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BIM and the Future of Construction-Are Professionals Ready?

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Abstract- This work assessed the readiness of professionals for the adoption of Building Information Modeling in Nigeria. 350 questionnaires were distributed to respondents that were carefully selected based on their knowledge of BIM while 250 were returned and used for the study. Percentage frequency, Standard deviation, and mean score SPSS were used for the analysis. The result shows that although respondents possess knowledge of BIM but their readiness was low (0.12>0.05). However, the professionals understand it involves new methods and approaches which is different from the traditional ways of operation (mean=3.91, RII = 77.20%). Therefore, this study recommends the training of professionals to further get them ready for the future.

Indexed Terms- Building Information Modeling, Professionals, Construction, Virtual Construction, Architecture, Engineering and Construction.

I. INTRODUCTION

The construction industry trails behind other industries in terms of automation and efficiency. Architecture, Engineering, and Construction professionals have experienced their most significant transformation through Building Information Modeling which remains the most vital development in their history. BIM has gained worldwide popularity because it enhances productivity while decreasing errors and expenses according to Lack (2019). The concept of Building Information Modeling was not popular until its efficient and effective application in construction projects about 10 years ago through the use of computerized and integrated information management systems.

The idea of BIM and its possibilities have been in development since 1970s but it was only coined for industry use in the early 2000s. Autodesk made Building information modeling mainstream when Revit software was released. The AEC industry began practically implementing BIM in construction projects in the mid-2000s. The white paper by Autodesk in 2002 enhanced its acceptability while other software vendors also started to assert their involvement in the field (Laiserin, 2002). The AEC industry has had BIM for more than thirty years, but it became prominent when it became evident that it offers the industry more streamlined and efficient outputs in the last few years (Arayici, Egbu, and Coates, 2012). As an emerging technology, BIM is used to assist in conceiving, designing, constructing, and operating buildings in many countries (Wong, Wong, and Nadeem, 20011). BIM growth is potentially from countries like United Kingdom, Scandinavian countries, Germany, and United States of America (USA) and is highly regarded as the groundbreaking technology in these countries (Khosrowshahi and Arayici, 2012).

Therefore, this study aims to ascertain the level of readiness of professionals to embrace the possibilities of Building Information Modeling as the future of the construction industry.

BIM and the Future of Construction

BIM historical facts show that the emergence of BIM started with the first computing era while the first building database known as the building description system (BDS) was made by Charles Eastman. The system, which was developed based on a graphical user interface, orthographic, and perspective views describes individual library elements of buildings and allows its users to retrieve information by attributes and add it to an existing model (Ibem, Uwakonye, Akpoiroro, Somtochukwu and Oke, 2018). According to Graphisoft (2013) Gabor Bojar in 1983 developed the first BIM application at the Graphisoft office in

Hungary but it was popularized in 2002 though it started in the 1970s. It became well-known when some software developers got involved in this area and thus it became popular in the digital world of design and construction.

BIM is the most significant advancements in building design, management, maintenance, and operations (Ayarici, Khosrowshahi, Ponting and Mihindu, 2009). Project teams now possess multi-sensory collaborative tools and new communication structures due to the advancements. These tools function as powerful analytical instruments for interdisciplinary decision-making to represent and simulate real or hypothetical buildings and their settings. BIM is also changing how procurement happens in organisations (Azhar, Carlton, Olsen, and Ahmad, 2011), thus making it a key knowledge area for the Architectural and Construction Engineering industry. Gu and London (2010) explained that BIM functions as an IT-based system that maintains an integrated digital repository of building data throughout project lifecycle phases. The NBIMS Building Information Modeling standard establishes a standard information model that is machine-readable for facilities during all lifecycle stages such as planning, designing, constructing, operating, and maintenance (NBIMS, 2007).

According to Smith (2013), BIM can be used to make the construction industry more effective and value-driven and thus meet the needs of the clients and its application can make the construction industry to be rich in data and knowledge-based to support virtual and automated design, analysis, construction and communication. The construction industries in the developed countries are moving forward. This serves as a challenge for a developing country like Nigeria to develop the ability of its construction industry to use new and innovative processes for delivering projects. In Nigeria, few investigations have been carried out on issues related to BIM implementation.

