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Awareness of Factors Contributing to Sustainable Construction in Nigeria

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Abstract

The need to slow down climate change and global warming has made sustainable development major issue among policy makers and world leaders. Awareness on sustainability concept among industry practitioners is crucial in influencing design, materials selection and construction methods. The aim of this study is to examine the level of awareness on key sustainability concepts and factors that influence their adoption during construction by practitioners in Nigeria. Through an online survey, 120 copies of semi-structured questionnaire were administered on built environment practitioners such as architects, engineers, quantity surveyors, and builders working in client, contracting, consulting and academia with 77% response rate. Factorial two-way ANOVA was performed to examine if there are differences in the level of awareness of factors contributing to sustainable construction among the groupings. Also, binomial logit regression analysis was adopted in predicting the factors that significantly influence adoption of sustainability concept among practitioners in construction industry. The study revealed that professionals from client organization recorded highest (3.8) mean score in terms of awareness on sustainability concept followed by those from academia (3.6), consulting (3.0) and contracting (2.2). In terms of factors that significantly influence adoption of sustainability concept during construction, findings from the study revealed that academic qualification ($\beta = 2.226$, $p<0.05$) and type of organization ($\beta = 1.127$, $p<0.05$) significantly influence adoption of sustainability concept during construction. Practitioners with high academic qualification and those from client organization, exhibited high level of awareness on sustainability concept, this equally influenced their adoption of key elements of sustainability (site planning, energy efficiency, water efficiency, renewable energy, resource conservation, material reuse, indoor environmental quality) during construction. The determination of the level of awareness and adoption of factors contributing to sustainable construction by practitioners will serve as guide to industry practitioners regarding issues to integrate into design and construction project from inception to completion. To improve awareness of sustainable practices in the industry, stakeholders should direct efforts towards organizing seminars, conferences and workshops centered on sustainable construction through the various professional bodies at state and local government levels.

Keywords: Awareness, environmental sustainability, green building, Nigeria, sustainable construction

1.0 INTRODUCTION

The impact of human activities on the environment has increased the need to pay special attention towards implementation of sustainable development in the construction industry (Chan et al., 2016). The World Commission on Environment and Development (WCED) 1987 opined that humanity has the ability to make development sustainable when such development activities are carried out in a way which meets the needs of the present without compromising the ability of future generations to meet their own needs. The Federal Government of Nigeria (FGN) has emphasized that a consistent effort is required by stakeholders for the adoption of sustainable development in the country (Ajao et al., 2008). However, previous studies have shown that the concept of sustainability is still new to most construction experts and stakeholders in developing countries (Akadiri et al., 2012; Tomislav, 2018). Therefore, a generally low level of adoption of sustainable construction practices in the construction sectors of developing countries exist (Aghimien & Awodele, 2016; AlSanad, 2015). The need for the adoption of sustainable practices exist but the level of awareness is low in the Nigerian construction industry compared to more developed countries (Abisuga & Oyekanmi, 2014). Additionally, there is no enabling environment in the form of policy or legislation that will motivate prospective clients to adopt it. Consequently, many construction projects executed in Nigeria have failed to consider the key objectives of sustainable development (Aghimien et al., 2019; Al-Saleh & Taleb, 2010; Dahiru et al., 2014; Tunji-Olayeni et al., 2018).

However, it is important for professionals in the construction industry to be informed about the consequences each project will have on the environment, thereby arousing the need for adopting sustainable practices as opined by Gou et al. (2013). Implementing sustainable construction practices has been advocated as a way forward to fostering economic advancement in the building industry while minimizing negative impact on the environment (Akadiri et al., 2012). This must be reflected in design, materials selection, construction and maintenance of construction facilities; because every development exists within an environmental context upon which it has its own consequential effect

(Geng et al., 2017). According to Adetunji et al. (2003) adoption of multi-disciplinary approach covering sustainability features such as: energy saving, improved use of materials, material waste minimization, pollution and emissions control are germane to sustainable construction. Du Plessis (2007) argued that a huge development gap exists in construction sectors of developing countries and that significant effort is needed to fill these gaps. He suggested a need to maximize the use of scarce resources by ensuring sustainability in every construction while the active players within the broader construction sector must have what is needed, to make sure their solutions support sustainable development.

