal harm to

the natural habitat. Location of building on site, including access, and utility supply routes; Arrangement of internal rooms, and doors and windows; Dimensions of building

and environmental components Finally it takes into consideration the Colour, texture, ornamentation of building in relationship to the environment.

A Court or courtyard is an enclosed area, often a space enclosed by a building that is open to the sky and areas in inns and public buildings were often the primary meeting places for some purposes, leading to the other meanings of court. Courtyards have always been part of residential architecture for a very long time. In contemporary African setting like in Nigeria, it has been historically used for many purposes which included cooking, sleeping, working, playing, gardening, and even places to keep animals.

One of the great attributes of courtyard design concept is that it allows for good fenestration and privacy. It allows for good flow of indoor and outdoor activities thereby removing the pressure of activities within a given space. Courtyard regulates the micro climate within the enclosure through the free use of vegetation. In densely populated areas, a courtyard in a home can provide privacy for a family, a break from the frantic pace of everyday life, and a safe place for children to play. With space at a premium, architects are experimenting with courtyards as a way to provide outdoor space for small communities of people at a time.

Courtyard design accommodates the requirements of the permanent resident, whilst offering the flexibility required by the transient occupation of holiday accommodation. In traditional houses, courtyards perform an important task as a modifier of climate. It allows outdoor activities to occur with protection from wind, dust, and sun (Petherbridge, 1995).

Courtyards serve as light-wells in a building type that restricts exterior windows. They also serve as air-wells into which the cool, dense night air sinks. Since the courtyard is usually protected by walls, loggias, or galleries sun rays do not heat it until later in the day. When the sun reaches the court and heated air rises, convection current set up airflow that ventilates the house and keeps it cool Abarkan and Salama (2000).

### **IMPLICATIONS OF GREEN BUILDING FOR NIGERIA**

Okwo (2008) identifies socio-economic development and mitigating climate change as two significant yet conflicting challenges facing Sub-Saharan

Africa. Green innovations, beside the objective of mitigating climate change, have impacts on various issues that include social, economic, political and technological developments in Nigeria. It is imperative for developing countries to enhance their developments by concentrating on indigenous practices and values, in order to enhance the economy.

This study identifies as graphical comparison quadrant worked out based on estimates for similar specifications among these two systems: Nigeria's indigenous and the contemporary building types. It emphasizes the vitality of adopting indigenous architecture in Nigeria. It is observed that construction period for indigenous building is low, energy usage for indigenous building is low, sustainability is high and invariably lower building total cost. This is in comparison with contemporary buildings. The reliance on modern design techniques and materials has resulted to high cost of construction in recent years. Contrary to this, traditional building materials enable cost effectiveness in terms of materials and simple innovative expertise of the local builders.

### **HINDRANCES TO GREEN BUILDING DEVELOPMENTS IN NIGERIA'S BUILT ENVIRONMENT.**

Every project or development comes with its unique benefits, challenges and factors that hindered its success; Green Building developments in Nigeria are not an exception.

Capital constraints has been identified as a primary reason for the lack of energy efficient measures being taken. The common and 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 green or sustainable design features? The answers to these questions have been thus far elusive, due to the lack of hard data. Morris (2007); argued that the increase in the first cost" Bartlett and Howard (2000) suggest that is a misconception in the construction industry that energy and environmentally friendly buildings cost 5-15% more to build.

"The most common reasons cited for not incorporating green elements into building designs is

They outline one of the reasons for this being that examples of environmentally friendly buildings are used in the press that are usually ‘futuristic’ buildings that do cost more to build and therefore the wrong conclusions are drawn that green buildings are more expensive and complex to build. This is supported by Sorrell (2003) who highlights that there may be a bias against energy efficient buildings as they tend to involve more design work and therefore a timelier design process despite the possible result of lower capital and operating costs. It is stated that; ‘at all stages of the construction process, it can take longer to design, assess and implement novel and unfamiliar features than to use tried and trusted solutions.’

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”.

Below is a Listing of Hindrances to Green Building Developments in Nigeria

- a) The Perception of green building as Expensive Concept (Perceived Increased cost for incorporating green building features etc.)
- b) Green building Technical Know How (green building requisite knowledge among the Built environment Professionals & the scarcity of green building certified professionals).
- c) Divergent interests and views of success factors and success criteria of green building developments among stakeholders.
- d) Shortage of green building cost data and other performance related.
- e) green building as a new change ( which comes with its associated risks)
- f) Green Buildings awareness .
- g) Insufficiency of Locally or a single unified/standard green building assessment system.
- h) lack of local green building material and other components and High cost of Imported green building materials

## **DISCUSSION**

The two main targets to achieve green architecture are the institutions of higher learning and building industry with its professionals. Indeed, universities are often relied on to serve as the well spring of innovation and success, particularly for the sciences and engineering; for centuries they have been precisely doing that in nearly any field that has played a role in the

remarkable success of twenty-first century humanity. Now they must embrace and foster a new direction of innovation:

Universities that once relegated sustainability to the provinces and to grassroots efforts should now make serious structural and philosophical changes in recognition of the challenges and opportunities a resource-limited world brings. Green or sustainability concepts should be universities watch word.

Sustainable construction measures needs the support of multiple actors at various places and times in the decision making process to become effective. The professionals such as architects, engineers, town planners, builders amongst others should take cognizance of indigenous design theory, technology, craftsmanship and artisanship associated with the advent of traditional building. Thus, recent domination of modern innovations would be to the detriment of our indigenous expertise. The construction industry needs a review of the way that it design and builds to encourage more sustainability.

**Various measure to improve sustainable practices, include:**

- making developers more accountable for the performance of buildings in use
- Widespread adoption of whole life costing
- Development of integrated design
- Client education and adoption of post-occupancy evaluation
- Comparison of building performance against standardised benchmarks

**CONCLUSION**

The sustainable energy potential of Nigeria encourages the adoption of green architecture concept. Green and sustainable design has become an increasingly popular issue in both the preservation and new construction industries. With our threatened environment, it is imperative that we make sustainable living a part of our lives. The public benefits of both preservation and sustainability are very clear and there is no reason why these goals cannot work together. From studies, it is evident that sustainability in general is a huge field incorporating different dimensions and within that there are different areas to consider with regards to sustainable construction. Like the design process, the design of green

buildings and sustainable environment involves creative arrangement of components and details to meet a set of specifications/guidelines subject to other constraints. The "green" architect or designer attempts to safeguard air, water, and earth by choosing eco-friendly building materials and construction practices. There is no doubt that sustainable development concepts, applied to the design, construction and operation of buildings can enhance both the economic welfare and environmental health of communities in Nigeria and other third world countries. This is more apt in this era of climate change. There is no better time other than now for Nigeria to pursue green designs and technologies to combat present and future challenges.

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