

Understanding Sustainability and Challenges with Sustainable Building Design and Construction Practice in Lagos-State, Nigeria.

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ABSTRACT: Integrating the concept of sustainability into building design and construction practices is an effective approach to reduce the negative impacts of the building construction industry on the environment. This study is aimed at conducting an industry based survey to appraise the level of familiarity with the concept of sustainability within the building design and construction practices in Lagos-State, Nigeria. The objectives are to examine the attributes of sustainability as it relates to the building construction industry; determine the level of familiarity with the concept of green building and to investigate the challenges hindering the practice of Green building in the study area. In June, 2020; a survey was conducted with eighty (80) employee professionals in architectural design and building construction firms resident in Lagos-State, using a questionnaire. Analysis of the responses to the questionnaire indicated that majority of the respondents have a fair understanding of the concept of Green Building. While majority of the professionals are aware of the enormous benefits of green buildings, there is a low level of acceptance from the public, particularly home owners and developers because they are not aware of the cost-benefits from green buildings. Therefore, the study concludes that there is not enough support on the part of the government and other relevant agencies in terms of putting in place effective policies and structural framework to encourage green building practices and promote public awareness of the benefits of sustainability. Recommendations are thus made in this regard.

KEYWORDS: Architectural Design, Building Construction, Green Building, Sustainability.

I. INTRODUCTION

In developing countries, Nigeria inclusive, there is a very low level of response to matters of sustainability in the building design and construction industry (Alabi, 2012; Aje, 2016; Baron & Donath, 2016). Changing this thus requires a change in the thinking process, behavioural pattern, production and consumption within the construction industry (Ofori, 1998). Miyatake (1996) suggested that in order to achieve sustainability, the industry must change from linear to cyclic processes which will consequently yield increase in the use of recycled, renewed and reused resources; and decrease in the use of energy and other natural resources.

The buildings and construction sector has been identified as a major contributor to global warming and climate change. According to the 2019 Global Status Report for Buildings and Construction, in 2018, the buildings and construction sector accounted for 36% of final energy use and 39% of energy and process-related carbon dioxide (CO₂) emissions; 11% of which resulted from manufacturing building materials and products such as steel, cement and glass.

Primarily, Carbon dioxide emissions from buildings are caused by the use of electricity to provide heating, cooling, lighting, water, information management, and entertainment systems (Vyas et. al., 2014). Because of their long-life expectancies, buildings affect the environment and public health for many years. Therefore, it is imperative to explore sustainable design strategies that reduce energy consumption and minimise damage to the environment.

Green Building strives to build or renovate homes and buildings using a combination of energy-efficient technology, renewable materials, and innovative design. This approach reduces

waste and uses sustainable products, which minimize the environmental impact of a new development (CRL, 2018). It also affects the long-term environmental consequences by producing energy-efficient buildings. The green building concept is not confined to new build properties. It can also be applied to existing buildings to make them more energy-efficient. Solar panels, insulation, and newer, low-energy heating systems are all simple and effective ways of making a property 'greener' in design and operation. Ideal green building projects can promote occupant health by using renewable, natural materials, sourcing their own energy and water, and functioning without having an adverse effect on the environment. When the amount of energy used by buildings across the globe is considered, it becomes obvious that sustainable architecture and design are extremely important.

Architecture is a discipline that is directly linked to have profound impact on all aspects of environmental sustainability. Despite the futuristic benefits associated with sustainable Architecture and Green Building concepts, the practice is relatively new in Nigeria. Therefore, this research is carried out to reveal the current status with sustainable design and construction practices in Nigeria's most populous city; Lagos State, Nigeria.

1.1 AIM AND OBJECTIVES OF STUDY

This study is aimed at appraising the level of familiarity with the concept of sustainability so as to understand the challenges with sustainable design and construction practices in Lagos-State, Nigeria. The objectives are;

1. To examine the attributes of sustainability as it relates to the building design and construction industry.
2. To determine the level of familiarity with the concept of Green building, and
3. To investigate the challenges hindering the practice of Green building in Lagos-State, Nigeria.

II. THEORETICAL ISSUES ON THE ATTRIBUTES OF SUSTAINABILITY IN THE BUILDING DESIGN AND CONSTRUCTION INDUSTRY

Generally, sustainability is an ethical concepts applied indiscriminately to policies to express desirable outcomes from economic and social decisions. As a concept, sustainability simply implies meeting our own needs without compromising the ability of future generations to meet their own needs ((World Commission on Environment and Development, 1987; Holden,

1995). Embedded in the most definitions of sustainability are concerns for social equity and economic development. The concept has roots in social justice, conservationism and internationalism. Therefore, Sustainability is a holistic approach that considers ecological, social and economic dimensions, recognizing that all must be considered together to find lasting prosperity (HKU Architecture, 2002; Sverdrup & Svensson, 2004; Yilmaz&Bakis. 2015). These three dimensions represent the attributes of sustainability and are universally called the triple pillars of sustainability (Boyer et al. 2016; Purvis, 2019) as depicted in figure 1 below. The area where the circles overlap and all three needs are met is the area of sustainability.