BIM was introduced to virtually provide a representation of a construction project before the actual construction work commenced in order to identify, simulate, and assess potential problems and factors of delay that may occur during the construction phase of a project (Liu, Xie, Tivendal, & Liu, 2015). As BIM-related software has progressed the initial use has extended into scheduling, cost control, safety, green certification, and operation and maintenance including infrastructures like bridges, and stadiums. According to Azhar (2011), the adoption of BIM will benefit construction firms in the following ways;

a. Cost estimate: BIM software can be used for quantity take-off and automatically adjust and accommodate changes that occur through the project cycle.
b. Fabrication/shop drawings: Due to BIM, developing shop drawings for various systems of buildings is quite easy.
c. Construction sequencing: BIM also assists in sequencing and coordinating fabrications, materials orders, and delivery schedules for project components.
d. Conflict and clash detection: All the models in BIM are created in the right scale in a 3D space, and the software has the capability of identifying any clashes between building and utility elements. As a result, the changes on the model are instantly updated on all drawings.

The most significant highlights of BIM methods are; the single file concept; use of real Architectural elements for modeling, parametric features where changes are reflected all through the related drawings while the documents are also generated and updated (Aouad, Wu, & Lee, 2006; Aranda-Mena, Crawford, Chavez, & Froese, 2008; Abdullahi, Ibrahim, & Ibrahim, 2014; Aouad, Wu, Lee, & Onyewobi, 2014; Yahaya and Muhammad, 2016).

Since the development of BIM, the way it is seen has broadened from conceptual, design, estimation, construction, maintenance, and operation through the facility life cycle, performance, and technology. In essence, its purpose is to ensure that the right information is generated in the right format at the right time in order to enable better decision-making throughout the design, construction, and operation of built assets.

Indeed, many have standards for BIM that dictate that certain BIM levels must be met on projects (Lorek, 2018). BIM has been adopted in many countries all over the world. The United States is one of the leading countries in BIM adoption and several USA public sector organizations at different levels have created BIM programs, set BIM goals, developed BIM implementation roadmaps, and developed BIM standards (Porwal and Hewage, 2013). Apart the USA, Other countries that have used BIM include United Kingdom, Germany, France, Switzerland, etc. BIM has been faced with several challenges that have limited its growth and these include; the cost of ICT infrastructure, software and training. Furthermore, some organisations do not seem to be ready for the migration hence the reluctance to incur the costs of infrastructure, software and train the employees.

The study by Abubakar, Ibrahim, and Bala (2013) assessed the readiness of the design firms in Nigeria to adopt BIM using management, people, process, and technology as the readiness components and established that firms are not fully ready for the adoption. Some readiness components of the Nigerian public sector (specifically, Federal Ministries and Departments and Parastatals) have shown some level of readiness for BIM adoption. Likewise, Usman (2015) examined the readiness of the Nigerian public sector (Federal Ministries, Departments, and Parastatals) for the implementation of BIM in its project delivery process. Results showed that the federal ministries of Nigeria have attained management, process, and technology readiness but still need to enhance people’s readiness. Also, BIM requires specialized training because of the complexity of the processes. BIM has been offered as a very useful tool that enables users to develop the visual simulation of a project and to generate the virtual prototype of a building before the actual construction. Furthermore, BIM has been recently integrated into the curriculum for higher education. If the Instructors are adequately trained, the next generation of professionals will be informed about BIM and operationalize it. However, classroom training may not be sufficient to convey the required information.

II. METHODOLOGY

Pragmatic research paradigm was adopted for this study since it encourages the use of a method that appears best suited for the research problem. Questionnaires were used as the primary data source while secondary data source relied on published and unpublished data. The questionnaire was adopted since it can be distributed widely to a large number of persons. Questionnaires also allow greater confidence in anonymous responses. The questionnaire was structured guage the readiness of construction professionals for the future of construction.

