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THE USE OF BINARY LOGISTIC REGRESSION ON THE AWARENESS LEVEL OF BUILDING INFORMATION MODELLING IN NIGERIA

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Abstract
The study examined the awareness level of BIM in the Nigerian construction industry, with a view to achieving sustainable building projects through effective collaboration among building professionals. A survey was carried out, using 191 copies of structured questionnaire, self-administered through random sampling technique on the construction professionals in Akwa Ibom State, South-South, Nigeria; to examine the respondents' awareness level of BIM. The responses from the professionals were analysed using binary logistic regression; while the hypothesis was tested using the Kruskal-Wallis test. The findings revealed that the professionals were probably aware of BIM in the study area with 65.7% awareness probability against 45.1% unawareness probability level. The overall classification accuracy of the model was 55.3% which showed a perfect fit to model in the data; it also revealed that there is a significant variation in the professionals' awareness level of BIM. Most of the variables were with p-values less than 0.05, which by indication means they are significant. This means that the null hypothesis was rejected, while the alternative hypothesis was accepted for the variables. However, there were three variables with p-values greater than 0.05; this means that for those three variables, the null hypothesis was accepted, while the alternative hypothesis is rejected. Hence, due to the significant variation of eleven variables, a post hoc test was carried out on these variables using Mann-Whitney U test to determine the variations' contributing respondents. The study concluded that there is a high level of awareness of BIM, and its concepts in Nigeria's construction industry. Hence, the study recommended that there is still a need for an increased awareness of the benefits of BIM, and how it can be used particularly in the Nigerian construction industry.

Keywords: Building information modelling, Information technology, Sustainable buildings, and Building projects.

1.0 INTRODUCTION

The need for information exchange in the construction industry cannot be overemphasized. The construction industry is an environment that requires intensive information in its construction processes from the design stage to the actual site activities, and which needs to be shared to and exchanged among its stakeholders on a consistent basis. Chen and Kamara (2008) explained that due to the intense and diverse need for construction information, its management must be efficient enough in the construction industry to serve as an imperative competitive advantage among construction companies. According to ClearPath IT Solutions (2016), information technology forms have been around before now to help manage information on construction sites; they are: Cloud computing (which offers increased freedom and easy access to information at any time, from any location, such as job sites, customer locations, and satellite offices, to construction firms); project management software (which leads to high efficiency in executing projects, thereby delivering quality projects and increasing profitability); mobile device management (where mobile devices are used as the main line of communication during a project).

The Design and construction stages are different from each other in the construction process. With a look at the design stage, the client′s brief are transformed into information for the construction stage; and to ensure the brief′s constructability, the design stage must also have the information about construction and the operation and maintenance of a facility. In the construction industry, the site where the construction activities are done is usually far from the design offices and this has led to the lack of information communication and its access between

project stakeholders on construction work sites (Chen and Kamara, 2008). The design and construction phases of a building project can be greatly accomplished if there is a well-equipped information database. The information exchanged on construction site should be able to assure task control, data integration, material and resource control, and communication between the project participants (ClearPath IT Solutions, 2016). This has led to the importance of having a critical study on the newly developed information management tool called Building Information Modelling.

Building Information Modelling (BIM) is an innovation in the global construction industry. BIM is the process of constructing a virtual 3D, 4D (time schedule), 5D (cost schedule) digital model before carrying out the real site activities in a construction project. It could be said to mean building twice – first by using software packages and then on site. BIM is a management method of developing a building model through collaboration for use by the project team and facility managers (Alliance for Construction Excellence, ACE, 2008). Hence, there is need to assess the awareness of this innovative concept in the construction industry.

The projects in the Nigerian Construction Industry have experienced a lot of problems on site. The problems, to mention but a few, are project delays, unkempt construction sites, complex site conditions, reoccurring accidents and poor work output. Ryal-Net and Kaduma (2015) noted that about 70% of problems encountered during construction are based on inadequacies in communication and information exchange. Dim, Ezeabasili and Okoro (2015), on the issue of the traditional approach in procuring building projects, noted that it lacks the collaboration but enhances isolation among the construction professionals or stakeholders with regards to the building project delivery process, and this does not satisfy the clients' need. They based the assertion on observations that in projects with an architect, engineers and the contractor, the design stage would be completed before engaging the general contractor who would have offered advice on the constructability and buildability of the project; this had led to variations on sites.