Existing literature is replete with studies on sustainable construction in Nigeria. For example, Aghimien et al. (2019) examined the challenges, barriers and ways of improving adoption of sustainable construction in Nigeria and found that sustainability knowledge, regulation and policy, sustainable materials and technology, information and management as the key barrier factors inhibiting the adoption of sustainable construction practice in Nigeria. However, the study by Aghimien et al. (2019) was limited to only three disciplines in the industry and failed to consider organizational influence on the adoption initiatives of practitioners. Similarly, in the study by Abisuga and Oyekanmi (2014) on organizational factors affecting the usage of sustainable materials in the Nigerian construction industry through questionnaire survey to professionals and contractors. The authors classified their findings into external and internal factors. The external factors according to the study are research and development, knowledge and skill of personnel, learning period, and local authority and government, while the internal factors include lack of awareness and knowledge of construction personnel, cost and economic viability, passive culture or norm, top management commitment, organizational goal and objectives. Nonetheless, the study is limited to the usage of sustainable construction materials for building projects, while other studies have also examined the drivers, material and management tools in delivering sustainable construction (Aghimien & Awodele, 2016), principles, attributes and framework for sustainable construction (Nwokoro & Onukwube, 2011), energy efficiency and renewable energy technologies (Ahmed & Gidado, 2008). However, majority of the studies have focused on general implementation of sustainable construction at industry level. Abidin (2010) noted that the factors that will jumpstart sustainable movement are knowledge and awareness followed by interest and demand, then implementation. However, there is paucity of studies on factors contributing to awareness of sustainable construction among practitioners as influenced by the type of organizations and education qualification in Nigeria. This gap in knowledge is what this research wants to fill. Specifically, the study examined the level of awareness on key sustainability concept and factors that influence their adoption during construction by practitioners in Nigerian. The paper is structured into five sections. The first section is introduction, followed by review of previous studies. The third section describes the research method adopted. Data analysis and discussion of findings is contained in the fourth and fifth sections respectively and lastly the conclusion.

■2.0 LITERATURE REVIEW

2.1 Sustainable Development

The World Commission on Environment and Development (The Brundtland Commission) defined sustainability as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". According to Tomislav (2018), sustainable development encompasses the balance between the three pillars of sustainability namely: environmental sustainability: which focuses on maintaining the quality of the environment which is necessary for conducting the economic activities and quality of life of people; social sustainability: which strives to ensure human rights and equality, preservation of cultural identity, respect for cultural diversity, race and religion, and; economic sustainability: which is necessary to maintain the natural, social and human capital required for income and living standards.

The author also observed that complete sustainable development is achieved through a balance between the three pillars and that the required condition between them is not easy to achieve, because in the process of achieving its goals each pillar of sustainability must respect the interests of other pillars to avoid creating an imbalance. So, while a certain pillar of sustainable development becomes sustainable, others can become unsustainable, especially when it comes to ecological sustainability, on which the overall capacity of development depends. Environmental sustainability regarding construction is focused on the impact of construction activities on the environment (Adetunji et al., 2003; Akadiri et al., 2012). Geng et al. (2017) argued that environmental sustainability is not limited to preventing negative effects on the environment by careful use of natural resources and minimizing waste, but also encompasses efforts aimed at enhancing the quality of environment.

2.2 Sustainability in Construction

It is necessary to first clarify the specific interpretation of the terms sustainable development ‘awareness’ and ‘sustainable construction’ as used in this paper. Sustainability is an all-encompassing notion which can impact and be impacted by every aspect of development (Du Plessis, 2007). While development denotes changes and it often involves the transformation of natural resources into desired outputs (Hill & Bowen, 1997). According to Du Plessis (2007), sustainable development is about managing the relationship between the needs of humans and their environment (biophysical and social) in such a way that critical environmental limits are not exceeded and modern ideals of social equity and basic human rights (including the ‘right to development’) are not obstructed. Sustainable construction is defined by the International Council for Research and Innovation in Building and Construction (CIB) as ‘the sustainable production, use, maintenance, demolition, and reuse of buildings and constructions or their components’, while sustainable buildings and built environments are seen as ‘the contributions by buildings and the built environment to achieving components of sustainable development’ (CIB, 2004). Awareness is the knowledge of the key principles of sustainable development that can be applied to a construction project to make it meet the key objectives of sustainable development.

The concept of sustainability in construction as described by previous studies (Adetunji et al., 2003; GABC et al., 2019; Hwang & Tan, 2012) includes: minimizing resource consumption particularly carbon based energy, water, materials and land; maximizing resource re-use/recycling; use of renewable resources in preference to non-renewable resources; proportional extraction of fossil fuels and minerals, and produce persistent substances foreign to nature, at rates which are not faster than their slow redeposit into the Earth's crust; protecting and enhancing the earth's vitality and bio-diversity; creation of a healthy and non-toxic environment by minimizing pollution; pursuit of quality in creating the built-environment and; minimize damage to sensitive landscape. Sustainable development in construction refers to both the structure and a process that is more environmentally responsible during the entire life cycle of a building. These life cycle stages are: site selection; design; construction; operation and maintenance; renovation; and demolition (Hwang & Ng, 2013).

Sustainable development, when used in a practical term to construction industry, focuses on how to reduce the impact of design, materials usage during design, actual construction and maintenance on the natural environment with the objectives of efficient use of resources, protective of the occupants' health and well-being, and reducing the negative impacts, such as waste and pollution (GABC et al., 2019). This is further illustrated in Figure 1.

