Assessing the Factors that Influence the Attitudes of Built Environment Professionals towards the Implementation of Sustainable Construction in Nigeria

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ABSTRACT

Researches has shown that professionals' attitude to sustainable construction are very important if sustainable construction is to be achieved but practicing Nigerian Built Environment (BE) professionals have been seen to be sustainable construction inefficient. This study assesses the factors that affects the attitudes of BE professionals' towards achieving the implementation of sustainable construction practices in the Nigerian construction industry. The study adopted a quantitative research approach with data collected using a structured questionnaire. The proportional allocation method of stratified random sampling and snowballing technique were used for the survey and data collected was analysed using descriptive statistics. The Kruskal Wallis test was also applied to check for the significance differences in the means score of the BE professionals' responses. The study established that poor communication, team work, cooperation and collaboration, expensive nature of sustainable construction, lack of proper legislation and regulation are the top factors influencing BE professionals' attitude in implementing sustainable construction. The study concludes that implementation level of sustainable construction practice is not directly proportional to the awareness of BE professionals within the Nigerian construction industry. Thereby BE professionals need to improve their attitudes towards the implementation of sustainable construction practices in the Nigerian construction industry.

Keywords: Construction, Sustainability, Built Environment, Professionals, Sustainable Construction, Nigeria

INTRODUCTION

Sustainable construction (SC) is an application of the principles of sustainable development to comprehensive construction cycles from the extraction of raw materials through planning, design and construction of buildings and infrastructure until the last deconstruction and management of resultant waste (Yunus & Yang, 2011). This process subsequently enhances the creation of a healthier and eco-friendlier environment and is undertaken with the highest level of cooperation and coordination of the design team,

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engineers, constructors and owners all through the particular project (AlSanad, 2015).

According to Halliday (2008), The BE professionals as an academically trained specialist, and statutorily registered professionals, responsible for the design, construction, operation and management of the BE, have the responsibility of adopting new technologies, processes, products, and systems that guarantee the achievement of SC. In other words, the BE professionals should ensure that construction is undertaken in an environmentally conducive manner. Also, the structure produced should be destructive to the environment and also meet the increasingly common social expectation, such that the effort will lead to the delivery of buildings/infrastructural facilities that are functional, efficient, safe and sound. This presumes that professionals within the BE need to be fully familiar with SC principles so as to implement its practice (Rydin, Amjad, Moore, Nye, & Withaker, 2006).

According to Dahiru, Dania and Adejoh (2014) SC is not practiced in Nigeria; there is no any enabling environment in the way of legislation or policy on SC practice; their study revealed that most professionals are aware of the new trend (Sustainable construction) and the enormous benefits derived from it and they see SC as a basis for appealing liveable homes and preserving natural resources while taking care of their health. However, the generality of the public is not fully aware of this development i.e., level of awareness of SC is low. Nduka and Ogunsami (2015) also claimed that a higher percentage of Nigerian BE Professionals are aware and familiar with the SC concepts which confirmed the earlier results of other similar studies by Ameh, Isijiola & Achi, (2007), Abolore (2012) and Waniko (2014) in Nigeria. Whiles we have a significant level of awareness of this concept in the construction industry; its implementation cannot be seen or has not really manifested (Araújo, Bragança, & Almeida, 2013). The implication of this is that more commitment is needed from the industry stakeholders such as the professionals, to adjust their businesses and practices to capture SC principles (Oni, 2015).

It is on this background that the research explored the attitude of BE Professionals towards the implementation of SC practice in the Nigerian construction industry. Assessing these factors is essential for fostering sustainable development in the construction sector and aligning it with global sustainability goals. In line with the United Nations Sustainable Development Goals (SDGs) and international trends in SC as Nigerian policymakers and stakeholders have expressed a commitment to integrating sustainability into the construction industry (Abolore, 2012). However, the successful implementation of sustainable construction practices will depend on the willingness and engagement of the BE Professionals, who are key stakeholders and within the industry.

Problem Statement

The Nigerian construction industry is at a crucial point positioned for considerable growth and development. Yet, contends with the challenge of extensive adoption of SC adoption (Ofori, & Kien, 2004; Lam, Chan, Poon, Chau, & Chun, 2010). Creating a more sustainable BE has been a growing concern for the construction industry in developing and developed countries, but the efforts made by the BE professionals in West Africa in achieving SC practice has been shown to be very little, this is particularly true, when such effort is compared with that of the developed nations – in terms of awareness, training, skills, exposure and cooperation, etc. (Dahiru, Bala, & AbdulAzeez, 2015).

Despite the global call for SC and the innate benefits it presents, there remains a lack of empirical study which explores the factors that influence the attitudes of BE Professionals in the Nigerian context. As emphasized by Ogunmakinde *et al*. (2016), Professionals' attitude to SC are very important if SC is to be achieved but Dania, Larsen and Yao (2013), claimed that practicing Nigerian BE Professionals are seen to be SC inefficient. Therefore, this study seeks to assess the factors influencing the attitude of BE

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Professionals' towards the Implementation of SC practice in the Nigerian Construction Industry.

Research Purpose

The main purpose of this research is to assess the factors influencing the attitude of BE Professionals towards the Implementation of SC practice in the Nigerian Construction Industry with a view to improving sustainable construction implementation. The following objectives were addressed;

1. To determine the awareness of BE professionals about SC practice in the Nigerian construction industry
2. To determine the implementation level of sustainable SC practice in the Nigerian construction industry
3. To assess the factors influencing the attitude of BE professionals towards the implementation of SC in the Nigerian construction industry

LITERATURE REVIEW

Sustainability in Construction

Constructing Excellence (2004) defined SC as the application of sustainable development in the construction industry and suggests that sustainable development is "all about ensuring a better quality of life for everyone, now and for generations to come, through: social progress which recognises the needs of everyone, maintenance of high and stable levels of economic growth and employment, whilst protecting, and if possible enhancing, the environment, and using natural resources prudently. Sustainable development embraces the three broad themes of environmental, social and economic accountability, often known as the 'triple bottom line'." (Constructing Excellence, 2004)

From the foregoing definition and noting the basic definition of sustainability which According to Brundtland Commission is "meeting the needs of the present without compromising the ability of future generations to meet their own needs". It therefore follows that human, natural and economic systems are interconnected and that the present generations are indebted to the future generations in terms of earth's resources (Kibert, 2005).