In order to have a sustainable building project devoid of the aforementioned problems, the use of BIM in building projects has proved useful. The imperativeness of this study is based on the fact that there have been a low level of BIM knowledge by professionals in the Nigerian construction industry, despite the innumerable benefits it has to offer in bringing about improved project delivery among professionals and clients; and which will also help in solving the construction problems especially collaboration problem among stakeholders. There is limited documentation of this kind of study in the South-South area of Nigeria; hence, this study sought to assess the level of knowledge of BIM in Akwa Ibom state, Nigeria, with a view to achieving sustainable building projects through effective collaboration among building professionals. In order to achieve this aim, the specific objective was to assess the awareness level of BIM by construction professionals for sustainable building projects in the study area; therefore, to further ascertain the outcome of this objective, the following hypothesis was formulated for the study:

H_0: There is no significant variation in the awareness level of BIM among the construction professionals in the study area.

2.0 REVIEW OF RELATED LITERATURE

BIM Awareness in the Construction Industry

Studies have shown that BIM is becoming popular in the building industry, as it was properly conceptualised over ten years ago to differentiate the 3D models from the traditional 2D designs (Jalaei and Jrade, 2014). Yusuf, Ali and Embi (2015) explained that the level of awareness of a society is an independent variable that other factors depend upon to achieve any capital development. Hence, this section gives a review of studies that were carried out on the awareness level of BIM. In North America, it was seen that there is a high level (62%) of BIM awareness among project stakeholders, and there is a plan to increase awareness among the 38% population that lacks understanding of BIM benefits (McGraw-Hill, 2012). In Europe, the same author observed that the project stakeholders are much aware and have

enjoyed the benefits of BIM in building projects. A study was carried out by Alabdulqader, Panuwatwanich and Doh (2014) in Australia and discussed that 84% of the respondents were aware of BIM, while 16% of them are not aware of these beneficial innovation.

An analysis on the Malaysian government by Enegbuma and Ali (2011) showed that the awareness of the importance of BIM which is a revolution in the building industry is high. The same author recorded that this level of awareness led to the establishment of JabatanKerja Raya (JKR) and the Construction Industry Development Board (CIDB) in Malaysia. In South Africa, a study by Kiprotich (2014) reflected that there is a high awareness level of BIM and its benefits, owing to the fact that the CAD systems previously used where abandoned for BIM usage. Armah (2015) in Ghana revealed that 41.37% of the respondents are not acquainted with the concept of BIM; the study showed that while 27.58% of the respondents had little knowledge of BIM, a lesser of 6.89% had a proficient knowledge of BIM.

Ryal-Net and Kaduma (2014) reported the study carried out in the Nigerian Construction Industry, Kaduna State, Northern Nigeria and they found out that only 32.6% of respondents are aware of BIM compared to 67.4% of the respondents that are not aware of BIM. The author explained that the stakeholders in the Nigerian Construction Industry are much unaware of BIM. However, in a study by Ugochukwu, Akabogu and Okolie (2015) on the awareness level of BIM by stakeholders in Anambra and Enugu State, Eastern Nigeria; it was seen that 67% of the respondents in the study are aware of BIM, while 33% of them are not aware of this concept. The observation from these studies indicates that though there is a high level of awareness of BIM in several countries, there is need to ascertain the level of BIM awareness in the Nigerian construction industry.

