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APPROPRIATE DRIVERS FOR SUSTAINABLE CONSTRUCTION PRACTICES ON CONSTRUCTION SITES IN NIGERIA

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Sustainable construction practices are associated with the profitable and competitive construction industry, enhancement of quality of life, improved client satisfaction, provision of desirable natural and social environments, and efficient use of resources. However, due consideration is not being given to sustainable construction practices in Nigeria. Therefore, this study aims to identify the unsustainable construction practices on construction sites and establish the barriers to and appropriate drivers for sustainable construction practices on construction sites in Nigeria. A questionnaire survey of 50 construction sites in Abuja, the Federal Capital Territory of Nigeria was conducted with construction professionals as the specific target, out of which only 43 construction sites have at least a construction professional present at the site. 43 filled questionnaires from the respondents was used for analysis in this study. The findings of the study show that misuse of natural and human resources are the most significant unsustainable construction practices in Nigeria. The findings also show that the use of conventional construction is a major barrier to sustainable construction practices on construction sites. The study identified education and training, sustainability assessment system, and availability of the National Building Code as the appropriate drivers of sustainable construction practices in Nigeria. The study concludes that sustainable construction practice is lacking consideration in Nigeria as a result of the use of conventional construction system, poverty, lack of expertise for sustainable construction, and unavailability of National Building Code.

Keywords: built environment, environmental impact assessment, sustainability, sustainable construction, and sustainable procurement

INTRODUCTION

The concept of sustainability and sustainable development gained prominence in the late 1980s when the UN world commission on environment and development

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through the Brundtland Commission released their report titled "our common future." In that report, sustainability was described as development that meets the present needs while also contributing to future needs (Brundtland, 1987). The need to live both for the present and future generations constitutes the core of a sustainable environment. The consciousness of sustainable built environment promotes design that accommodates and enhances the occupant's comfort and health, better employee productivity and improves the quality of life for the community (Bolis et al., 2014). Sustainable construction aims to minimize harm to the environment and also ensuring that new buildings do not have negative effects in social terms (crime, noise pollution, and health) (Leibrock and Harris, 2011). A good understanding of the site and its environmental conditions influences the design and leads to immediate environmental benefits such as energy savings through the consideration of simple factors such as orientation (Robichaud and Anantatmula, 2010).

Building and their infrastructure have a significant impact on the use of non-renewable materials and resources and the local environment (Augenbroe et al., 1998; Horvath, 2004). The construction industry while contributing to overall socio-economic development in the country is a major exploiter of non-renewable natural resources and a polluter of the environment. It contributes to the environmental crisis through resource depletion, energy consumption, air pollution and generation of waste in the acquisition of raw materials, the construction site processes, as well as the utilization of the resultant facilities (Windapo, 2014). A building can, therefore, be constructed in a way that is sustainable in environmental and economic terms (Windapo and Rotimi, 2012). Buildings could also be sustainable in social terms by adding value to the quality of life for the individual and the community (Windapo and Goulding, 2013). A key element of sustainable construction is a more strategic approach to material waste (Sodagar and Fieldson, 2008). To facilitate cultural change, it is necessary to integrate the various interests of the construction, demolition, haulage, and waste management sector. This requires a strategic alliance where the costs and rewards are shared and where continual improvement is ensured.

Currently, the construction process is full of wasteful activity with a focus on profitability without reflection of its long-term impacts (Kibert, 2013). For example, the land that is constructed on, the fuel to construct and sustain the building, waste removal, and water are all provided by nature (Abolore, 2012). Nonetheless, the construction process undesirably influences nature in numerous ways: causing erosion, desertification, generating waste, destroying the health and safety of the inhabitants, creating pollutants, and altering the balance of natural systems (Destatte, 2010). The solution to this challenge is the incorporation of the principles of sustainable development into the construction process. According to Abolore (2012), incorporating the principles of sustainable development into construction process will transform the architecture, engineering, construction industry and the number of green projects upsurges in industrialized countries as a result of market changes.

In spite of the benefits of sustainable construction practices, evidence suggests that the practice is not receiving adequate attention in Nigeria. The majority of building development is initiated, designed, permitted, built, operated and

managed but lacking the inclusion of the significances of sustainability (Abolore, 2012). The practice of sustainable construction must be given adequate consideration in Nigeria because of the need for a faster construction and mechanization, energy-intensive materials and cost reduction (Oyedepo, 2014) and because of the need to address the negative effects of unsustainable construction practices on the environment (Tunji-Olayeni et al., 2018). For these reasons, this study aims to identify the unsustainable construction practices on construction sites and establish the barriers to and drivers of sustainable construction practices on construction sites in Nigeria.