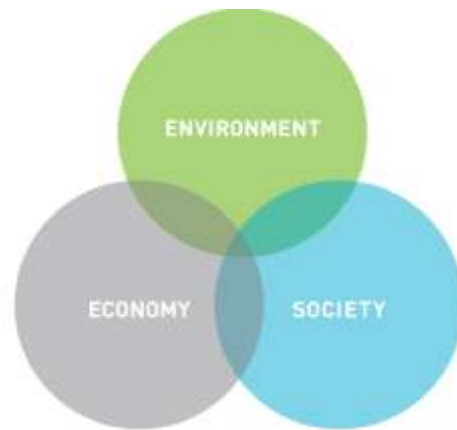


Figure 1: Three pillars of sustainability
Source: (Hart, 1999)

2.1 Social Attributes And Principles

The theory of 'social sustainability' calls for economic growth constrained by the requirements of social equity (Basiago, 1999). In order to achieve these, an enabling environment must be created that optimizes resource use, prioritizes resource allocation, and fosters equitable resource distribution. According to Hill & Bowen (1997), the social attributes of sustainable construction calls specifically for addressing poverty and inequality. Social sustainability attributes includes; improved quality of human life, including poverty alleviation, provision for cultural diversity in development planning, provision of healthy and safe working environments, implementing skills training and capacity enhancement of disadvantaged workforce, ensuring fair distribution of the social costs of construction, equitable distribution of the social benefits of distribution, and seeking intergenerational equity.

2.2 Economic Attributes And Principles

Economic sustainability implies a system of production that satisfies present consumption levels without compromising future needs (Hicks, 1946). In other words, it is an economic system designed to restrain resource use to ensure the ‘sustainability ‘of natural capital. According to Sultan (2005), the attributes of economic sustainability includes; labour-intensive construction policies (promotion of employment by mandating minimum crew size and supervisors and use of less machinery in construction projects associated with import reduction of machines, spares and foreign exchange savings); energy-efficiency policies in Design and Construction (Mandating the use of low embodied energy materials such as granite, minimizing high energy materials such as cement and steel, energy reduction in buildings via insulation, day lighting, optimize material use and minimize site waste); Credit and Policies to select projects, strategies for sustaining the continuity of affordable infrastructure projects (infrastructure projects can help enhance the process of industrialization by raising productivity and reducing production cost); Strengthening the law and regulations in construction and land affairs; Pricing policies (maintain the monetary and fiscal discipline required to promote price control); improve administration effectiveness and reduce bureaucratic procedures.

2.3 ENVIRONMENTAL ATTRIBUTES AND PRINCIPLES

The theory of environmental sustainability suggests a planning process that allows human society to live within the limitations of the ‘biophysical environment‘(Goodland, 1995). It is a state in which ecological integrity is maintained, all of earth’s environmental systems are kept in balance while natural resources within them are consumed by humans at a rate where they are able to replenish themselves. Environmental sustainability requires the improvement of the quality of human life within the carrying capacity of supporting ecosystems (IUCN, 1991).

The attributes in construction include: Project design facilities that reflect consciousness of the fragility of the ecology in which it is situated and the awareness of its impact upon it. The use of renewable building materials from sustainable sources and designs that take into consideration existing cultural patterns and behaviours, materials and techniques; Prevention of pollution from

construction activity and preserving sites in their natural state and water use reduction and conservation and rainwater collection and; Reduction of energy use and on-site renewable energy and encourage construction waste management (Wolley, 2000).

ELEMENT	CRITERIA
Social Sustainability	Equity Empowerment Accessibility Participation Sharing Cultural Identity Institutional Stability
Economic Sustainability	Growth Development Productivity
Environmental Sustainability	Eco-System Integrity Carrying Capacity Biodiversity

Table 1: The paradigm of sustainable development Source: Kahn 1995.

III. MATERIALS AND METHODS

The study followed two (2) methodological steps. The first step is focused on literature review to theorize the attributes of sustainable construction, which guided the field work. Secondly, we conducted a field survey with 80 respondents working in the Architectural design and building construction practice in Lagos state, Nigeria to determine the level of familiarity with the concept of Green Building and the challenges of sustainable construction practices in Lagos-State, Nigeria. The questionnaire responses are presented in tables indicating frequency and percentages, and analysed statistically.