3.0 RESEARCH METHODOLOGY

The study was carried out in one of Nigeria's oil-producing states in the South-South region – Akwa Ibom State, Nigeria. The survey design was used to obtain the expert opinion of construction professionals on the pertinent issue – BIM awareness. The population of the study was the construction professionals in the study area. These professionals are Architects, Builders, Engineers, Quantity Surveyors, Estate Surveyors, Land Surveyors and Town Planners within Akwa Ibom State only. The population size was the number of registered professionals in the industry, obtained from the directories of professional bodies in Nigeria; this gave a total of 366. The Taro Yamane's formula was used to obtain the sample size of 191. The study adopted the random sampling method which is a method under the probability sampling techniques, and this was chosen so that every member of the sample size would have equal opportunities or chances of been selected for the study. However, before this process of random sampling was carried out, the number of respondents to be allotted to each of the group of professionals in the construction industry was determined using the proportional stratified random sampling method.

Table 1: Sample size of each component of the population frame

Registered Professionals	Population (N)	Sample size (n)
Architects	49	26
Builders	24	12
Engineers	117	62
Quantity Surveyors	47	24
Estate Surveyors	28	14
Land Surveyors	40	21
Town Planners	61	32
Total	366	191

(Source: Author's Survey, 2016)

The research instrument that was used to obtain and collect the study data is the questionnaire. Babbie (2001) explained that the questionnaire contains questions and other items forms needed to obtain information for data analysis. The questionnaire was developed by the researcher and structured to investigate the respondents' awareness of BIM in building projects in Akwa Ibom State. It used a five-point Likert scale for measurement of perceptions ranging from "very weak" to "very strong" and "strongly disagree" to "strongly agree", "very low" to "very high". The rating to be used was based on a

numerical scale of 5 for highest and 1 for lowest. Hence, the number of questionnaires administered on the respondents was one hundred and ninety-one (191). The questionnaires were self-administered by the researcher on the respondents within the study area.

The questionnaire was examined and criticised by experts in this field in the department of building, University of Uyo, Akwa Ibom state, Nigeria, to ensure its adequacy, and effectiveness in achieving the intended results. The reliability analysis was also carried out on the research instrument using Cronbach's alpha. Table 2 reveals the outcome of the reliability test carried out on the data obtained from the completed questionnaires used for the study. The result showed that the data was satisfactory to be used for the study, since the Cronbach's alpha scores were between the given range of 0.65 to 0.95.

Table 2: The reliability test

	Cronbach's Alpha
	Awareness Level of BIM
Minimum	0.910
Maximum	0.912

(Source: Author's Survey, 2016)

The data analysis was done using different methods, both for the descriptive and inferential statistics. The responses on the research objective was analysed using the Binary Logistic Regression, while the tests of hypothesis was carried out using the Kruskal-Wallis test.

The copies of questionnaire that were properly filled and returned from the field were one hundred and forty-one (141), out of the one hundred and ninety-one (191) copies of questionnaire that were administered on the respondents. This represented a response rate of 74.2% which is far above the 30% rate, as a satisfactory response rate in construction studies (cited in Ryal-Net and Kaduma, 2015). Hence, the total of one hundred and forty-one copies of questionnaire was used for the analysis. The response rate is shown in Table 3.

Table 3: The response rate of the research instrument

Responses	Number	Percentage
Questionnaires properly filled and returned	141	74.2
Questionnaires not properly filled and returned	50	25.8
Total	191	100

(Source: Author's Survey, 2016)

4.0 DATA ANALYSIS AND DISCUSSION

Respondents' Socio-economic Characteristics

Table 4 shows the result of the respondents' characteristics which were gotten from the one hundred and forty-one (141) questionnaires used for the analysis. The characteristics are: sex, nationality, profession, years of experience, age, educational status, professional affiliation, and registration status.