The concept of SC concerns the responsibility of the construction sector of creating the BE in a sustainable manner (Pearce et al, 2012). That is, in a way that is environmentally friendly, socially responsible and economically supportive. SC is centred on the economic, social, and environmental impact of creating a usable structure. In other words, it requires all stakeholders (Professionals, contractors and the clients) to imbibe construction practices that will minimise the damages done to the environment. SC practices reduces the use of raw materials and land, minimises the consumption of energy and water. It also reduces emissions, waste and pollution in the environment (McMahon et al., 2015).

Despite the variance between the different definitions of sustainability, there is a wide acceptance that sustainable development integrates, at least, three dimensions: social, economic and environmental (Sourani & Sohail 2006). Although some publications in the literature have mentioned other dimensions of sustainability such as technical sustainability (Hill & Bowen, 1997; Ashley, Blackwood, Butler, Davies, Jowitt, & Smith, 2003), cultural sustainability (Ofori, 1998; CIB, 1999), community sustainability (Ofori, 1998) and managerial sustainability (Ofori, 1998). The sustainable development concept is becoming increasingly important within the construction industry owing to the several challenges this sector faces like energy consumption and climate change, impact on natural resources, waste management and well-being of users. To overcome these problems, the appropriate application of sustainability principles to construction works will contribute to the development and implementation of new solutions at different levels such as the

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building design, the functional performance or the choice of materials. Nevertheless, the fragmentation of the construction sector accounts for a barrier to innovation and therefore it is essential the involvement of the various stakeholders to move forward (Martins & Gonçalves, 2012).

Principles of Sustainability in Construction

Sustainable building approach is considered as a way for the building industry to move towards achieving sustainable development considering environmental, socio and economic issues. It is also a way to portray the industry's responsibility towards protecting the environment (Ding 2008). The practice of SC refers to various methods in the process of implementing building projects that involve less harm to the environment. For instance, prevention of waste production (Ruggieri *et al*., 2009), increased reuse of waste in the production of building material. For instance, waste management (Asokan *et al*., 2009) beneficial to the society, and profitable to the company (Tseng *et al*., 2009). Hill and Bowen (1997) state that SC starts at the planning stage of a building and continues throughout its life to its eventual deconstruction and recycling of resources to reduce the waste stream associated with demolition. The authors then describe SC as consisting of four principles: social, economic, biophysical and technical. The proposed principles for SC are discussed in table 1 below.

Table 1: Proposed Principles for Sustainability/Sustainable Building

Authors	Proposed principles for sustainability/sustainable building
Halliday (2008)	*Economy*: Good project management is a vital overarching aspect in delivering sustainable projects, both in the short and long term. *Using Resources Effectively*: Buildings should not use a disproportionate number of resources, including money, energy, water, materials and land during construction, use or disposal. *Supporting Communities*: Projects should clearly identify and seek to meet the real needs, requirements and aspirations of communities and stakeholders while involving them in key decisions. *Creating Healthy Environments*: Projects should enhance living, leisure and work environments; and not endanger the health of the builders, users, or others, through exposure to pollutants or other toxic materials. *Enhancing biodiversity*: Projects should not use materials from threatened species or environments and should seek to improve natural habitats where possible through appropriate planting and water use and avoidance of chemicals. *Minimising pollution*: Projects should create minimum dependence on polluting materials, treatments, fuels, management practices, energy and transport.
DETR (2000)	Profitability and competitiveness, customers and client's satisfaction and best value, respect and treat stakeholders fairly, enhance and protect the natural environment, and minimise impact on energy consumption and natural resources.

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Hill and Bowen (1997)	*Social pillar*: improve the quality of life, provision for social self-determination and cultural diversity, protect and promote human health through a healthy and safe working environment and etc. *Economic pillar*: ensure financial affordability, employment creation, adopt full cost accounting, enhance competitiveness, sustainable supply chain management. Biophysical pillar: waste management, prudent use of the four generic construction resources (water, energy, material and land), avoid environmental pollution and etc. *Technical pillar*: construct durable, functional, quality structure etc. These four principles are contained within a set of over-arching, process-oriented principles (e.g., prior impact assessment of activities).
Miyatake (1996)	Minimization of resource consumption, maximization of resources reuse, use of renewable and recyclable resources, protection of the natural environment, create a healthy and non-toxic environment, and pursue quality in creating the built environment
Cole and Larsson (1999)	Reduction in resource consumption (energy, land, water, materials), environmental loadings (airborne emissions, solid waste, liquid waste) and improvement in indoor environmental quality (air, thermal, visual and acoustic quality)
Kibert (2007)	The creation and responsible management of a healthy built environment based on resource efficiency and ecological principles. Kibert (2007) submits that the tenets of sustainable construction are hinged on seven essential principles as postulated by CIB 1994 which include: Reduce resource consumption (Reduce); Reuse resources (Reuse); Use recyclable resources (Recycle); Protect nature (Protect); Eliminate toxic (Toxic); Apply life-cycle costing (Economics); Focus on quality (Quality).

Source: Literature

This study will adopt the principles submitted by Kibert (2007) as it applies throughout the entire life cycle of the construction from planning to deconstruction. The principles also apply to the resources (land, materials, water, energy and ecosystem) required for creating and operating the structure during its entire life cycle. The consideration of the various aspects of sustainability namely, environmental, social, economic, technical and political; also, the dynamics and synergies between them are essential in order to maximise the solutions to complex building and infrastructure challenges (Kibert, 2007).