3.1 STUDY AREA

Lagos, Nigeria, is the second largest city in Africa after Cairo, Egypt and one of the primary economic hubs for the continent. It is Nigeria’s largest urban area with a metro-population of over 14 million (MacroTrends, 2020). It is located in the south-western geopolitical zone of nation; bounded on the north and east by Ogun-State. On the west by the republic of Benin and behind its southern borders lies the Atlantic Ocean. While the state is essentially a Yoruba-speaking environment, it is home to Nigeria’s diverse ethnic groups and a socio-cultural melting pot attracting both Nigerians and foreigners alike.

IV. RESULTS AND DISCUSSION

The results of survey are presented and analysed statistically as shown below;

4.1 Background Information And Socio-Economic Characteristics Of Respondents

Table 2: PROFESSION OF RESPONDENTS

PROFESSION	FREQUENCY	PERCENTAGE
Architect	32	40.00%
Builder	15	18.75%
Engineer	18	22.50%
Surveyor	9	11.25%
Others	6	7.50%
Total	80	100.00%

Source: Researcher's field survey, June 2020

Table 2 shows the professions of the respondents. Most of the respondents were Architects and Engineers. As captured, thirty three (32) out of the total of 80 respondents, making 40% of the respondents were Architects, while eighteen

(18) respondents, 22.5%, were Engineers. All other professionals: Builders, Surveyors and Project Managers accounted for the remaining 37.5% of respondents.

Table 3: EDUCATIONAL QUALIFICATION OF RESPONDENTS

EDUCATIONAL QUALIFICATION	FREQUENCY	PERCENTAGE
BSc / HND	37	46.25%
MSc	30	37.50%
Others	13	16.25%
Total	80	100.00%

Source: Researcher's field survey, June 2020

It can be reliably gathered from Table 3 that majority of the respondents were first-degree (BSc. / B.Tech.) and higher national diploma (HND) degree holders. A total of thirty seven (37)

out of the eighty (80) respondents fell in this range, thus accounting for 46.25% of the population size. Thirty (30) of the respondents had second degrees (MSc. / M.Tech.); others accounted for 16.25%.

Table 4: FIRM / COMPANY SIZE OF RESPONDENTS.

FIRM SIZE	FREQUENCY	PERCENTAGE
Small Scale	18	22.50%
Medium Scale	58	72.50%
Large Scale	4	5.00%
Total	80	100.00%

Source: Researcher's field survey, June 2020

As seen in Table 4, majority of the respondents work in medium sized firms; a total of fifty eight (58) respondents fall into this category

and account for 72.50% of the population size. Eighteen (18) respondents work with small sized firms, while four (4) persons work with large firms.

Table 5: EXPERIENCE OF RESPONDENTS.

YEARS OF EXPERIENCE	FREQUENCY	PERCENTAGE
1-5 years	12	15.00%
6-10 years	43	53.75%
11-20 years	16	20.00%
20 and above	9	11.25%
Total	80	100.00%

Source: Researcher’s field survey, June 2020

As represented in Table 5 above, majority of the respondents, forty three (43) out of a total of eighty (80) respondents, have between six (6) to ten (10) years working experience. This was closely followed up by persons whose years of experience were between eleven (11) to twenty (20) years. Not surprisingly, persons in the category of above 20 years’ experience had the least number of respondents.

4.2 Awareness Level Of Green Building Concept

The tables below provide information on the level of awareness of the respondents on the concept of sustainability and green strategies in building design and construction.

Table 6: FAMILIARITY WITH THE CONCEPT OF GREEN BUILDINGS

RANKS	FREQUENCY	PERCENTAGE
Very Great Extent	9	11.25%
Great Extent	18	22.50%
Moderate Extent	33	41.25%
Low Extent	12	15.00%
Very Low Extent	8	10.00%
Total	80	100.00%

Source: Researcher’s field survey, June 2020

Table 6 shows respondents’ awareness level of the concept of Green Buildings. As seen above, majority of the respondents totalling thirty three (33) out of eighty (80) indicated that they are aware of the concept to a moderate extent.

Therefore, it may be generalized that the respondents have a fair understanding of the concept; as only thirty persons (30%) indicated little knowledge (low and very low) of the concept.

Table 7: APPLICABILITY OF SUSTAINABILITY PRINCIPLES IN THE CONSTRUCTION INDUSTRY

RANKS	FREQUENCY	PERCENTAGE
Yes	42	52.50%
No	38	47.50%
Total	80	100.00%

Source: Researcher’s field survey, June 2020

Table 7 above shows respondents’ opinions on the applicability of sustainability

principles in Lagos-State construction industry. As captured herein, a total of thirty eight (38) out of

the eighty (80) respondents, accounting for 47.50% indicated that they did not think that the principles of sustainability are applicable, while forty two

(42) persons (52.50%) indicated that the principles of sustainability are applicable in the Lagos-State construction industry.