Likert scale was used to retrieve the responses indicating Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). The registered professionals at the time of this study in FCT, Abuja formed the population. The professionals were Builders, Engineers, Quantity Surveyors, Land Surveyors, Estate Managers and Town Planners.

Based on stratified purposive sampling technique, the sample size for this study was selected using Yamane (1967) sample size determination for formular.

Therefore, the researcher derived the samples size (n) from the population size (N), thus;

$N = 4992$

$e = 0.05$

Substituting, $= 4992/(1+4992(0.05)2)$

$= 4992/(1+4992\ (0.0025)\ )$

$= 4992/12.48$

$= 400$

Therefore, sample size (n) = 400

The questionnaires returned and used for analysis were 328 questionnaires. Through the use of Bowley’s proportional statistical techniques, the respective number of respondents per profession was determined as follows;

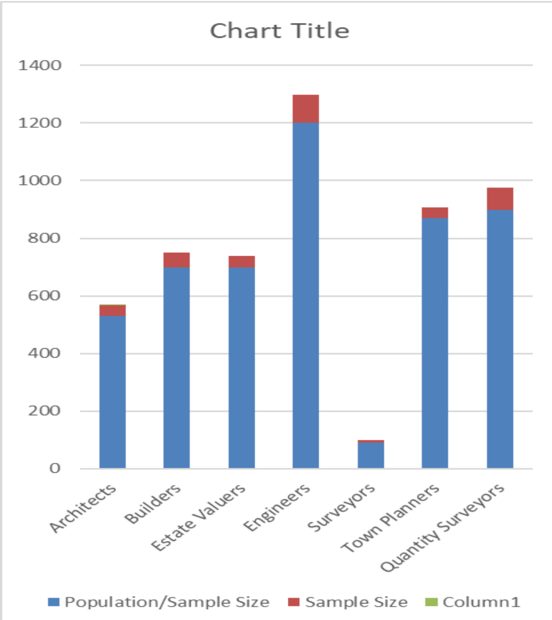

Figure 1.0: Respondents Selection

III. RESULTS AND DISCUSSION

Table 1.2: Analysis of data on the readiness of professionals for the future of the industry

QUESTION ITEMS	Mean ± SD	WiXi	RII
Most construction professional understand what BIM means.	2.11 ± 0.94	600	42.45
Building Information Modeling aids collaboration among professionals.	3.90 ± 1.05	1109	78.20
The need for transition from manual construction method to digital approach is understood by most professionals.	2.52 ± 0.92	715	50.25
Professionals understand the concepts of BIM.	2.29 ± 0.92	651	45.86
Components of BIM such as maturity level is understood by every professional.	2.33 ± 0.86	663	46.79
Professionals understand the importance of BIM	2.38 ± 1.03	676	47.62
Adequate publicity has been made for understanding of BIM.	2.57 ± 1.03	729	51.44
	2.59±0.96		51.80

For T-Test of the Mean

Variable	N	Mean	St.Dev	SE Mean	T	P
mean	7	2.59	0.599	0.226	-1.83	0.12

The statistical result in table 2.1 emanated from the inquiry on the readiness of professionals for BIM as the future of construction. The figure 51.80% which is above average signifies that professionals understand the importance of BIM for collaboration among professionals. This will change the way the professionals interface and communicate among themselves. Specifically, the professionals understand it involves new methods and approaches which is different from the traditional ways of operation (mean=3.91, RII = 77.20%). However, the t-test shows that the level of preparedness of professionals is low.

Hypothesis:
The hypothesis are;
Ho: Professionals are not ready for BIM as the future of construction
H1: Professionals are ready for BIM as the future of construction
Decision rule: if p-value ≤ 0.05 Reject Ho. If t-calculated value > t-critical value, reject Ho. Else, accept.
Ho: $P \leq 0.05$
H1: $P > 0.05$
The null hypothesis was rejected and the alternate hypothesis was accepted since $P = 0.12$ is greater than 0.05. Thus, the readiness of professionals for BIM as the future of construction is low.

CONCLUSION

Building Information Modelling is key for the operation of the construction industry. This has been adopted by several countries since it encourages collaboration, enhances communication, saves cost, reduces time, reduces stress, wastage and errors in a project. The set objective and statistical analysis as highlighted in Table 1.2 shows that although low, professionals may be ready for BIM as the future of construction.

