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Assessment of the Adoption of Building Information Modelling (BIM) in Quantity Surveying Practice in Abuja, Nigeria

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ABSTRACT

Building information modeling (BIM) is an innovative concept for the majority of firms in the construction industry. The aim of the study was to assess the adoption of building information modeling in quantity surveying practice in Abuja, Nigeria. The research was exploratory in nature: a field survey was conducted with the use of structured questionnaire. Out of 105 questionnaires administered, 90 were returned and considered suitable for the analysis. The analysis of the collected data was carried out using percentile and mean item score. The study revealed that Autodesk, Naviswork and Vico were the commonly used building information modeling tools. The study further reveals that the challenges of building information modeling adoption in quantity surveying practice in Abuja were; lack of skilled personnel, lack of BIM object libraries and cost of technology. It also revealed that training of staff and assigning of responsibility is the most effective strategies for mitigating the challenges of building information modeling. It recommended that strategies developed should be used specifically for solving each challenge hindering the adoption of building information modeling in quantity surveying practice.

1. INTRODUCTION

According to Deaton (2008), the international network for small and medium enterprise (INSME) defines technology as a human innovation in action that involves the generation of knowledge and process to develop system that solves problems and extends human capability. Across the world new technologies are developed daily which are bringing about revolution, from the basic to the intricate functions of life and the construction industry is no exception. Building information modeling (BIM) is the use of computer- generated models to simulate the planning, design, construction and operation of a facility. It is a technology that allows user to create visual simulation of a project with a digital prototype of a building prior to construction (Takim et al.,

2013). Azhar (2011) defined BIM as a model that characterizes the geometry, spatial relationships, geographic information, quantities and properties of building elements, cost estimates, material inventories, and project schedule. As the world is transforming and developing at very fast pace, rapid technologically innovative practices are increasing in order to achieve the competitive advantage. BIM is one of the innovative practices which is becoming a well-known established collaboration process in the construction industry (Gemunu et al., 2013).

Quantity surveying is concerned with cost and financial management of construction project. Its expertise enhances the design process through logical use of cost parameter to sustain viable links relating price, utility and forms which assists in attaining the employer's objective within the predetermine budget (Maarouf and Habib, 2011). Despite the industry awareness of the potential benefits of building information modeling, building and construction organization are yet to utilize it aggressively. There is a clear gap in terms of concrete understanding, planning and investment around BIM (McGraw-Hill, 2014).

Studies by Olatunji et al. (2010) and Eastman et al. (2011) provided a comprehensive list of benefits derived from the usage of building information modeling technology at pre-construction phases. These include but are not limited to the following; simultaneous access to project data base by all stakeholders, robust information, quantification, quality communication, multi-dimensional integration, project visualization, project documentation, digital facilities management and clash detection. Despite the great benefits of BIM, multiple challenges still exist, such as; change in practice, financial and time issue, legal issue, organizational issue and management issue. This situation drives the aim of this study which is to assess the challenges associated with the adoption of BIM in quantity surveying firms in Abuja, Nigeria.

2. MATERIALS AND METHODS

2.1. Data Collection

The study employed survey research design approach in the collection of the required data. The data was collected through the use well-structured questionnaire. The population for this study consists of registered quantity surveying firms in Abuja, Nigeria. The number of registered quantity surveyors in Abuja is 504, while the number of registered quantity surveying firms is 86 according to the records from Quantity Surveyors Registration Board of Nigeria (QSRBN) as at 2019. The sample size was determined using the approach of Yamane (1967). The sample size was 105 (105 was the number of registered quantity surveyors in the 86 firms). Purposive sampling was employed because quantity surveying firms were selected based on the availability of adequate information. The questionnaire was divided into two sections: The preliminary section of the questionnaire dwelt on the background information of the respondents while the other section focused on matters relating to the research objectives. Questions inherent in the questionnaire were multiple-choice type with different check boxes and tables posed on a 5-point Likert-type scale for ease and uniformity of response. Out of 105 questionnaires administered, 90 questionnaires were returned and considered suitable for analysis. Descriptive statistics were used to gain an overview of the numeric data. These include frequencies and percentages, and mean item score.

2.2. Mean Item Score (MIS)

Mean score was used to rank the challenges associated with the adoption of BIM in quantity surveying practice. The premise of decision for the ranking is that the factor with the highest mean item score is ranked 1st and others in such subsequent descending order. The equation for the mean score is given as:

$$Mean\ score = \frac{\sum FX}{N} \quad (1)$$

Where X is the rating used per column, F is the sample size for each rating and N is the total sample size.

Since a Likert of 5-point scale was employed for the collection of data, the equation 1 can thus be written as

$$Mean\ score = \frac{5F5 + 4F4 + 3F3 + 2F2 + F1}{N} \quad (2)$$

The basis of determination of level of awareness, usage, challenges and measures of militating challenges of building information modelling adoption in quantity surveying practice was as follows:

$1.00 < MIS \leq 1.99$: Very Low
$2.00 < MIS \leq 2.99$: Low
$3.00 < MIS \leq 3.99$: Neutral
$4.00 < MIS \leq 4.89$: High
$4.90 < MIS \leq 5.00$: Very High

3. RESULTS AND DISCUSSION

From Table 1, it is observed that a larger percentage of respondents (63.30%) have above 10 years of experience in the built environment making them suitable to give reliable data for the research.

Table 2 showed that about 57.80% of respondents work in a firm that has been in operation for more than 10 years. It indicates that the various firms have adequate knowledge and experience.