Sustainable Construction in the Context of Developing Countries

Du Plessis (2007) posits that most developing countries are faced with the serious developmental challenges such as housing and infrastructure shortages, poor governance, high level poverty, ineffective institutions, and high rate of urbanisation, weak economy and low human development index. The Construction activities in these developing nations of the world are somewhat paradoxical. On one hand, they attempt to plug the gaps in housing and infrastructure needed for social-economic growth; on the other hand, these activities are plundering the environment, socially harmful and economically destructive. With sustainability becoming a serious global issue, it is essential that the developing countries give the much-needed attention to it, given the negative implications its neglect possess. However, Thorpe and Ryan, (2007) contend that it is worrisome to note that there is little or no evidence in extant literature on the advancement made in sustainable construction by the developing countries of the world. In order to implement sustainable construction, a responsive, efficient and viable construction sector is essential to drive the implementation process. The stakeholders in the construction industry also have vital roles to play in the actualisation of

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sustainable construction.

For developing countries to embark on a path of sustainable development and construction a two-pronged approach is required: it is first necessary to create a capable and viable local construction sector; second, it is necessary to ensure that the sector is able to respond to the demands sustainable development places on its activities. This can only be possible if all the different stakeholders cooperate in the implementation of a clear strategy that involves specific supportive actions by all role players and the development of a set of enablers. Du Plessis *et al*. (2002) identified three types of interdependent and multi-dimensional enablers: technological, institutional and enablers related to value systems (both how things are valued and the social, spiritual or moral values that guide decisions). These enablers are informed by local development needs (human needs) and both local and global environmental considerations (environmental limits).

Sustainable Construction Implementation and its Impact

A review of literature has identified three general objectives which should shape the framework for implementing sustainable building design and construction, while keeping in mind the principles of sustainability issues (social, environmental and economic) identified previously. These objectives are resource conservation, cost efficiency and design for human adaptation. (Akadiri et al., 2012). The construction industry has come to terms on the broader environmental and social agenda that seeks to present SC as a key concept to resolving the menace posed by construction. This is because the built environment affects our daily human activities. The construction industry represents over 50% of the national capital in most countries. In some cases, they make up 10% of GNP (Bash & Häkkinen, 2015). Globally it accounts for almost 10% of the world's Gross Domestic Product, (GDP) leading to the creation of about 7% of jobs.

Thus, its contribution to a nation's socioeconomic development cannot be overruled. In this sense, it provides significant opportunities for employment and also infrastructure and facilities needed. These facilities include schools, factories, residential accommodation, and hospitals among others. This leads to a huge demand on the environment and natural resources. For instance, cement production, which is core to the construction industry, leads to enormous amount of CO2 emission. It is estimated that the production of a ton of cement leads the release of almost one ton of CO2. This situation is more alarming in the industrialized countries. In the US alone buildings consume 38.9% of energy, 38% of CO2 emission and 30% of waste output (Chen, Okudan, & Riley, 2010). In the UK, the 40% of all waste is generated by the construction industry. They are also responsible for 50% of the total energy usage and 45% of heat, lighting and ventilations (Pitt *et al.*, 2009).

Another material which is energy intensive in its production that is used heavily by the construction industry is steel. It is evident that the use of materials in the construction industry affects the environment during the production of these materials and during its use. Some researchers have demonstrated that about half of wastes materials result from building activities.

The construction industry forms a large part of the economy of every country contributing between 5 and 10 percent of gross domestic product and employs up to 10 percent of the working population (Ofori, 2012). Construction provides the physical infrastructure needed by all spheres of the economy (school, hospitals, residential buildings, commercial buildings among others,) to function effectively, therefore the quality of the production environment provided by the construction industry eventually impact on the economy of the nation (Djokoto *et al*., 2014). Construction has many complex correlations with other sectors of the economy especially the manufacturing sector and can influence the performance of these sectors (Ofori, 2012), for instance low demand from the construction industry for materials will eventually impact on the

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manufacturing industry and the economy as a whole.

Walker (2000) identified that SC improves resource efficiency, air quality, social sustainability (e.g., local employment) and occupant health, reduction of embodied/capital carbon, better resource security, and greater energy efficiency and these are beneficial to everyone. It helps in attracting and retaining good support staff as well as reduces absenteeism and also boosts the brand image of organizations (Pitt et al., 2009). The social dimension of sustainability has been argued to be the most ignored of the three dimensions of sustainability.

Attitudes of Professionals towards Implementing Sustainable Construction Practice

One of the most crucial factors to SC is the lack of capacity of the construction sector (CIB Report, 1999). In other words, does the construction sector have the capacity to actually implement SC practices? It has been established that sustainable construction practices are stalled by ignorance and lack of common understanding (Häkkinen & Belloni, 2011). Practitioners' confidence on their knowledge on construction is high; however, this confidence drops whenever they are faced with issues of sustainable construction (Rydin *et al*., 2006). Thus, professionals within the construction industry appear not to be fully abreast with the totality of sustainable construction concepts. In addition, sustainable technologies and materials require newer competence levels that may be beyond the expertise of those in the industry (Djokoto *et al*., 2009). That notwithstanding, there is a possibility that this situation may not be the reality but rather a perception. Sustainable construction is a relatively new concept and thus professionals may not be confident or aware of how knowledgeable they are. Thus, their perception on their capacity can lead to their slacking approach to its adoption and implementation.

According to Dahiru *et al*. (2014), SC is not practiced in Nigeria; there is no any enabling environment in the form of legislation or policy on SC practice; their study revealed that most professionals are aware of the new trend of SC and the enormous benefits derived from it and they see SC as a basis for appealing liveable homes and preserving natural resources while taking care of their health. However, the general public are not fully aware of this development i.e. level of awareness of Green Building is low. Nduka and Ogunsami (2015) claimed that a higher percentage of Nigerian built environment professionals are aware and familiar with the green building concepts (Ameh, *et al*., 2007; Abolore, 2012 and Waniko, 2014). Williams and Dair (2006) identified that, hindrance due to a lack of information was an experience common to most stakeholder groups and in several cases, stakeholders admitted to not being aware of sustainable measures or alternatives that fall within their remit.