LITERATURE REVIEW

Sustainable and unsustainable construction practices

The practice of sustainable construction is mainly concerned with the process of creating buildings and infrastructural facilities with the aim of restoring harmony between the natural and the built environment and creating settlements that affirm human dignity and encourage economic equality, enhance the quality of life and offer customers satisfaction; offer flexibility and the potential to cater to user changes in the future; provide and support desirable natural and social environments; and maximize the efficient use of resources while minimizing wastage (Dahiru, 2005; Kaatz, Root and Bowen (2005); Watuka and Aligula, 2002). Any contrary construction practices are termed unsustainable construction practices. Unsustainable construction practices disregard the use of nonrenewable energy, prudent use of natural resources, and minimization of the negative impacts of construction activities on the earth's ecosystems (Watuka and Aligula, 2002; Shen, Shen and Sun, 2012; Adogbo, 2005; Sev, 2009).

According to Sev (2009), the elements of sustainable construction practices can be classified into three phases – Sustainable procurement; Sustainable design; and Sustainable construction.

Sustainable procurement has to do with building relevant factors relating to sustainable development and the environment into contract specifications, for example, specifications may reflect environmental matters by taking award decisions by whole life costs (Windapo and Rotimi, 2012). Sustainable design focuses on the thoughtful integration of architecture with electrical, mechanical and structural engineering. Contrariwise traditional design adds to these criteria minimization of resources depletion and environmental degradation and creating a healthy built environment life cycle analysis strategy. Choices of more costly design alternatives or features are offset by cost, resources and energy savings realized over the life cycle of the facility. While Sustainable construction involves sustainable/cleaner technology – sustainable technology minimizes the use of non-renewable energy and resources satisfy human needs with sensitivity to cultural context and have a minimal negative impact on the earth's eco-systems (Oke et al., 2019). Waste reduction measures – salvaging items that have some remaining life, such as household goods and building materials reduces construction and renovation waste. Waste is also reduced or minimized by designing buildings to use standard-dimension lumber and through adaptive reuse (renovating existing buildings, rather than destroying them and making new ones (Sodagar and Fieldson, 2008).

Sustainable construction processes comprise stages from the selection of the raw materials to manufacture of construction materials, components thereof and completed building materials; and to the design of streets, highways, drainage systems, final garbage dumps for liquid and waste and pavements. Also included is preparedness for the development and agglomeration of people and vehicles to avoid or mitigate environmental contamination. A key point for sustainable construction is the consideration to minimize energy wastage, taking rational advantage of the natural conditions without altering them and allowing other living forms to live and be preserved (Flint, 2013). Ameen, Mourshed and Li, (2015) remark that sustainable construction processes introduced within the design of the elements of urbanization (buildings, streets, transport services, public spaces), criteria for recycling, the use of energy saving technologies and interaction with nature in urbanization and socialization processes, provides the necessary spacers and landscapes for human harmony and balance.

Barriers to Sustainable Construction Practices in Nigeria

Over the years, indigenous contractors in Nigeria have recorded a low level of input and have often been sidelined in large scale construction operations. Due to several factors such as mismanagement of funds and working capital which makes them prone to insolvency, with poor project execution and abandonment the possible outcome (Chukwudi and Tobechukwu, 2014). Dependent on foreign building and construction firms compared to qualified local contractors is on the high side. Ibrahim (2011) posits that shortages in home-grown construction capacity in Nigeria have caused an unpleasant dependence on imported inputs (such as construction materials, machinery, and the skilled manpower) that is requiring to carry out much-needed infrastructure for economic growth and to improve living conditions. Thus, foreign contractors carry out significant proportion (90%) of construction works in monetary terms across the three tiers of government in which their numerical strength is only about 7% of the total number of contractors in Nigeria (Ibrahim, 2011). Subsequently, Oribuyaku (2011) asserts that if the predisposition continues, the Nigerian construction industry may continually be foreign dominated.