Table 4: Outcome of respondents' characteristics

Characteristics	Frequency	Percentage
Sex		
Male	130	92.2
Female	11	7.8
Nationality		
Nigerian	141	100
Non-Nigerian	0	0
Profession		
Builder	12	8.5
Architect	22	15.6
Estate Manager	14	9.9
Quantity Surveyor	20	14.2
Land Surveyor	8	5.7
Town Planner	4	2.8
Engineer	61	43.3
Years of Experience		
1-5 years	28	19.9
6-10 years	52	36.9
11-15 years	12	8.5
16-20 years	11	7.8
21-25 years	17	12.1
Above 25 years	21	14.9
Respondents' Age		
21-30 years	10	7.1
31-40 years	64	45.4
41-50 years	28	19.9

51-60 years	33	23.4
Above 60 years	6	4.3
Educational Status		
OND	0	0
HND	3	2.1
B.Sc	43	30.5
M.Sc	62	44
Ph.D	29	20.6
Others	4	2.8
Professional Affiliation		
NIOB	12	8.5
NITP	4	2.8
NIESV	16	11.3
NIQS	20	14.2
NIA	22	15.6
NSE	61	43.3
NIS	6	4.3
Registration Status		
Student	0	0
Technician	0	0
Licentiate	0	0
Graduate	25	17.7
Corporate	108	76.6
Fellow	8	5.7
Honorary	0	0

(Source: Author's Survey, 2016)

As shown on Table 4, the sex distribution outcome reflects that 92.2% of the respondents were male, while 7.8% of them were female. This shows a low participation of the female gender in the construction industry which in turn affects their proficiency in BIM. It could e said that when there is an increase in women's participation in the industry, it may influence the implementation of BIM in projects. The nationality characteristic of respondents reveals that 100% of the respondents were Nigerian. The study has to do with the application of BIM in the Nigerian environment; therefore this outcome will give a suitable and satisfactory result, since Nigerians who are aware of their environment are completely involved in the study. The result of the respondents' profession returns that 43.3% of them are engineers, the architects are 15.6%, quantity surveyors 14.2%, estate mangers 9.9%, and the builders are 8.5%. The land surveyors and town planners represented 5.7% and 2.8% of the respondents, respectively. This shows that the appropriate professionals were represented in the study.

The result of the respondents' years of experience reveals that 19.9% of the respondents are experienced between 1-5 years, 36.9% of them are experienced between 6-10 years, 8.5% are between 11-15 years, 7.8% are between 16-20 years, 12.1% are between 21-25 years, and 14.9% of the respondents had experience above 25 years. Since BIM is an innovation in the Nigerian construction industry, the result of the study will be true and satisfactory enough; this is so because 36.9% of the respondents are experienced within the range of 6-10 years, and those between 1-5 years, which are all in present times. The age distribution of the respondents outlines that 7.1% of the respondents had ages between 21-30 years, 45.4% of them were between 31-40 years, 19.9% were between 41-50 years, 23.4% were between 51-60 years, while 4.3% were above 60 years. This also reveals that the outcome of the study will be satisfactory, since the respondents with lower ages are more in percentage, and it is expected that the younger ones will be more proficient in the application of BIM in construction projects.

The result also shows that none of the respondents were at the level of ordinary national diploma (OND) in the educational status of the respondents, 2.1% of them have attained the higher national diploma (HND) level, 30.5% have attained the bachelor of Science (B.Sc) degree, 44% had attained the master of science (M.Sc) degree, 20.6% had attained the doctor of philosophy (Ph.D) status, while 2.8% filled for other educational qualifications. This shows that the respondents are qualified through experience, expertise and training to give the appropriate information needed for the study. It can also be seen from the Table that all the respondents were affiliated to their respective professional bodies which are the Nigerian Institute of Building (NIOB), Nigerian Institute of Town Planners (NITP), Nigerian Institute of Estate surveyors and valuers (NIESV), Nigerian Institute of Quantity Surveyors (NIQS), Nigerian Institute of Architects (NIA), Nigerian Society of

Engineers (NSE), and the Nigerian Institution for surveyors (NIS). This shows that the right hands that are not quacks have been selected for the study; and this would give the needed outcome. The result on the registration status of respondents exposes that 76.6% of the respondents were corporate members, 17.7% graduate members, and 5.7% were fellow members. This means that the study is in line with its scope of using registered professionals, since 82.3% of the respondents were fully registered with both their professional and regulatory bodies.