The cultural shift required by sustainability can be summarized as the need to work with a holistic approach, the capacity to connect the local to the global, the ability to recompose knowledge, the skill in using technologies and innovations, directs architects and engineers to cooperate between themselves and other actors of development processes in order to produce a sustainable built environment. Actually, it is almost frequent that professionals in building and construction field collaborate in team, in search for design solutions based on different expertise and evaluated under the many aspects of a project. So, developed projects are often more competitive thus rewarding collaboration in team. However, designing in team is not easy for many reasons, starting from the basic problem of languages used to describe the object of design that usually differ between professionals.

RESEARCH METHODOLOGY

This study adopted the quantitative research approach. The choice of quantitative method for this research is because it informs statistically significant conclusions about a population by studying a representative sample of the population (Creswell, 2003). Since quantitative research approach was adopted; structured

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questionnaires were used in obtaining primary data required from the respondents. This technique has been used widely to solicit stakeholders' views on subjects within the domain of sustainable construction practices and management. The structured questionnaires contained only closed ended questions allowing respondents to only tick as appropriate and using a 5-point Likert scale rating where applicable. The questionnaire was designed based on the constructs identified from literature.

The questionnaire was structured into four sections. In the first part, the respondents were asked to give their respective demographic backgrounds details (i.e., position, length of experience, professional affiliation); the second part focused on determine the awareness level of BE professionals about SC practice in the Nigerian construction industry. The third part also focused on determining the implementation level of SC practice in the Nigerian construction industry using. The fourth part asked questions on the factors influencing the attitude of BE professionals towards the implementation of SC in the Nigerian construction industry. A 5-point likert scale was used where applicable in sections two, three and four.

The targeted population for the study comprised of the fully registered BE professional (architects, builders, quantity surveyors, engineers, land surveyors, estate valuers and town planners in Abuja, Nigeria. Abuja was selected as the study area because it is one of the fastest-growing cities in the country and has a very high concentration of registered Built Environment Professionals. This can be attributed to the large quantity of construction works in the area (Ameh & Odusami, 2010b). According to sources there are 3,399 fully registered BE professionals in Abuja as at March, 2020. Table 2 shows the population distribution of the various professionals.

Table 2: Population Distribution of Professionals

Professionals	No. of Reg. Members
Architects	433
Builders	410
Engineers (Civil)	360
Estate Valuers	578
Land Surveyors	570
Quantity Surveyors	454
Town Planners	594
Total	**3,399**

Source: Abuja branches of the professional Bodies

The sample size was determined with the formula proposed by Yamane, (1967) since the population size "N" is known while using a confidence level of 90% and a level of precision of 10%. Hussey and Hussey (1997) stated that a confidence interval of 10% is acceptable for social science researches.

$$n = \frac{N}{1 + N(e)^2} \quad \text{.....(1)}$$

Where N = total study population, which is 3399

e = precision level of ±10% @ 90% confidence level

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$$\frac{3399}{1+3399(0.1)^2} = 97.14$$

The sample size was 97.

According to Glenn (1992), either 10% or 30% can be added to account for non-response. In this case, 30% was added to account for non-response.

Adding 30% to the total for non-response = 97 + (97 x 30/100) = 97 + 29.1 = 126.1

A sample frame of 126 was selected for the survey.

In order to secure quality responses, credible and fair feedback in this study, for selection of samples, the seven categories of professionals, were considered as seven strata. The proportional allocation method of stratified random sampling was used to determine the sample size for each stratum and the sample from each stratum was taken through a snowballing sampling technique. Snowballing technique was used because of the difficulties usually encountered such as rejection by randomly selected personnel and sometimes the non-presence at their indicated addresses.

The proportional allocation method was originally proposed by Bowley (1926). In this method, the sampling fraction, $\boldsymbol{n/N}$ is same in all strata. The allocation of a given sample of size n to different stratum will be done in proportion to their sizes. I.e., in the i^{th} stratum,

$$\boldsymbol{n_i = n(N_i/N)} \text{.....} = 1, 2.$$

Where $\boldsymbol{n}$ represents sample size, $\boldsymbol{N_i}$ represents population size of the i^{th} strata, $\boldsymbol{n_i}$ represents the sample size for the i^{th} strata and $\boldsymbol{N}$ represents the overall population size. In this study, $N = 3399$; $n = 126$; $N_{i(1)} = 433$; $N_{i(2)} = 410$; $N_{i(3)} = 360$; $N_{i(4)} = 578$; $N_{i(5)} = 570$; $N_{i(6)} = 454$; $N_{i(7)} = 594$. Applying the above formula, $n_{i(1)}$ was 15; $n_{i(2)}$ was 14; $n_{i(3)}$ was 13; $n_{i(4)}$ was 21; $n_{i(5)}$ was 20; $n_{i(6)}$ was 17; $n_{i(7)}$ was 26. Table 3.2 shows the distribution of sample by category of professionals.

Table 3: Distribution of Sample by Category/Strata

Categories of Professionals	Total Number of Reg. Members	
	N_i	*ni* (Prop)
Architects	433	16
Builders	410	15
Engineers (Civil)	360	14
Estate Valuers	578	21
Land Surveyors	570	21
Quantity Surveyors	454	17
Town Planners	594	22
Total	**3399**	**126**

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Data Analysis

The data collected were subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS) software. Descriptive statistics was used to describe the basic characteristics of the data from the questionnaire survey such as, simple percentages, frequency, and bar charts. Meanwhile, mean item score (MIS) and standard deviation (SD) was used for the ranking and to determine the severity and also rank each factor identified. Inferential statistics was carried out using Kruskal Wallis to test for the significant difference in the responses on the factors influencing the attitude of BE professionals towards the implementation of sustainable construction in the Nigerian construction industry. The Kruskal Wallis test reveals whether the ranks established by more than two groups possess significant differences, the H_0 signifies that 'there is no significant difference in the variable ranks among the various groups.' As a result, H_0 is rejected if the Kruskal Wallis test value extends beyond its critical value at a significance level less than or equal to 0.05 ($p \leq 0.05$).