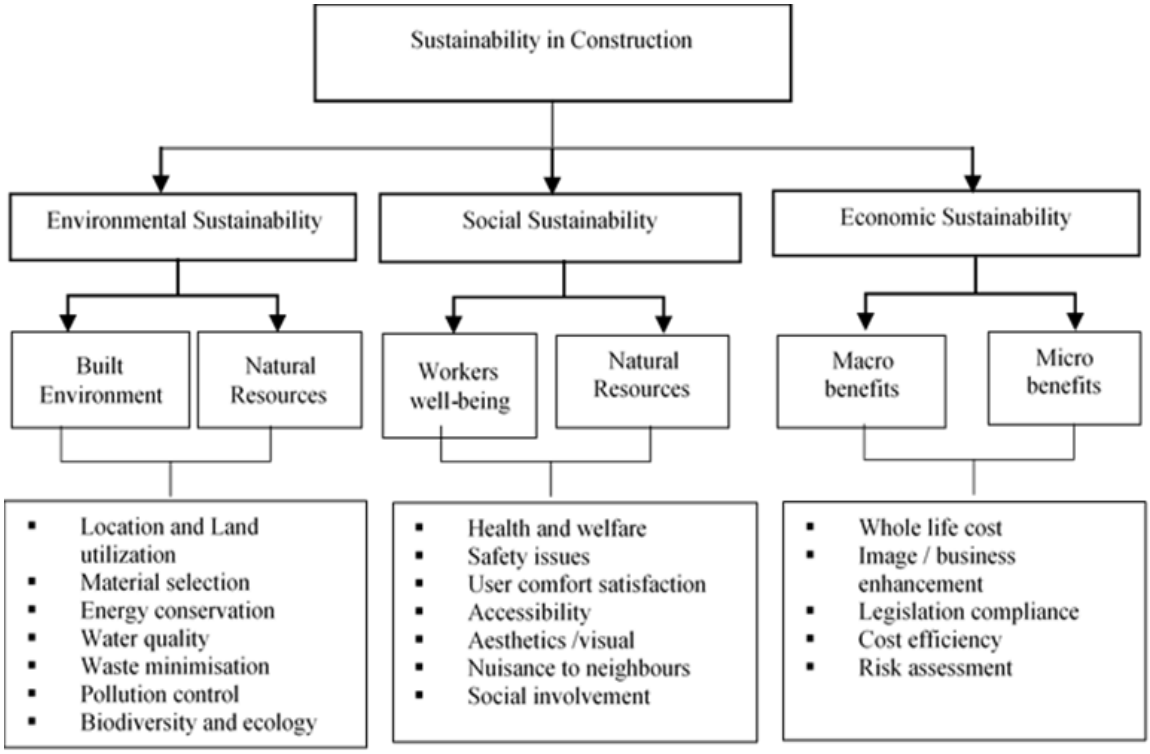

Figure 1 Sustainability concept in construction
(Source: Abidin, 2005)

Social sustainability ensures that any major development project is planned and constructed after consulting or attending to the needs of the people, their location and environment to avoid loss of livelihood and disruption of social activities. Construction should promote healthy living, socially cohesive communities and respond to any changes in societal expectation (Addis & Talbot, 2001). Social sustainability can be categorized into two: workers' benefits and community / users' benefits. Workers' benefits are concerned with the well-being of all the employees in the project, from consultants to laborers while community/users' benefits are concerned with gains that are derivable. The general perspective about sustainability is that it is not possible to achieve sustainable construction purely through an environmental perspective. This is because sustainable construction incorporates three dimensions: environment, social and economic elements. In describing sustainable construction, Liu (2006) considered two elements, socio-economic (which describes the behavior of project participants' in acquiring built assets) and socio-environmental.

Valentin and Spangenberg (2000) stated the need to differentiate institutions aspect from the three common elements. Thus, they used a fourth element to differentiate the institutional aspects from the environmental, economic and social elements. In their work, the institutional element is referred to as the human interaction and the rules by which they are guided, which in other words is viewed as 'institutions of the society'. Ofori (1998) pointed out that the selection of what specific elements are to be considered and prioritized would depend upon the context of the study. Ofori (1998) further explained that managerial and community elements are especially relevant for developing countries. This is because in these contexts, managerial sustainability can ensure that 'construction products, especially large and complex ones undertaken by foreign companies, remain in effective and efficient use throughout their lives'. Similarly, community sustainability is important in instances where major developments are carried out (Abidin, 2005). According to Liu (2006), the factors that could play a part in determining the significance of different sustainable construction elements include: the development priorities, capacity of local industry and government, nature of building stock, stage of industrial development, skill levels and cultural values and scale of problems faced.