The Awareness Level of BIM in the Study Area

Table 5 and 6 shows the result of the construction industry professionals with respect to their level of awareness of the BIM concept for sustainable building projects. The binary logistic regression was adopted for the analysis to determine whether the construction professionals are aware or not aware of BIM.

Table 5: The awareness level of BIM by construction professionals in the study area

BIM Concepts	Yes Freq.	%	No Freq.	%	Not Sure Freq.	%
Collaboration of design and construction techniques	119	84.4	6	4.3	16	11.3
Communication between project stakeholders	121	85.8	9	6.4	11	7.8
Clarification and reduction of risk	104	73.8	18	12.8	19	13.5
Reduction of change orders and request for information	100	70.9	13	9.2	28	19.9
Facilities and asset management for owners	88	62.4	29	20.6	24	17.0
Linking of Quantity take-off to construction drawings	107	75.9	19	13.5	15	10.6
Linking of project budgets & schedules to construction drawings	115	81.6	19	13.5	7	5.0
Linking of 3D model to construction drawings	117	83	9	6.4	15	10.6
Production of As-Built drawings	108	76.6	20	14.2	13	9.2
Clash detection	77	54.6	21	14.9	43	30.5
Improved visualisation for project stakeholders	118	83.7	11	7.8	12	8.5
Fast-tracking building process due to virtual building model	112	79.4	14	9.9	15	10.6

Improved productivity due to easy determination of information	119	84.4	12	8.5	10	7.1
Quicker building and system start-up times and personnel training due to the virtual building BIM model	112	79.4	17	12.1	12	8.5
Average	108.4	76.8	15.5	11.0	17.1	12.2

(Source: Author's Survey, 2016)

Table 6: The awareness level of BIM by construction professionals in the study area

Observed		Predicted Awareness Probabilities		
		Not Aware	Aware	Percentage Correct
Awareness Probabilities	Not Aware	32	39	45.1
	Aware	24	46	65.7
Overall Percentage				55.3

The cut value is .500

(Source: Author's Survey, 2016)

The result showed that the professionals were probably aware of BIM in the study area with 65.7% awareness probability against 45.1% non-awareness probability level. The overall classification accuracy of the model was 55.3% which showed a perfect fit to model in the data.

Test of Hypothesis One on Awareness Level of BIM in the Study area

A certainty in the study was needed to affirm if there is a variation in the awareness level of BIM among the different professionals in the study area. Hence, the following hypotheses were tested:

H_O: There is no significant variation in the awareness level of BIM among the construction professionals for sustainable building projects in the study area.

H_1: There is significant variation in the awareness level of BIM among the construction professionals for sustainable building projects in the study area.

The H-test was carried out on the hypothesis and the decision rule is such that if the p-value is less than 0.05, it means the null hypothesis is rejected and the alternative hypothesis is accepted. Otherwise, the null hypothesis is accepted and the alternative hypothesis is rejected.

Table 7: Variation on the awareness level of BIM by professionals in the study area

BIM Concept	Designation of Respondent	N	Mean Rank	Chi Square	D/f	Sig.	Remark
Collaboration of design and construction techniques	Builder	12	96.75	28.519	6	0.000	S
	Architect	22	79.05				
	Estate Surveyor	14	68.93				
	Q.S	20	60.00				
	Land Surveyor	8	94.00				
	Town Planner	4	60.00				
	Engineer	61	64.82				