The reliability of respondents' ratings was assessed to determine the internal consistency. The value of the Cronbach's Alpha coefficient (α) ranges from 0 to 1 and can be used to describe the reliability of variables deduced from questionnaires or dichotomous and multipoint structured scales (Chan *et al*., 2017). The closer the value of α is to 1, the more reliable the adopted measurement scale. According to Nunally, (1978) in order to justify the reliability of the scale adopted, α value should be no less than 0.7. The SPSS 23.0 statistical package was specifically employed to calculate the value of α for this dataset. The value obtained was 0.969, which indicated a very high degree of reliability.

RESULTS AND DISCUSSION

4.1 Survey Results

A total of 126 questionnaires were administered to the respondents using the proportional allocation method, 16 questionnaires was administered to Architects, 15 to Builders, 14 to Engineers, 21 to Estate Valuers, 21 to Land Surveyors, 17 to Quantity Surveyors while 22 was administered to Town Planners. This makes a total of 126, 115 were duly filled and returned and only 103 were found fit for analysis. The response rate is presented in table 4 below.

Table 4: Response Rate of Administered Questionnaires

Questionnaires	Frequency (No)	Percentages (%)
Total administered	126	100
Total recovered	115	91.27
Total analysed	103	81.75

The response rate was deemed adequate and acceptable for the study. This is because, the response rate is relatively high (81.75%) as compared to similar studies relating to sustainable construction by Durdyev *et al.* (2018), (77.03%), Ayarkwa et al. (2017) (73.1%), Nduka and Ogunsamnmi (2015) (61%) and hence validates representativeness of the sample of study. Moser and Kalton (1971) also stated that the result of a survey could be considered as biased and of little value if the response was lower than 30-40%, the response rate for the research is 81.75% which indicate an unbiased and higher value of survey.

Demography of Respondents

Considering the type of respondent organization, out of the total number of 103 respondents 55 (53.4%) work with contracting organization 42 (40.8%) work with consulting organization while only 6 (5.8%)

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works with client organization. All the participants in the survey were drawn from either one of the 3 organisations from within the construction industry sector. This was to ensure an equal representation as well as an all-encompassing view on the subject matter. 27 (26.2%) of the respondents have between 0 and 5 years, 50 (48.5%) have between 6 and 10 years of experience, 12 (11.7%) have between 11 and 15 years of experience, while 6 (5.8%) of the respondents have between 16 and 20 years of experience and 8 (7.8%) have above 20 years of experience.

The average working experience of the respondents are (6-10) years and (11-15) years which is quite enough for them to be able to respond to the questions and give valid and reliable responses in the survey. This is indicative of the adequate practical experience and exposure of the respondents and also reflective that the respondents have sufficient knowledge and are very likely to understand and accurately interpret the questionnaire items leading to the quality responses. Additionally, the table also shows the respondents' professional affiliation: 12 (11.7%) of are architects, 13 (12.6%) are builders, 11 (10.7%) are civil engineers, 18 (17.5%) are estate valuers, 15 (14.6%) are land surveyors, 15 (14.6%) are quantity surveyors and 19 (18.4%) are town planners. It is also important to note that all the 7 professionals of the built environment were fairly represented in the survey as the study to seek to get the built environment professionals' perceptions on the subject matter. The diverse background of the respondents as attested ensures the reliability and quality of the responses gathered.

Table 5: Respondents' Demography

Characteristics	Classification	Frequency	%
Organization Type	Contracting	55	53.4
	Consulting	42	40.8
	Client	6	5.8
	Total	103	100.0
Working Experience	Less than 5 years	27	26.2
	6–10 years	50	48.5
	11–15 years	12	11.7
	16–20 years	6	5.8
	Above 20 years	8	7.8
	Total	103	100.0
Professional Affiliation	Architecture	12	11.7
	Building	13	12.6
	Engineering (Civil)	11	10.7
	Estate surveying	18	17.5
	Land Surveying	15	14.6
	Quantity Surveyor	15	14.6
	Town Planning	19	18.4
	Total	103	100.0

Awareness of BE professionals about sustainable construction in the Nigerian constructionindustry

According to Zainul-Abidin (2010), the implementation of SC practices starts with awareness, and that after awareness, knowledge can be a good catalyst in achieving implementation. As such, the level of awareness and adoption of sustainable construction plays a significant role in the implementation. This was achieved by asking respondents to select statements that best described the meaning of sustainable construction in

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their own opinion from the statements that were derived from literature regarding the meaning of sustainable construction and also to rate their awareness level using the other various awareness indicators as derived from the review of literature.

Figure 1 below shows the response pattern on what the BE professionals understand as the meaning of sustainable construction, the question gave room for multiple selections and the result showed that most of the respondents agreed more with the definition that sustainable construction is a holistic process aiming to restore and maintain harmony between the natural and the built environment, and create settlements that affirm human dignity and encourages economic equity. This got a response rate of 69.9% although (Anzagira *et al.*, 2021) claimed that there is significant association between the professional background of the respondents and their understanding of the meaning of sustainable construction. The least definition that got the lowest response rate is sustainable construction being total quality approach to building with 6.8% response rate.