Akadiri et al. (2012) suggested that to create a competitive advantage using environment-friendly construction practices, the whole life-cycle of buildings should, therefore, be the context under which these practices are carried out. The authors proposed a framework for implementing sustainable building design and construction while keeping in mind the principles of sustainability issues (social, environmental and economic) identified previously. The framework was classified into: resource conservation which comprises of energy conservation, material conservation, water conservation and land conservation; cost efficiency which include initial cost (purchase cost), cost in use and recovery cost and; design for Human adaptation which comprises of protecting human health and comfort and protecting physical resources.

According to Hill and Bowen (1997), sustainable construction was proposed to describe the responsibility and role of the construction industry in achieving sustainability, where the construction industry is deemed to include civil engineering and building construction. Du Plessis (2007) opined that combining the sustainability and construction as one term would further magnify the interpretive dilemma since these two terms are both highly complex ideas. Goh and Rowlinson (2013) said that sustainable construction should cover a wider aspect in the comprehensive construction circle from material extraction, planning, design, implementation, deconstruction and management of resultant waste. Du Plessis (2007) argued that interpretation of sustainable construction should cover environmental protection, value addition to the quality of life, and both technological and non-technological aspects of social and economic sustainability.

CIB (2004) identified seven principles of sustainable construction to include: reduce resource consumption, reuse resources, use recyclable resources, protect nature, eliminate toxins, apply life cycle costing and focus on quality. However, Fellows and Liu (2008) considered sustainable construction indicators to include economic, socio-economic, socio-environmental and legal systems. Measuring users' well-being through completed assets was described by Pearce (2006) as economic perspective of sustainable construction. Hill and Bowen (1997) classified sustainable construction into four pillars as: social, economics, biophysical and technical aspects. Du Plessis (2007) argued that sustainable construction must not only be seen as just reducing the negative impact on the environment and further expanded the concept as: a broad interpretation of construction involving many more role players than just those traditionally identified as making up the construction industry; it emphasizes both environmental protection and value addition to the quality of life of individuals and communities; it embraces not just technological responses, but also the non-technical aspects related to social and economic sustainability. Table 1 provides a summary of factors used in measuring awareness of practitioners on sustainable construction in Nigeria.

Table 1 Key objectives of sustainability construction

Factors	Description	Authors
Sustainable site planning	This relates to consciousness of environmental protection at project inception	(Addis & Talbot, 2001; Du Plessis, 2007; Fellows & Liu, 2008; Goh & Rowlinson, 2013; GABC et al., 2019)
Safeguarding water and water efficiency	Conserving water during construction and ensuring that completed projects maximises water usage.	(Abidin, 2005; GABC et al., 2019; Tomislav, 2018)
Energy efficiency	Ensuring that all project components conserve the use of energy	(Akadiri et al., 2012; GABC et al., 2019)
Renewable energy	using environment-friendly construction materials and methods.	(Hill & Bowen, 1997; CIB, 2004; Akadiri et al., 2012; GABC et al., 2019)
Lower greenhouse gas emissions	Consideration to biophysical aspects of construction	(Ahn et al., 2013; CIB, 2004; Liu, 2006; Fellows & Liu, 2008; Hill & Bowen, 1997)
Resources conservation	Cost efficiency, and conservation in the use of energy, materials and all other resources required for construction.	(CIB, 2004; GABC et al., 2019; Goh & Rowlinson, 2013)
Material reuse	Reuse of construction materials	(Du Plessis, 2007; Fellows & Liu, 2008; Goh & Rowlinson, 2013)
Improvement in human health	value addition to the quality of life of occupants	(Abidin, 2005; Du Plessis, 2007; GABC et al., 2019; Pearce, 2006)
Indoor environmental quality	This includes design, construction and maintenance for human adaptation which comprises of protecting human health and comfort and protecting physical resources.	(Akadiri et al., 2012; Fellows & Liu, 2008; Liu, 2006; Ofori, 1998)

■3.0 METHODOLOGY

To ensure validity of the survey instrument, the key objectives of sustainable development as identified from previous studies were summarized under nine headings. These factors were further verified by three industry practitioners and one academic practitioner who has been involved in sustainable development research. The refined questionnaire was therefore used as survey instrument. The questionnaire was structured into two sections. First section contains personal information on the respondents while the second part contains set of questions that measure awareness of sustainability concept on one hand and involvement in a project that adopts key objectives of sustainability concept on the other hand. Respondents were therefore requested to rate their opinion on the 9 items used in measuring awareness on sustainable construction on a 5-point Likert Scale ranging from 1 = very low to 5 = very high. The pilot exercise is considered adequate since the establishment of content validity is not numerical but subjective and judgmental (Chen & Paulraj, 2004). The 9 items measuring awareness