Communication between project stakeholders	Builder	12	73.50	18.908	6	0.004	S
	Architect	22	74.64				
	Estate Surveyor	14	86.36				
	Q.S	20	70.75				
	Land Surveyor	8	93.50				
	Town Planner	4	61.00				
	Engineer	61	63.46				
Clarification and reduction of risk	Builder	12	92.25	24.127	6	0.000	S
	Architect	22	76.36				
	Estate Surveyor	14	95.68				
	Q.S	20	60.45				
	Land Surveyor	8	83.00				
	Town Planner	4	52.50				
	Engineer	61	62.32				
Reduction of change orders and request for information	Builder	12	63.33	17.953	6	0.006	S
	Architect	22	71.50				
	Estate Surveyor	14	89.75				
	Q.S	20	58.20				
	Land Surveyor	8	103.13				
	Town Planner	4	50.50				
	Engineer	61	69.35				
Facilities and asset management for owners	Builder	12	87.00	5.992	6	0.424	N.S
	Architect	22	65.77				
	Estate Surveyor	14	73.36				
	Q.S	20	71.88				
	Land Surveyor	8	80.38				
	Town Planner	4	44.50				
	Engineer	61	69.42				
Linking of Quantity take-off to construction drawings	Builder	12	67.33	21.398	6	0.002	S
	Architect	22	61.27				
	Estate Surveyor	14	94.86				
	Q.S	20	72.30				
	Land Surveyor	8	101.25				
	Town Planner	4	54.00				
	Engineer	61	66.48				
Linking of project budgets & schedules to construction drawings	Builder	12	84.67	12.478	6	0.052	N.S
	Architect	22	64.09				
	Estate Surveyor	14	77.14				
	Q.S	20	74.75				
	Land Surveyor	8	91.50				
	Town Planner	4	58.00				
	Engineer	61	66.33				
Linking of 3D model to construction drawings	Builder	12	84.00	17.128	6	0.009	S
	Architect	22	72.64				
	Estate Surveyor	14	93.07				
	Q.S	20	66.50				

	Land Surveyor	8	59.00				
	Town Planner	4	59.00				
	Engineer	61	66.62				
Production of As-Built drawings	Builder	12	67.92	9.336	6	0.156	N.S
	Architect	22	66.14				
	Estate Surveyor	14	86.64				
	Q.S	20	62.55				
	Land Surveyor	8	86.50				
	Town Planner	4	54.50				
	Engineer	61	71.59				
Clash detection	Builder	12	79.50	13.225	6	0.040	S
	Architect	22	67.09				
	Estate Surveyor	14	63.36				
	Q.S	20	67.35				
	Land Surveyor	8	96.00				
	Town Planner	4	120.00				
	Engineer	61	67.20				
Improved visualisation for project stakeholders	Builder	12	72.17	24.140	6	0.000	S
	Architect	22	73.32				
	Estate Surveyor	14	68.71				
	Q.S	20	65.95				
	Land Surveyor	8	113.63				
	Town Planner	4	59.50				
	Engineer	61	67.28				
Fast-tracking building process due to virtual building model	Builder	12	69.42	27.385	6	0.000	S
	Architect	22	62.23				
	Estate Surveyor	14	102.18				
	Q.S	20	56.50				
	Land Surveyor	8	88.00				
	Town Planner	4	56.50				
	Engineer	61	70.80				
Improved productivity due to easy determination of information	Builder	12	72.75	27.029	6	0.000	S
	Architect	22	60.00				
	Estate Surveyor	14	69.36				
	Q.S	20	60.00				
	Land Surveyor	8	109.13				
	Town Planner	4	60.00				
	Engineer	61	74.33				
Quicker building and system start-up times and personnel training due to the virtual building BIM model	Builder	12	69.67	22.823	6	0.001	S
	Architect	22	62.36				
	Estate Surveyor	14	91.86				
	Q.S	20	68.35				
	Land Surveyor	8	104.88				
	Town Planner	4	56.50				
	Engineer	61	66.97				

N.S = Not Significant; S = Significant; N = Number of Respondents
D/f = Degree of freedom; Sig. = Significant Level

(Source: Author's Survey, 2016)

From Table 7, most of the variables are with p-values less than 0.05, which by indication means they are significant. This means that the null hypothesis is rejected, while the alternative hypothesis is accepted for the variables. However, there were three variables with p-values greater than 0.05; this means that for those three variables, the null hypothesis is accepted, while the alternative hypothesis is rejected. Hence, due to the significant variation of eleven variables, a post hoc test was carried out on these variables using Mann-Whitney U test to determine the variations' contributing respondents. Its findings are explained below.