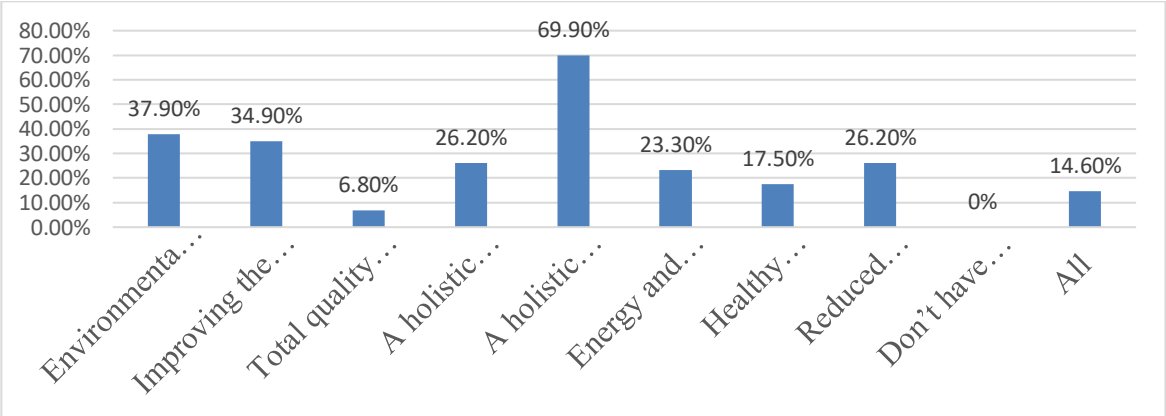

Fig. 1**:** Meaning of Sustainable Construction

Furthermore, BE professionals' awareness of sustainable construction was assessed by asking them to rate their awareness using the awareness indicators like familiarity with sustainable construction concept, personal experience in possible sustainable construction concept, level of interest and expertise in possible sustainable construction, and their willingness to incorporate sustainable construction concept. The result is presented in table 6 below.

Table 6: Awareness of the Be Professionals on Sustainable Construction Practices Using the Awareness Indicators

Awareness Indicators	Mean	Rank
Willingness to incorporate sustainable construction concept	4.30	1st
Level of interest and expertise in possible sustainable construction	3.65	2nd
Familiarity with sustainable construction concept	3.56	3rd
Personal experience in possible sustainable construction concept	3.15	4th

According to the above respondents' ratings of the awareness indicators, we could easily infer that the respondents have moderate to excellent awareness on the subject matter. This is because, according to the Oxford and Burry-Stock (1995) scale of mean interpretation, mean scores within the range of 1.0–2.4 are a low score, 2.5–3.4 are a medium score and 3.5–5.0 are a high score. The reason for this could be that they might have had some level of exposure in their respective profession to make them have such awareness. From the response, willingness to incorporate sustainable construction concept is ranked first among the indicators while level of interest in possible sustainable construction is ranked second. Familiarity with

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sustainable construction concept is ranked third. According to Nduka and Ogunsami (2015), familiarity draws on knowledge and experience and it goes beyond to include a sense of comfort. As one acquires knowledge and gains experience, comfort will increase as well. While personal experience in possible sustainable construction is ranked least among the indicators. This result agrees with the result of previous studies by (Ameh, *et al*., 2007; AlSanad, Gale, & Edward 2011; Waniko, 2014; Nduka & Ogunsami 2015) which found that the awareness on sustainable construction by the industry stakeholders was considered to be in the "moderate to good" region. Even at this, there is need to do more on the awareness as it an important mechanism for developing knowledge around sustainable construction and bridge the skillset gap in that regard.

Implementation level of sustainable construction practice in the Nigerian construction industry

On the implementation level of sustainable construction practice in the Nigerian construction industry, the involvement of BE professionals in sustainable construction as well as their compliance with principles of sustainable construction when carrying out construction activities was used to determine the level of sustainable construction practice in the Nigerian construction industry. The responses are presented and discussed below;

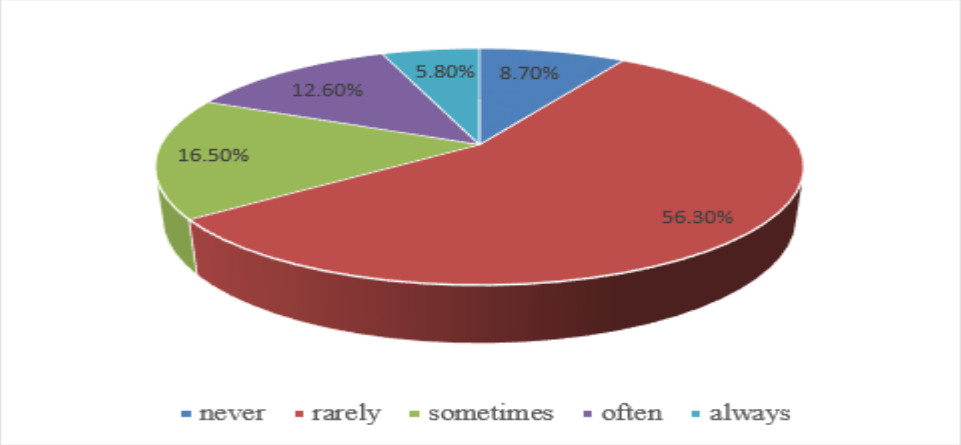

Fig. 2: Involvement in Sustainable Construction Projects

Figure 2 above represents the responses of the BE professionals on their involvement in sustainable construction projects, 9 (8.7%) said they have never been involved in any sustainable construction projects, 58 (56.3%) said they rarely participate in sustainable construction projects, 17 (16.5%) said they sometimes partake in sustainable construction projects, 13 (12.6%) said they often participate in sustainable construction projects while 6 (5.8%) have always been involved in sustainable construction projects. With respect to the principle of sustainable construction often applied when carrying out construction activities, the table 7 shows the response pattern of the BE professionals

Table 7: The Principles of Sustainable Construction Often Applied When Carrying Out Construction Activities

Principles of Sustainable Construction	Mean	Rank
Focus on quality (Quality)	3.73	1st
Reduce resource consumption (Reduce)	3.29	2nd
Protect nature (Protect)	3.04	3rd
Reuse resources (Reuse)	3.02	4th
Eliminate toxic (Toxic)	3.01	5th

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Apply life-cycle costing (Economics)	2.82	6th
Use recyclable resources (Recycle)	2.54	7th

Table 7 above presents the mean statistic and rank of the principles of sustainable construction usually adopted when carrying out construction activities by the respondents. Focus on quality (Quality) have the highest mean score (3.73) and is ranked first, this indicates that BE professionals focus more on quality when carrying out sustainable construction practices. Reduce resource consumption (Reduce) is ranked second with mean score of (3.29), protect nature (Protect) is ranked third with mean score of (3.04), reuse resource is ranked fourth (Reuse) is ranked fourth with mean score of (3.02), eliminate toxic is ranked fifth with mean score of (3.01), apply lie-cycle costing is ranked sixth with mean score of (2.82) while use recyclable resource (Recycle) have the least mean score (2.54) and is ranked seventh.