on key objectives of sustainable construction, were subjected to reliability test using SPSS version 20. A Cronbach Alpha value of 0.89 was obtained which shows that there is internal consistency among the 9 items. A purposive sampling approach was adopted on experienced professional in the North Central Nigeria. The email ID of the respondents were obtained through collaboration with various professional bodies such as Nigerian Institute of Architects (NIA), The Nigerian Institute of Quantity Surveyors (NIQS), Nigerian Society of Engineers (NSE): Nigerian Institute of Builders (NIOB). A total of 373 professionals were contacted via e-mail seeking their participation in the online survey. Only 193 responded to the email, with 120 indicating previous involvement on sustainable construction project. Therefore, 120 copies of questionnaires were sent out to the respondents through online survey out of which 92 responded after repeated phone calls. This gives a response rate of 77%. This was considered adequate for this study. According to Archer (2008) the expected response rate from a web-based survey is dependent on the type of survey. The author pointed out that 48.3 percent is adequate based on the calculated response rate of 84 web-based survey deployed in the US over 33 months. For the data analysis, binomial Logit regression analysis was adopted in predicting the factors that significantly influence adoption of key objectives of sustainable construction among practitioners in Nigeria. Two-way ANOVA was equally conducted to examine if there are differences on items measuring awareness on key objectives of sustainable construction among the various groupings.

■4.0 RESULTS

4.1 Demographic Information

About 38% of respondents surveyed are Builder, 30.4% Quantity Surveyors, 16.3% Engineers, 7.6% Project Manager and 7.6% Architects respectively. In terms of educational qualification, 35.9% possess a Master's degree (M.Sc.), 29.3% Bachelor's degree (B.Sc.), 20.7% Doctor of Philosophy (Ph.D) and 14.1% Higher National Diploma Certificate (HND). Among the respondents 39.1% are from consulting firms, while 30.4% are from academia, 22.8% are clients and 7.6% are from contracting organizations. In terms of working experience, 38% have worked between 16-20 years, 30.4% between 6-10 years, 16.3% between 11-15 years and 7.6% have worked more than 20 years.

4.2 Awareness of Sustainability Concept

Nine items rated on a five-point Likert scale ranging from 1 (very low) to 5 (very high) were used to assess the level of awareness and understanding of sustainability concept among the respondents based on their educational and professional groupings. Table 2 illustrates the mean score for each item used in assessing awareness and understanding of sustainability concept.

Table 2 Descriptive statistics for the items measuring awareness on sustainability concept

Code	Description of Item	Mean	Std. Deviation
SUS_1	Sustainable site planning	3.0652	.73834
SUS_2	Safeguarding water and water efficiency	3.1522	.86361
SUS_3	Energy efficiency	3.4674	.84452
SUS_4	Renewable energy	3.1522	.86361
SUS_5	Lower greenhouse gas emissions	3.6957	.99160
SUS_6	Resources conservation	3.4565	.84402
SUS_7	Material reuse	3.0000	.78446
SUS_8	Improvement in human health	3.2391	.80342
SUS_9	Indoor environmental quality	3.3913	.83806

The nine items were transformed into one factor in SPSS environment. Thus, the mean score for each respondent was obtained. Factorial two-way analysis of variance (ANOVA) test was conducted to examine if there are differences on sustainable construction awareness based on type of organization on one hand and academic qualification of respondents on the other hand. Thus, the study wants to know whether there are differences in awareness on sustainability for professionals varying on type of organization they belong and their academic qualification. Also, whether the interaction between organization type and academic qualification has any effect on awareness on sustainability concept. The mean values for organization groupings range from 3.8 (highest) to 2.2 (lowest) while that of academic qualification ranges from 3.2 (highest) to 3.0 (lowest). For interaction between type of organization and academic qualification, the highest mean interaction was recorded for client and academia (3.9) respectively while the least was between contractor and all academic qualification groupings (2.2).

The results in Table 3 revealed that there is significant difference in awareness on sustainability based on type of organization which respondents belong ($F= 35.174$ (df) 3, $p<0.05$). On the contrary, no significant differences were established based on academic qualification ($F= .642$, (df) 3, $p>0.05$). What this result suggests is that the level of awareness on sustainability concept depends on the type of organization respondents belong to. A closer look at the mean values obtained for the organizational groupings (see Table 3) revealed that those from client and academia recorded higher mean score (3.8 and 3.6 respectively) while those from contracting firms recorded low mean (2.2). In view of this, it could be said that the level of awareness on sustainability concept is high among respondents from client organization and academia.

Table 3 Analysis of variance

Tests of Between-Subjects Effects

Source	Sum of Squares	df	Mean Square	F	Sig.
Type of organization	16.933	3	5.644	35.174	.000*
Academic qualification	.309	3	.103	.642	.591
Type of organization * Academic qualification	3.527	9	.392	2.442	.017*
Error	12.196	76	.160		
Total	1030.259	92			
Corrected Total	33.799	91			

a. R Squared = .639 (Adjusted R Squared = .568)

*Note: Statistics is significant 0.05

After it had been established that there is significant interaction between type of organization and academic qualification, the study went further to examine the individual effect. The results in Table 3 above revealed that there is a significant difference in environmental awareness and sustainability based on type of organization which respondents belong ($F= 35.174$ (df) 3, $p<0.05$). On the contrary, no significant differences were established based on academic qualification ($F= .642$, (df) 3, $p>0.05$). What this result suggests is that the level of environmental awareness and sustainability depends on the type of organization respondents belong. A closer look at the mean values obtained for the organizational groupings in Table 2 reveal that those from client and academia recorded higher mean score (3.8 and 3.6) while those from contracting firms recorded low mean (2.2). In view of this, it could be said that the level of environmental awareness and understanding of sustainability concept is high among respondents from client organization and academia.