Lack of National Building code is also another factor hindering against the development of construction sustainability in Nigeria (Dahiru et al., 2012). Poverty and low urban investment also have been identified as a factor militating against the development of construction sustainability. This includes perception of higher investment costs in the urban area, long pay-back period, client fears about viability, poor knowledge of life cycle cost and difficult access to financial resources (Alsand et al., 2011). The apparent high cost of carrying out sustainable construction is a challenge to its operation. Higher costs of applying sustainable construction may be seeming as more exclusive than conventional construction because of increase in consultancy fee (Alsand et al., 2011). Also, the long-term gains of sustainability are problematic to express in terms of financial gains (Dzokoto and Dadzie, 2013). Other major barriers to the development of construction sustainability are the poor awareness level. Numerous stakeholders in construction companies lack adequate information on sustainable construction (Williams and Dair, 2007). Abolore (2012) and Al-Sanad (2015) posit that the level of construction sustainability awareness among developing countries such as Nigeria and Kuwait are low. Previous research by Abolore (2012) confirmed that

there is low knowledge of sustainable construction in the construction sector that is below average. The study carried out by Elmualim et al (2012) stated that managers who are answerable for charting the sustainability cause have little or no information about sustainability construction. Consequently, this average level of awareness will affect on the level of implementation of these sustainable construction practices. It will be difficult to develop and execute a concept that is not well understood (Tunji-Olayemi, 2018).

Lack of expertise for sustainable construction serves as a challenge that influences the implementation of sustainable strategies in the construction sector. In the research carried out by Baron and Donath (2016), it was discovered that the major challenge of sustainable construction was not only awareness but appropriateness. It was discovered that there is an awareness of sustainable construction, but its implementation was not correct. This could be as a result of budget constraints, or lack of technical know-how or its reduction to the problem of sustainable resource management (Oke et al, 2019). More also, the negative implications for the implementation of sustainable construction could be demonstrated when the unavailability of sustainable construction materials, non-existence of sustainability measurement tool and absence of exemplary demonstration projects are issues bothering around expertise for sustainable construction (Dzokoto and Dadzie, 2013). Abolore (2012) further noted that efficiency to manage the growing demand for public service is another hindrance to implementing sustainable construction.

Drivers of Sustainable Construction Practices

The construction industry is client driven, and as such the level of awareness, training, education, and adoption of sustainable construction by clients play a significant role in the implementation. Construction experts are a group of significant stakeholders in attaining sustainable construction (Hakkinen and Belloni, 2011). The execution process of sustainable construction has been decelerated given the fact that most construction organisation saddled with the task believe, it will result in increased risks. This is because they are ignorant about the market value of such higher initial cost, they face the hitches in securing financial aid from funding institutions and there is lack of clients' awareness of sustainable construction (Zhou and Lowe, 2003). The client is seen to be one of the key drivers towards the development of sustainable construction in the construction sector (Abidin and Pasquire, 2005). This is because client demand is fundamental to the development of sustainable construction (Hakkinen and Belloni, 2011). Oke et al. (2019) confirmed that the client's request has a direct connection with cost, knowledge, method, supply, and value. While Niroumand et al. (2013) and Udawatta et al. (2015) posit that clients demand, and awareness directly connected to education and training in the pursuit towards adopting sustainable construction in the construction sector. It is therefore important that sustainability construction can only be set into motion if awareness with interest and knowledge are in place (Du Plessis, 2007), as gaining knowledge will lead to increased demand that results into implementation (Abidin, 2010; Oke et al., 2019).

In moving towards achieving sustainable construction by the construction sector, there is need to take into consideration the integration of environmental and economic issues. This entails the issues of design and management of buildings construction, materials and building performance, energy and resource

consumption that are amidst the greater trajectory of urban development and management (UNEP, 2015). Hence, construction organization that wishes to align their strategies and operations with the principles of construction sustainability needs to understand and manage how their economic impacts link to environmental outcomes (Abolore, 2012). This necessity will be marked for those construction organisations that have the most vital economic influences.

Previous research by Darko et al. (2017) highlight cooperation and partnership among the project participants as a driver that influence and encourage the adoption of certain sustainable construction practices and can include the possible benefits or decisions or actions that persuade professionals in the implementation of green building. Partnerships support the means of implementation and revive the global partnership for sustainable development (Davis, 1999). Action by individual companies is essential but not adequate to drive transformational and complete change toward sustainable development. Cooperation, partnership, and participation will be essential (Fiszbein, and Lowden, 1999).