From the responses above, a large percentage of the BE professionals have never been involved in sustainable construction projects despite the fact that the awareness on sustainable construction practice among the BE professional is between the moderate and excellent level. This can only mean that awareness alone does not determine implementation and are not directly proportional, other factors such as proper government legislation and regulations, enabling environment, required technologies etc. needs to be put in place to enhance implementation. Also, using the Oxford and Burry-Stock (1995) scale of mean interpretation, it can be deduced that the compliance in using the principles of sustainability can be rated as between low to medium which will mean that the implementation level of sustainable construction practice in the Nigerian construction industry still needs a lot of improvement.

Factors influencing the attitude of BE professionals towards the implementation of sustainable construction in the Nigerian construction industry

Respondents were asked to rate factors influencing the attitude of BE professionals towards the implementation of sustainable construction in the Nigerian construction industry, the table below shows the mean score, standard deviation and rank of their responses.

Table 8**:** Factors Influencing the Attitude of BE Professionals Towards the Implementation of Sustainable Construction in the Nigerian Construction Industry

Factors that may Influence the Attitude of BE Professionals	Mean	SD	Rank
Poor communication, team work, cooperation and collaboration	4.16	0.998	1st
Expensive nature of sustainable construction	4.00	1.213	2nd
Lack of proper legislation and regulation within the country	3.98	1.120	3rd
Knowledge sharing	3.97	0.880	4th
Lack of coordinating structure	3.94	1.056	5th
Self-satisfaction and personal values	3.83	1.121	6th
Self-motivation and commitment	3.80	1.070	7th
Lack of guidelines and construction standards	3.73	1.002	8th
Political situation	3.70	1.211	9th
Lack of competitive advantage	3.69	1.172	10th
Lack of interest	3.65	1.135	11th
Inadequate skills and trainings	3.63	1.188	12th
Unwillingness to change	3.62	1.238	13th
Inappropriate priorities	3.56	1.007	14th

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Technological barriers	3.51	1.092	15th
Poor enabling environment	3.50	1.195	16th
Lack of government support/incentives	3.49	1.195	17th
Client knowledge about sustainable buildings and materials	3.47	1.121	18th
Availability and accessibility to sustainable materials/equipment	3.46	1.211	19th
Societal integration and adoption of sustainable construction practices	3.45	1.055	20th
Lack of integrated research and innovation	3.38	1.222	21th
Low level of client demand	3.33	1.061	22nd
Lack of capacity	3.28	1.175	23rd

The table 5 above presents the mean statistic, standard deviations and rank of the factors influencing the attitude of BE professionals towards the implementation of sustainable construction in the Nigerian construction industry. Poor communication, team work, cooperation and collaboration take the lead on the factors influencing the attitudes of BE professionals in implementing sustainable construction in the Nigerian construction industry with the mean score of (4.16). This can easily have attributed to the fragmentation and adversarial posture of the construction industry; Effective communications protocols are necessary for maximising the benefits of collaborative working in construction. Thus, the implementation of sustainable construction essentially calls for a close working relationship between the BE professionals working on sustainable construction projects from design to execution and completion. Expensive nature of sustainable construction follows with a mean score of (4.00), generally, it is believed that, the implementation of sustainable construction always comes with higher expenses. Researchers believes that there may be an element of bias in the perceptions of industry practitioners in SC practices, despite clear evidence that it is very possible to procure sustainable buildings without significantly higher initial costs. This result has only reaffirmed this notion which is in fact consistent with the outcomes of many studies worldwide.

Lack of proper legislation and regulation within the country follows with a mean score of (3.98), Governments of various nations are supposed to play a vital role in promoting and implementing sustainable construction practices. It is basically the role of government to provide proper legislation and regulation within the country with regards to sustainable construction practices as this will go a long way in giving a better framework with which the industry professionals can work with in implementing sustainable construction practices. The next is knowledge sharing with a mean score of (3.97). Knowledge sharing among the BE professionals can never be overemphasized when it comes to the issue of sustainable construction this is because, sustainable construction has a wide focus and needs all BE professionals to share and collaborate on the knowledge they have to achieve success. This is supported by the statement of (Oni, 2015) to a large extent, success in construction project delivery is hinged on effective integration of the knowledge and experiences of many people working together as a team. Since knowledge is created by individuals, leveraging knowledge is only possible when individuals share their knowledge with others. The construction industry is described as a knowledge-intensive industry, where output products (e.g. buildings, bridges) need substantial input of professional knowledge and problem-solving know how (Egbu and Robinson, 2005).

Also, this is followed by Lack of coordinating structure with mean score of (3.94), the next is Self-satisfaction and personal values with mean score of (3.83), next is Self-motivation and commitment with mean score of (3.80), Lack of guidelines and construction standards with mean score of (3.73), this is followed by Political situation with mean score of (3.70), the next is Lack of competitive advantage with mean score (3.69), the next is Lack of interest with mean score of (3.65), the next is Inadequate skills and training with mean score of (3.63), Hankinson & Breytenbach (2012) reported that professionals within the built environment are not yet fully trained in sustainable construction principles and thus lack education and

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experience to properly carry out such practices. Although formal education has informed younger generations about sustainable construction techniques and equipped them for the tasks ahead, their theoretical skills have not been tested (Zainul-Abidin, 2010). Jailani *et al*. (2015) posit that the knowledge required to enhance sustainable performance has not been fully disseminated through the construction industry and that it is compounded by a lack of critical knowledge of building design and operation.