A closer look on the interaction between type of organization and educational qualification in Figure 1 shows that those respondents with M.Sc degree from client organization recorded higher (3.9) mean score when compared with those with B.Sc/B.Tech or HND (3.7). Similarly, respondents from academia with PhD recorded higher (3.9) mean score compared to those with M.Sc and B.Sc/B.Tech (3.2 and 3.7 respectively). In general, it could be seen from the results that irrespective of the type of organization the respondents belong (i.e. client, or academia) their level of awareness on sustainability concept strongly depends on educational qualification.

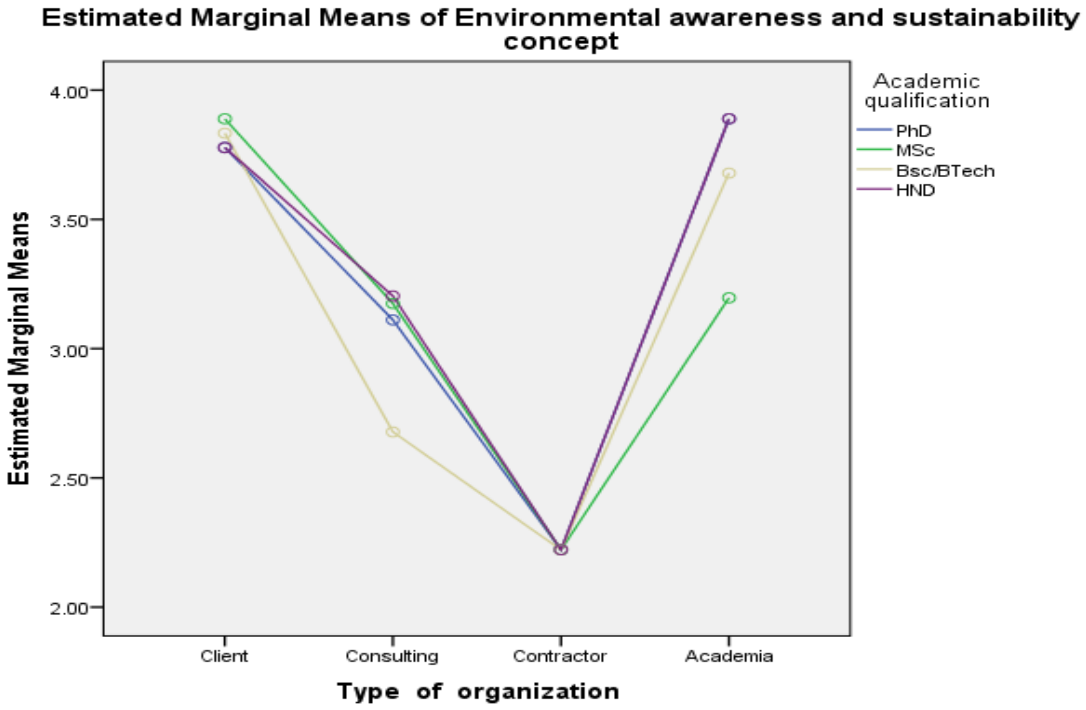

Figure 2 Marginal mean on interaction between type of organization and educational qualification

Furthermore, Tukey HSD post-hoc for multiple comparison test for the organizational groupings was conducted. Results (Table 4) reveal that there is significant difference in level of awareness on sustainability concept between respondents from client, consulting and

contracting organizations ($p<0.05$). However, no significant differences exist between those from academia and client organization. In other words, the two organization groups (client and academia) are homogenous in their level of awareness on sustainability concept.