Table 8: UNDERSTANDING OF THE MEANING OF GREEN BUILDING

DESCRIPTION	FREQUENCY	PERCENTAGE
Environmentally friendly buildings	52	65.00%
Improving building users' health through reduction of toxic materials	16	20.00%
A holistic approach to planning, designing, and constructing building.	12	15.00%
Total	80	100.00%

Source: Researcher's field survey, June 2020

In Table 8 above, respondents understanding of the definition of Green Buildings are as shown. Out of the eighty (80) respondents, fifty two (52) respondents favoured environmentally friendly buildings as the definition for Green Building. While 20% defined is as

improving building users' health through reduction of toxic materials, forty-nine (49) respondents (18%) of the respondents defined it as a holistic approach to planning, designing, and constructing building.

4.3 CHALLENGES HINDERING THE PRACTICE OF GREEN BUILDING IN LAGOS, NIGERIA

Table 9: FACTORS AFFECTING PRACTICE OF GREEN BUILDING IN LAGOS STATE, NIGERIA.

DESCRIPTION	FREQUENCY	PERCENTAGE
Lack of Public awareness of cost-benefits	24	30.00%
Developers and Builders tend to keep things as simple as possible.	3	3.75%
Market expectation.	11	13.75%
No enabling environment.	18	22.50%
Economic situation.	7	8.75%
Lack of professionals to handle the task.	7	8.75%
Lack of technical know How.	10	12.50%
Total	80	100.00%

Source: Researcher's field survey, June 2020

Table 9 shows a list of factors affecting practice of sustainable construction in Lagos-State Building Industry and respondents' opinions about them. As shown herein, most of the respondents – twenty four (24) respondents (30%) out of the eighty (80) respondents indicated the lack of Public awareness of cost-benefits of sustainability. Also,

18 respondents (22.5%) indicated the lack of enabling environment for ideal practice; and three (3) respondents (3.75%) indicated that Developers and Builders tendency to keep things as simple as possible is a factor that affects the practice of Sustainable Construction in the study area.

Table 10: STAKEHOLDERS LEVEL OF INFLUENCE IN ADOPTION OF GREEN BUILDING

DESCRIPTION	FREQUENCY	PERCENTAGE
Developers/ Owners/ Clients	36	45.00%
Architects	25	31.25%
Land Surveyors	0	0.00%
Town Planners	5	6.25%
Structural Engineers	11	13.75%
Service Engineers	3	3.75%
Quantity Surveyors	0	0.00%
Total	80	100.00%

Source: Researcher’s field survey, June 2020

Table 10 shows a list of stakeholders influencing the practice of sustainable construction in the Building Industry and respondents’ opinions about them. As shown herein, majority of the respondents – thirty six (36) respondents (45%) out of the eighty (80) respondents indicated that clients, building owners and developers greatly influence the adoption of Green Buildings; followed by Architects (31.25%). Others indicated that the Structural Engineers, Town Planners, Services Engineers and Surveyors at 13.75%, 6.25%, 3.75% and 0% respectively.

V. CONCLUSION AND RECOMMENDATION

The attributes of sustainability (social, economic, environmental) as it relates to the building construction industry was reviewed through literature.

On the level of familiarity with ‘Green building’ concept, a critical analysis of the field survey revealed that majority (65%) of the respondents understand ‘Green Buildings’ to mean ‘Environmentally friendly buildings’ while a few (15%) consider it to mean ‘a holistic approach to planning, designing, and constructing building’. Others (20%) think it means ‘Improving building users’ health through reduction of toxic materials’. These deductions reveal that the sampled population have a fair understanding of the concept and that it is relatively practiced in Lagos-State.

On investigating the challenges hindering the practice of Green building in Lagos-State, we found out from survey that while most professionals are aware of the enormous benefits and potentials for achieving sustainability through Green Building, the greatest barrier to its implementation is the lack of public awareness of

the cost-benefits of green building. The survey also revealed the influential capability of building owners and developers in adopting Green buildings.

Therefore, the study concludes that there is not enough support on the part of the government and other relevant agencies in terms of putting in place effective policies and structural framework to encourage Green building practices and promote public awareness of the benefits of sustainability.

5.1 RECOMMENDATIONS

Based on the results of the study, the followings recommendations are made:

1. Inclusion of sustainability checks into building approval standards and requirements.
2. Post-construction periodic assessment of existing buildings for compliance with Green building standards
3. Government at all levels should through effective policies and enforcement mechanisms support Green building practices
4. Designers should adopt a more integrated design approach that incorporates sustainability throughout the design process.
5. Public enlightenment programs should be embarked upon by government and professional bodies to sanitize the general public on the enormous benefits of having green buildings and thus, more sustainable environment.

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