The next is Unwillingness to change with mean score of (3.62), given the complex and fragmented nature of the construction industry, there is the general inclination to resist change; especially the kind of paradigm shift engendered by sustainable construction (Hakkinen & Belloni, 2011). The next is Technological barriers with mean score of (3.51), the next is Poor enabling environment with mean score of (3.50), the next is Lack of government support/incentives with mean score of (3.49), the next is Clients knowledge about sustainable buildings/materials with mean score of (3.47), the is followed closely by Availability and accessibility to sustainable materials with mean score of (3.46), the next is Societal integration and adoption of sustainable construction practices with mean score of (3.45), the next is Lack of integrated research and innovation with mean score of (3.38), the next is Low level of client demand with mean score of (3.33), as with any business, market demand is very significant and plays a vital role in the adoption of sustainable construction. The low demand by clients can easily influence the attitude of professionals in the BE in the implementation of sustainable construction. The factor with the least mean score of (3.28) is Lack of capacity. One of the most critical challenges to building green is the lack of industry skill of the construction sector to actually design and implement green practices. Hankinson & Breytenbach (2012) contend that the industry is hampered by a lack of technical expertise to actually develop and implement sustainable construction practices.

Table 9**:** Kruskal Wallis Test Comparing Perception of BE Professionals on the Factors Influencing their Attitude Towards the Implementation of Sustainable Construction in the Nigerian Construction Industry

Variables	Test Statistics	Asymp. Sig. (2-sided test)	Decision
Self-motivation and Commitment	8.467	0.293	Retain the null hypothesis
Self-satisfaction and personal values	5.687	0.577	Retain the null hypothesis
Knowledge sharing	7.130	0.415	Retain the null hypothesis
Lack of guidelines and construction standards	3.665	0.817	Retain the null hypothesis
Lack of coordinating structure	14.808	0.039	Reject the null hypothesis
Lack of proper legislation and regulation within the country	11.913	0.103	Retain the null hypothesis
Lack of government support/incentives	8.969	0.255	Retain the null hypothesis
Expensive nature of sustainable construction	9.631	0.210	Retain the null hypothesis
Unwillingness to change	13.060	0.071	Retain the null hypothesis
Technological barriers	18.986	0.008	Reject the null hypothesis

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Political situation	13.769	0.055	Retain the null hypothesis
Poor communication, team work, cooperation and collaboration	8.099	0.324	Retain the null hypothesis
Lack of capacity	15.175	0.034	Reject the null hypothesis
Inappropriate priorities	12.080	0.098	Retain the null hypothesis
Low level of client demand	11.901	0.104	Retain the null hypothesis
Lack of integrated research and innovation	9.489	0.219	Retain the null hypothesis
Poor enabling environment	6.291	0.506	Retain the null hypothesis
Inadequate skills and trainings	5.545	0.715	Retain the null hypothesis
Lack of competitive advantage	8.718	0.274	Retain the null hypothesis
Availability and accessibility to sustainable materials/equipment	9.872	0.196	Retain the null hypothesis
Lack of interest	5.183	0.638	Retain the null hypothesis
Societal integration and adoption of sustainable construction practices	11.541	0.117	Retain the null hypothesis
Client knowledge about sustainable buildings and materials	0.373	0.936	Retain the null hypothesis

Table 6 represents the kruskal-wallis test carried to compare the perception of BE professionals on the factors influencing the attitude of BE professionals towards the implementation of sustainable construction in the Nigerian construction industry. The null hypothesis (H0) states that there is no significant difference in the factors influencing the attitudes of BE professionals towards the implementation of sustainable construction practice within the Nigerian construction industry. The level of significance of the Kruskal Wallis test conducted was set at 5%. The result indicates that there are statistically significant differences in some of the rankings between the responses of the various BE professionals on the factors influencing the attitudes of BE professionals in implementation sustainable construction in the Nigerian construction industry, the factors they differ on are lack of coordinating structure with p-value of 0.039, technological barriers with p-value of 0.008 and lack of capacity with p-value of 0.034. These values are less than 0.05, which indicates statistically significant differences among the ranks in the responses of the BE professionals.

CONCLUSIONS

Sustainable construction practices have continued to receive growing concerns; awareness level keeps increasing but its implementation level is still very low. The result of the research established the fact that the BE environment professionals are very much aware of sustainable construction practices in the Nigerian construction industry. The awareness on sustainable construction by the industry stakeholders was considered to be in the “moderate to good” awareness. Even at this, there is need to do more on the awareness as it an important mechanism for developing knowledge around sustainable construction and

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bridge the skillset gap in that regard.

The implementation level of sustainable construction practice is not proportional to the awareness level of BE professionals within the Nigerian construction industry as the implementation level is still low. The research establishes the factors influencing the attitudes of BE professionals towards implementing sustainable construction in the Nigerian construction industry. The result statistics showed that the top five factors are; poor communication, team work, cooperation and collaboration, expensive nature of sustainable construction, lack of proper legislation and regulation sustainable construction within the industry, Knowledge sharing, and lack of coordinating structure.

The research recommends that there is the need for the BE professionals to improve on their communication level and team building for more effective synergy; and there has to be a genuine collaborative training and integrated practice among the BE professionals to fast track the implementation of sustainable construction in Nigeria. The BE professionals need to give way for new skills and expertise as well as increase their capacity in order to achieve a holistic sustainability paradigm that will influence the Nigerian construction industry towards a sustainable future. The BE professionals need to share their knowledge so as to foster cooperation, team building, establish mutual understanding, jointly seek effective solutions, and improve the implementation of sustainable construction practices in the Nigerian construction industry. And finally, the Government needs to provide better and more enabling environment for sustainable construction to thrive within the industry, this might include providing the right policies and regulation in place, intensifying the aspect of sustainable construction.

The findings of this study have contributed to the body of knowledge as regards the factors that influence the attitudes of built environment professionals towards the implementation of sustainable construction practices in the Nigerian construction industry by establishing that Poor communication, team work, cooperation and collaboration is the greatest factor influencing the BE attitudes towards the implementation of sustainable construction practice in the Nigerian construction industry with mean score of (4.16) and also establish that the principle of sustainable construction/buildings professionals are willing to adopt is to focus on quality while carrying out the implementation of sustainable construction with mean score of (3.73)

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