Table 4 Tukey HSD post-hoc multiple comparison

(I) Type of organization	(J) Type of organization	Mean Difference (I-J)	Sig.
Client	Consulting	.778*	.000*
	Contractor	1.597*	.000*
	Academia	.156	.240
Consulting	Client	-.778*	.000*
	Contractor	.820*	.000*
	Academia	-.622*	.000*
Contracting	Client	-1.597*	.000*
	Consulting	-.820*	.000*
	Academia	-1.441*	.000*
Academia	Client	-.156	.240
	Consulting	.622*	.000*
	Contractor	1.441*	.000*

*Note: Statistics is significant 0.05

4.3 Determinants of Adoption of Key Sustainable Concept in Construction

The factor(s) that could influence adoption of key sustainable concept in construction are examined in this section. Thus, logit regression analysis was adopted for the analysis. Logit regression analysis is used when the dependent variable is a categorical outcome that involves two or more levels. However, when the outcome is mutually exclusive and exhaustive, binary logit regression is adopted. The dependent variable can only take on one of the two values: 0 or 1. The value that is assigned to the characteristic of interest is 1 and 0 to absence of such characteristic. In this study, the response (Yes/No) given by respondents with respect to adoption of sustainable concept in construction forms the dependent variable. Thus, if a respondent says yes, it is assigned 1 otherwise 0. The independent variables which measure contribution to variations in the dependent variable have coefficient 'b'. What is being predicted from a knowledge of relevant independent variables and coefficients is therefore not a numerical value of a dependent variable as in linear regression, but rather the probability (p) that it is 1 rather than 0 (belonging to one group rather than the other). In this study, the following independent variables were used in data analysis: (i) type of organization (ii) academic qualification (iii) professional qualification (iv) professional background and (v) years of work experience. The aim is to assess whether or not the five predictor variables significantly predict the adoption of sustainable objective in construction.

Results (Table 5) show that when all the five predictor variables are considered together, they significantly predict whether or not a respondent adopts sustainable objective in construction ($X2 = 27.799$, $df = 5$, $N = 92$, $p<0.05$). One of the ways of checking for goodness of fit statistic in logit regression is through the classification table. It tells us how many of the cases where the observed values of the dependent variable (adoption of sustainable concept) were 1 or 0 respectively have been correctly predicted. The overall percentage predicted correctly by this model is 82.6%. Overall fit of the model was measured by log likelihood statistics which was 59.5. The model chi-square ($X2 = 27.799$, $p<0.05$) was also used to predict how better the model predicts the outcome.

In order to examine the contribution of each independent variable in predicting correctly awareness on sustainability concept, the odds ratio in Table 5 is examined. Odds ratio in logit regression indicates how the predictors (independent variables) influence the chances of an outcome (dependent variable). The odds ratio (ExpB) presents the extent to which raising the corresponding measure by one unit influences the odds ratio. Thus, Exp(B) is interpreted in terms of change in odds. When the value is greater than 1 the odds of an outcome occurring increases and if otherwise (i.e. less than 1) any increase in predictor leads to a drop in the odds of an outcome occurring. It is against this backdrop that the results are interpreted. The results (Table 5) show that only two variables (type of organization and academic qualification) are significant predictors of adoption sustainable concept in construction. For the type of organization, the odds ratio is 4.3. What this suggests is that type of organization respondents' work will influence their chances of adoption of sustainable concept in construction by 4.3 times. For educational qualification, it is categorized into 4 (i.e. 1= PhD, 2 = M.Sc, 3= B.Sc and 4= HND). The results show that a unit increase in education qualification (1), the odds ratio is 9.3. Thus, respondents with PhD are 9.3 times likely to adopt sustainable concept in construction. The odds ratio for educational qualification (2) is 9.4 and therefore respondents with Master Degree are 9.4 times likely to adopt sustainable concept. Educational qualification (3) as revealed in the results (Table 4) is not significant, the odds ratio is 1.9. Hence, respondents with first degree (B.Sc/B.Tech) or less are 1.9 times likely to adopt sustainability concept in construction.

Table 5 Adoption of sustainability concept

Variables in the Equation						
Independent Variables	β	S.E.	Wald	df	Sig.	Exp(B)
Type of Organization	1.127	.401	7.889	1	.005*	4.324
Professional Background	-.528	.448	1.391	1	.238	.352
Academic qualification			7.948	3	.047*	
Academic qualification(1)	2.226	.995	5.006	1	.025*	9.260
Academic qualification(2)	2.241	.947	5.606	1	.018*	9.404
Academic qualification(3)	.675	.856	.621	1	.431	1.964
Professional qualification	.744	.542	1.889	1	.169	2.105
Years of work experience	-1.044	.694	2.263	1	.132	.352
Constant	7.529	4.629	2.645	1	.104	1861.495
X^2 = 27.799 -2 Log likelihood = 59.40 Nagelkerke R Square = .529						

*Note: Statistics is significant 0.05

5.0 DISCUSSION

Two stage analysis was performed to address the objectives of the study: the level of awareness on key factors contributing to sustainable construction and factors that influence their adoption during construction by practitioners in Nigeria. Results from the first stage which involved factorial two-way analysis of variance (ANOVA) reveal that there is a significant difference in the level of awareness among respondents based on organization grouping (client, consulting, contracting, and academia). The group means from the descriptive statistics show that practitioners from client organization recorded the highest (3.8), followed by those from academia (3.7), consulting (3.0) and contracting (2.2). Based on the results, it could be seen that level of awareness on key sustainability concept among practitioners from contracting organization is low when compared to other groupings (client, consulting and academia). This finding is in tandem with the observations of Abisuga and Oyekanmi (2014) that the level of the practice of the concept of sustainability of building material is low as perceived by the contractors and the professionals in Lagos State. This could be as a result of non-integration of the sustainable construction concept during design of construction projects. As also pointed out by AlSanad (2015) that concept of sustainability is still vague to most construction experts and stakeholders in developing countries. However, the level of awareness of sustainability concepts in clients organizations and the academia are higher.