The current faced with the effects of global warming, ozone depletion, destruction of natural habitats and loss of biodiversity on the world (Oke et al, 2019). The construction industry must consider enhancing or at least protecting biodiversity as it considers all things and their habitats (OGC, 2005) in other to achieve sustainable construction development. More also, this can be achieved through the adoption of a multi-disciplinary approach covering several features such as energy saving, improved use of materials, reuse and recycling, innovation design, and emission control (Aigbavboa et al., 2017; Oke et al., 2019). There is a need for obligation in other to consider biodiversity and conservation of natural resources in developments in terms of good design and landscaping (OGC, 2005).

Building sustainability assessments are the most broadly adopted approach for implementing a construction sustainable development and assessing building performance against sustainability criteria. Building sustainability assessment remains the vital instruments in acknowledging and institutionalizing the importance of assessing building(s) across a broad range of considerations beyond establishing the single performance criteria such as energy (Cole, 2001). These appraisals help to provide awareness and understanding amid the building professionals as to the significance of sustainable buildings (Cole, 1998; Ding, 2008). Larsson and Cole (2001) assert that the research community and government agencies see assessment and labeling systems as the most efficient system of driving market transformation. With the misperception that surrounds the definitions and boundaries of sustainable construction, building assessment tools propose a standard definition in terms of performance requirements and assist construction companies to interpret the confusing requirements of sustainable buildings into action (Yu and Jeong Tai Kim, 2011).

RESEARCH METHOD

Normal paragraph text This study surveyed on-going building construction projects in Abuja, the Federal Capital Territory of Nigeria. The decision to use on-going building construction projects was informed by the need to identify unsustainable construction practices and relates the responses of the respondents

to the actual practices on construction sites. The study employed structured questionnaire (based on a 5-point Likert scale) targeted at construction professionals (Architects, Builders, Quantity Surveyors, Town Planners, Surveyor, Estate Surveyors, and Engineers) that were available at the sites used for the study. The questionnaire consists of questions on the unsustainable construction practices, barriers to sustainable construction practices, and appropriate drivers for sustainable construction practices on construction sites in Nigeria.

The choice of Abuja as the study location was based on its unique position as the city with the highest number of on-going building construction projects. A total of 50 construction sites were selected from the on-going building construction projects in Abuja, out of which only 43 construction sites have at least a construction professional present at the site. This produced 43 filled questionnaire which was used for analysis in this study. Data analysis was done using the mean item score in order to determine the significant unsustainable construction practices, barriers to sustainable construction practices, and appropriate drivers for sustainable construction practices on construction sites.

RESULTS

Distribution of the respondents

As presented in Table 1, the distribution of the respondents is as follows: Builders (30%), Quantity Surveyors (18%), Architects (16%), Engineers (11%), Town Planners (11%), Land Surveyors (7%) and Estate Surveyor (7%). The majority of the respondents are Builders, closely followed by Quantity Surveyors and Architects. However, all the professionals are represented in the study, which suggests that the information elicited will be balanced.

Table 1: Profession of respondents

Profession	Number of Response	Percentage of Response (%)
Builders	13	30
Quantity surveyors	8	18
Architects	7	16
Engineer	5	11
Town planner	5	11
Land surveyor	3	7
Estate surveyor	3	7
Total	43	100

Unsustainable construction practices on construction sites

Normal paragraph text This study sought to identify the common unsustainable construction practices on construction sites in Nigeria. As explained in Table 2, Misuse of natural resources (mean score=3.4) was indicated as the leading unsustainable construction practices on construction sites, followed by Land misuse (mean score=3.3), Air pollution (mean score=3.3), excess wastage (mean score=3.2), noise pollution (mean score=3.2), non-management of health and safety of workers (mean score=3.1) and Material waste (mean score=3.1). The

findings suggest that the respondents agree that unsustainable construction practices on construction sites are relatively high.

Table 2: Unsustainable construction practices on construction sites

Unsustainable construction practices on construction sites	Mean
Misuse of natural resources	3.4
Land misuse (erosion, desertification)	3.3
Air pollution	3.3
Energy wastage	3.2
Noise pollution	3.2
Non-management of health and safety of workers	3.1
Material waste	3.1

Barriers to sustainable construction practices on construction sites

Respondents were asked to indicate the barriers to sustainable construction practices on construction sites. The result is summarized in Table 3. The results show that all the barriers are significant with a minimum mean score of 3.0.