Table 3 shows the academic qualification of respondents. From a total of 90 respondents, 32.20% have B.Sc/B.Tech/PGD, while 44.40% of respondents have at least M.Sc/M.Tech/M.Phi. It shows that they are capable of providing vital information on the objectives of this research.

Table 4 shows that all the respondents were affiliated to relevant professional bodies in their respective professions out of which 55.60% of them have attained corporate membership grade, 16.70% of them have attained fellow membership grade while 27.80% were probationary members of their professional bodies.

From the analysis shown in Table 5, the respondents were asked to rank the level of usage of the identified building information modeling tools for the adoption in quantity surveying practice. Autodesk, Naviswork and Vico were most commonly used with a mean score of 4.34, 4.31 and 4.29 respectively, while Tekla and Bentley were least used with a mean score of 3.86 and 3.77 respectively.

Table 1: Respondents years of experience

Years of experience	Frequency	Percentage
0-5 yrs	10	11.10
6-10 yrs	23	25.60
11-15 yrs	30	33.30
16-20 yrs	20	22.20
Above 20 yrs	7	7.80
Total	90	100

Table 2: Years of operation of firm

Organization's years of operation	Frequency	Percentage
0-5 yrs	13	14.40
6-10 yrs	25	27.80
11-15 yrs	28	31.10
16-20 yrs	14	15.60
Above 20 yrs	10	11.10
Total	90	100

Table 3: Academic qualification of respondents

Academic qualification	Frequency	Percentage
HND	16	17.78
B.Sc/B.Tech/P.G.D	29	32.2
M.Sc/M.Tech/M.Phi	40	44.4
Ph. D	5	5.56
Total	90	100

Table 4: Professional qualification of respondents

Professional qualification	Frequency	Percentage
Probationary members	25	27.8
Corporate members	50	55.6
Fellow members	15	16.7
Total	90	100

Table 5: Level of usage of building information modeling in quantity surveying practice

Building information modeling tools	Mean	Rank
Autodesk	4.34	1
Naviswork	4.31	2
Vico	4.29	3
Tekla	3.86	4
Bentley	3.77	5

From Table 6, the respondents were asked to rank the challenges of building information modeling adoption in quantity surveying practice. Lack of skilled personnel, lack of BIM object libraries, cost of technology and its implementation, limited technical expertise, cost of maintenance and replacement and fear of change were most severe of the challenges to its adoption in quantity surveying practice with mean scores 4.44, 4,41, 4.34, 4.31, 4.24 and 4.18 respectively. Ranking least are legality of responsibility and possession, suitability to project, lack of managerial skills and problems of team work and collaboration with mean scores of 3.77, 3.73, 3.71, and 3.68 respectively.

As shown in Table 7, the effectiveness of BIM adoption measures to put in place by quantity surveying practice to improve their level of usage were ranked and the analysis showed that training of staff and assigning responsibility is most effective with mean score of 4.44, followed by developing BIM strategy to assist in the BIM process with mean score of 4.34, reinventing workflows with mean score of 4.31, organizing workshops, seminar and training of BIM courses with mean score of 4.29 and enabling BIM experts with mean score of 4.24. Ranking least are internal persuasion, brainstorming and marketing.

Implementing BIM in tertiary institution curricula and creating a BIM strategic steering group in the organization with mean score of 3.77, 3.73 and 3.68 respectively.

Table 6: Challenges to building information modeling (BIM) adoption in quantity surveying practice

Challenges	Mean	Rank
Lack of skilled personnel	4.44	1
Lack of BIM object libraries	4.41	2
Cost of technology and its implementation	4.34	3
Limited technical expertise	4.31	4
Cost of maintenance and replacement	4.24	5
Fear of change	4.18	6
Lack of internet connectivity	4.09	7
Structure/culture of the firm	3.86	8
Inadequate manpower	3.82	9
Legality of responsibility and possession	3.77	10
Suitability to project	3.73	11
Lack of managerial skills	3.71	12
Problems of team work and collaboration	3.68	13

The findings of this research confirmed the assertion by Abbasnejad et al. (2016) that Human resources are required for an effective BIM implementation and for any organization to fully adopt BIM in their projects, their human resource department will need to go through a complementary change in terms of their skills alongside an essential process change within the organization.

Table 7: Measures of mitigating challenges of building information modeling adoption in quantity surveying practice

Identified mitigating measures	Mean	Rank
Training of staff and assigning responsibility	4.44	1
Developing BIM strategy to assist in the BIM process	4.34	2
Reinventing workflows	4.31	3
Organizing workshops, seminar and training of BIM courses	4.29	4
Enabling BIM experts	4.24	5
Setting up department BIM implementation plan	3.86	6
Internal persuasion, brainstorming and marketing	3.77	7
Incorporation of BIM to academic curriculum	3.73	8
Creating a BIM strategic steering group in the organization	3.68	9

4. CONCLUSION

The study aimed to identify the challenges associated with BIM adoption in quantity surveying practice. The challenges of its adoption have been attributed to lack of skilled personnel, lack of BIM object libraries, cost of technology and its implementation and limited technical expertise among others. Strategies such as training of staff and assigning responsibility, developing BIM strategy to assist in the BIM process and reinventing workflows should be used specifically for solving each challenge hindering the adoption of building information modeling in quantity surveying practice.

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6. CONFLICT OF INTEREST

There is no conflict of interest associated with this work.

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