For academic grouping (HND, B.Sc/B.Tech, M.Sc, PhD), results show that difference in level of awareness is not much. In other words, the difference that exists among the educational group is not statistically significant. The group means statistics show that practitioners with PhD qualification scored 3.2, M. Sc (3.1), B.Sc/B.Tech and HND 3.2 each. What this result suggests, is that there is not much difference in the level of awareness on key sustainability concept based on academic qualification of practitioners. Although differences in level of awareness as shown by the mean scores is not significant enough, it could be seen that respondents with PhD tended to record a little higher than others. This is, however, contrary to the assertion of Baron and Donath (2016) that there is no significant difference in the level of education and the understanding of sustainable development concept. This finding is not surprising because there has been pressure on the tertiary institutions to integrate the concept of sustainable development in the academic curricula.

The second stage analysis involved predicting the factor(s) that influence adoption of these key sustainability concepts by practitioners during construction. Thus, logit regression analysis was adopted. Results as shown in Table 4 above revealed that when all the five predictor variables (type of organization, professional background, academic qualification, professional qualification, and years of work experience) are considered, they significantly predict whether or not a practitioner adopts key sustainability concept in construction. Results in Table 4 revealed that only two variables (type of organization and academic qualification) significantly predict adoption of sustainability concept by practitioners during construction. Those practitioners with PhD are more likely to adopt sustainability concept in construction (i.e. 9.3 times likely). On the other hand, practitioners with first degree (i.e. B.Sc./B.Tech or HND) are 1.9 times likely to adopt sustainability concept during construction. In practical terms, what this result means is that practitioners with higher educational background are likely to adopt key objectives of sustainable construction compared to those with lower education. These findings corroborate earlier assertions that education played a role in the development, communication, public awareness and adoption of sustainable development (GABC, 2016; Tilbury & Wortman, 2004). In general, it could be said that the type of organization one works in or practices in (i.e. client, consulting, contractor and academia) and one's educational qualification are the two major predictors that significantly influence adoption of sustainable concept in construction among practitioners in Nigeria. Again, results equally reveal that practitioners from client organization and academia are more likely to adopt sustainability concept in construction.

6.0 CONCLUSION

The concept of sustainable development is a general approach to protecting the environment. Implementation of sustainability objectives is to ensure that there is interface among the three pillars (economic, social and environment) in the design and construction of projects. Understanding of sustainable construction concepts among the practitioners in the construction business will have a far-reaching effect on the achievement of sustainability objectives. This paper therefore investigated the awareness of factors contributing to sustainable construction among practitioners in Nigeria. A growing body of evidence in academic literature demonstrates that there is potential for reduction in energy use on project sites during construction. The reduction in energy use (energy efficiency) leads to environmental

sustainability. However, various factors such as economic, level of technological advancement, political/government policies, and behavioral play pivotal role in determining level of awareness of professionals and their adoption of sustainable practices during construction.

The study found that professionals from client organization recorded highest (3.8) mean score in terms of awareness on sustainability concept followed by those from academia (3.6), consulting (3.0) and then contracting (2.2). Again, the factorial two-way ANOVA result showed that there is a significant interaction between type of organization and educational qualification groupings ($F = 2.442$ (df) 9, $p<0.05$). Further analysis, revealed that level of awareness on sustainability concept depends on the type of organization one belongs on one hand and on the other, level of educational qualification. For example, those from client organization with higher educational qualification (i.e. PhD, MSc) rated higher in awareness on sustainability concept compared to those with other educational qualifications (BSc, HND). The logit regression results equally showed that academic qualification and type of organization are two major predictors that significantly influence the choice of adoption of sustainability concept during construction. This study has demonstrated that awareness on sustainability concept in construction among practitioners in Nigeria varied, which influenced their adoption during construction.

However, the variables used for this study are those obtained from previous studies and further subjected to the opinions of built environment professionals in the North Central Nigeria. Therefore, the outcome of the study should be generalized with caution in the context of Nigerian and other developing countries practice. The determination of the level of awareness and adoption of factors contributing to sustainable construction by practitioners will serve as guide to industry practitioners regarding issues to integrate into design and construction project from inception to completion. Further studies on the relationship between awareness of sustainability concept and adoption of green building technologies by built environment practitioners. It is also important to investigate the extent to which practitioners are able to integrate and strike a balance between the three dimensions of environmental, economic and social in their attempt to adopt sustainable construction practices.

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