For the collaboration of design and construction techniques, the builder, architect and the land surveyor, were the sources of the variation. In the case of the second variable which is communication between project stakeholders, the engineer was the source of the variation. The builder, quantity surveyor, and the engineer contributed to the variation in the clarification and reduction of risk. The estate and land surveyor were the source of the variation in the reduction of change orders and request for information. The contributing groups to the variation on the linking of quantity take-off to construction drawings are the estate and land surveyors. The engineer and the estate surveyor are the sources of the variation on linking of 3D model to construction drawings. The architect, engineer, town planner and estate surveyor contributed to the variation on clash detection. The contributing group to the variation on improved visualisation for the project stakeholders is the land surveyor. The quantity surveyor, estate and land surveyor are the source of the variation on fast-tracking building process due to virtual building model. For improved productivity due to easy determination of information, the engineer, quantity and land surveyor are the contributing group to the variation. The architect, estate and land surveyor are the sources of the variation on quicker building and system start-up times and personnel training due to the virtual BIM model.

Discussion of Major Findings

The study on the awareness level of BIM by construction professionals in the study area revealed that there is a high level of BIM awareness for sustainable building projects among the professionals. It can be asserted that since the professionals are much aware of the relationship between BIM and the sustainability of building projects, its usage and adoption can be much anticipated. This outcome is in agreement with a study in North America by McGraw-Hill (2012), where it was seen that there is a high level of BIM awareness among project stakeholders. It also agrees with a study by Bernstein (2010) in Europe where it was observed that the project stakeholders are much aware and have enjoyed the benefits of BIM in building projects. This supports the study by Alabdulqader, Panuwatwanich and Doh (2014) in Australia that reflected a high level of BIM awareness. It also agrees with the study by Enegbuma and Ali (2011) that the awareness of BIM importance and benefits in the Malaysian construction industry is high. It also supports a study by Kiprotich (2014) in South-Africa which reflected that there is a high awareness level of BIM and its benefits among project stakeholders. Ugochukwu, Akabogu and Okolie (2015) in South-Eastern Nigeria, also asserted that the level of BIM awareness in the Nigerian construction industry is high, which corresponds with the findings of this study. The results from the hypothesis on the variation of BIM awareness among construction professionals revealed a significant variation in their awareness level for eleven variables, and the null hypothesis was rejected while the alternative hypothesis was accepted for these variables; but three of the variables (facilities and asset management for owners, linking of project budgets & schedules to construction drawings, production of as-built drawings) revealed a not significant variation, meaning that the null hypothesis was accepted for them while the alternative hypothesis was rejected. This shows that though the professionals are aware of BIM and its concept in the study area, some group of professionals are more aware of BIM than the other groups. This implies that some professionals are still lagging behind in equipping themselves with the current trends in

technology advancements as it relates to the construction industry. This was also ascertained from the post hoc test, and it was seen that most of the professionals were appearing as the source of the variation in the awareness level of BIM in the study area. In a situation like this where some professionals are not fully aware of BIM's benefits, the movement for its adoption and the quest for sustainable buildings in the construction industry, will be slackened. This supports the study by Akerele and Etiene (2016) which asserted that the professionals' level of BIM awareness varies a lot in the different stages of construction project. A respondent made a comment on areas that the professionals ought to be aware of, as regards the concept of BIM for sustainable building projects in the construction industry: Minimization of waste on site, design of large-scale complex project and simulate /analyse potential impacts for sustainable construction.

5.0 CONCLUSION AND IMPLICATIONS OF THE STUDY

The study investigated the awareness level of BIM in the study area and concluded that there is a high level of awareness of BIM, and its concepts. The study therefore suggests that there is still a need for an increased awareness of the benefits of BIM, and how it can be used particularly in the Nigerian construction industry, though the overall level of awareness of BIM concept is high in Nigeria. This can be achieved through the use of professionals workshops organised in Nigeria. There is need for professionals to brace up to the current trend in information management on construction sites for improved project delivery, and for sustainable building projects, by making good use of BIM in their projects.

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