Table 3: Barriers to sustainable construction practices on construction sites

Barriers to sustainable construction practices on construction sites	Mean
Need for work and task simplicity	3.4
Lack of professional to hand the task	3.2
Lack of efficiency	3.2
Unavailability of national building code	3.1
Poverty and low urban investment	3.1
Lack of awareness	3.0
Lack of expertise for sustainable construction	3.0

Drivers of sustainable construction practices on construction sites

As explained in Table 4, respondents agree that Education, training, and awareness (mean score=3.4) is a key driver of sustainable construction practices on construction sites. This is closely followed by environmental and economic integration (mean score=3.3), Cooperation, partnership and participation (mean score= 3.2), Protection of biodiversity and conservation of natural resources (mean score=3.1) and Precaution and evaluation (mean score3.0).

Table 4: Drivers of sustainable construction practices on construction sites

Drivers of sustainable construction practices on construction sites	Mean
Education, training, and awareness	3.4
Environmental and economic integration	3.3
Cooperation, partnership, and participation	3.2
Guidelines on the protection of biodiversity and conservation of natural resources	3.1
Sustainability assessment	3.0

DISCUSSION OF FINDINGS

Normal paragraph text Towards the consideration of sustainable construction practices in Nigeria, this study identified the unsustainable construction practices on construction sites as well as established the barriers and suitable drivers for sustainable construction practices on construction sites in Nigeria. The findings of this study showed that the misuse of natural resources is the most significant unsustainable construction practices on construction sites in Nigeria. This could be as a result of the lack of usage of manufactured sand and recycled materials in the construction buildings in Nigeria. In Nigeria, the bulk of the sand and gravel used for concrete production are gotten from the borrowed pit. As noted by Abolore (2012), this action represents unsustainable construction practices. The findings of this study also showed that land misuse, air and noise pollution, materials and energy wastage, and non-management of health and safety of workers are common unsustainable construction practices in Nigeria. This means that efforts are not been made on construction sites in Nigeria to curb erosion and desertification as a result of construction activities. It also means that construction systems in use do not support materials and energy savings. Health and safety of workers are paramount to the availability of the workers for future projects. The lack of efforts to manage the health and safety of workers on construction sites in Nigeria as found in this study indicates an inefficient use of human and material resources in Nigeria. These findings are in line with the study by Kaatz et al. (2005) which indicated that the essence of sustainable construction practices is to maximize the efficient use of resources.

This study found the need to simplify work and task as the most significant barriers to sustainable construction practices on construction sites. This show that contractors in Nigeria are of the opinion that the conventional construction process is a simple way to work as compared to innovative or sustainable work process. The use of conventional construction process is a major unsustainable construction practice and it also constitutes a major barrier to sustainable construction practices (Ameen et al., 2015 and Dahiru, 2005). Lack of expertise for sustainable construction, lack of awareness of sustainable construction practices, poverty, and unavailability of National Building Code were also found to be significant barriers to sustainable construction practices on construction sites. The unavailability of the National Building Code means that contractors engage in construction activities without any minimum standards. This will also bring about the absence of energy-efficient designs and the use of low carbon materials, which as a result will constitute unsustainable construction practices on construction sites. This argument is in line with the conclusion by Dahiru et al. (2012). Poverty also constitutes a barrier to sustainable construction practices because of the high cost of sustainable construction in terms consultant fees and use of sustainable materials (Alsand et al., 2011; Dzokoto and Dadzie, 2013).

Further, the findings of this study show that the suitable drivers of sustainable construction practices on construction sites in Nigeria are education and training, availability of guidelines, availability of sustainability assessment system, and cooperation among the project participants. Education is required to develop expertise for sustainable construction and availability of sustainability assessment system is useful in driving awareness and transformation in the construction

industry; while cooperation among the project participants provides the required supports and innovation for sustainable construction practices. Studies by Yu et al. (2011) and Darko et al. (2017) provides support for this argument.

CONCLUSIONS AND RECOMMENDATIONS

The aim of this study is to identify the unsustainable construction practices on construction sites as well as established the barriers and suitable drivers for sustainable construction practices on construction sites in Nigeria. The study concludes that the misuse of natural resources is predominant on construction sites in Nigeria and that human resources are inefficiently utilized. The inefficient use of both natural and human resources is a major unsustainable construction practice in Nigeria. The study also concludes that contractors are reluctant to be innovative with construction systems on construction sites. The use of innovative construction systems would have ushered in sustainable construction practices. However, this was not the case on construction sites in Nigeria.

Sustainable construction is not being practiced on construction sites as a result of the use of conventional construction system, poverty, lack of expertise for sustainable construction, and unavailability of National Building Code. Finally, the study concludes that education and training, sustainability assessment system and National Building Code are suitable for driving sustainable construction practices in Nigeria.

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