There is need for deliberate development of professionals since it is an inevitable future.

REFERENCES

[1] Abdullahi, M., Ibrahim, Y. M., & Ibrahim, A. D. (2014). Assessing Contractors' Cash Flow Forecasting Process Capabilities. Paper presented at the 3rd NMMU Construction Management conference, Port Elizabeth, South Africa.

[2] Abubakar, M., Ibrahim, Y. M., & Bala, K. (2013). Readiness of Nigerian Building Design Firms to Adopt BIM Technologies. Paper presented at the 5th International Conference on Constrictions Engineering and Project Management (ICCEPM), Anaheim, California, US, 2013.

[3] Aouad, G., Wu, S., & Lee, A. (2006). N-dimensional modeling technology: Past, present, and future. Journal of Computing in Civil Engineering, 20, 151-153.

[4] Aouad, G., Wu, S., Lee, A., & Onyewobi, T. (2014). Computer Aided Design Guide for Architecture, Engineering and Construction. London: Routledge, Taylor and Francis.

[5] Aranda-Mena, G., Crawford, J., Chavez, A., & Froese, T. (2008). Building Information Modeling Dymistified: Does it make Business Sense to Adopt BIM? Paper presented at the CIB-W78, 25th Conference on Information Technology in Construction.

[6] Arayici, Y., Egbu, C. & Coates, P. (2012). Building information modeling (BIM) implementation and remote construction projects: Issues, challenges and critiques. Journal of Information Technology in Construction (ITcon), 17, 75-92.

[7] Ayarici, Y., Khosrowshahi, F., Ponting, A. M., & Mihindu, S. (2009). Towards implementation of Building Information Modeling (BIM) in the construction industry. Proc. Fifth International Conference on Construction in the 21st Century (CITC-V)-Collaboration and Integration in Engineering, Management and Technology. May 20-22, Istanbul, Turkey,2009

[8] Azhar, S. (2011). Building information modeling: Trends, benefits, risks and challenges, ASCE Journal of Leadership and Management in Engineering, 11 (3), 241-252.

[9] Azhar, A., Hein, M., & Sketo, B. (2008). Building Information Modeling (BIM): Benefits, Risks and Challenges. Proc., 44th Associated Schools of Construction National Conference, Auburn, AL.

[10] Gu, N., & London, K. (2010). Understanding and Facilitating BIM Adoption in the AEC Industry. Automation in Construction, 19, 988-999.

[11] Graphisoftwebsite. (2013). http://www.graphisoft.com/company/about

graphisoft/].

[12] Ibem, E. O., Uwakonye, U. O., Akpoiroro, G. O., Somtochukwu, M. & Oke, C. A. (2018). Building Information Modeling (BIM) adoption in architectural firms in Lagos, Nigeria. International Journal of Civil Engineering and Technology (IJCIET), 9(9), 902-915.

[13] Khosrowshahi, F. & Arayici, Y. (2012). Roadmap for implementation of BIM in the UK construction industry. Engineering, Construction and Architectural Management, 19(6), 610-635.

[14] Lack, B. (2019). The evolution of Building Information Modeling: Optimizing productivity, costs, and energy efficiency. https://blog.se.com/power-management-metering-monitoring-power-quality/2019/04/10/the-evolution-of-building-information-modeling-optimizing-productivity-costs-and-energy-efficiency/

[15] Laiserin, J. (2002). Comparing Pommes and Naranjas. The Laiserin Letter, 11-15.

[16] Lorek, S. (2018). Global BIM Standards: Is Your Country Next? https://constructible.trimble.com/construction-industry/global-bim-standards-is-your-country-next

[17] Liu, S., Xie, B., Tivendal, L. & Lie, C. (2015). The driving force of government in promoting BIM implementation. Journal of Management and Sustainability, 5(4), 157-164.

[18] Porwal, A. & Hewage, K. H. (2013). Building Information Modeling (BIM) partnering framework for public construction projects. Automation in Construction 31, 204-214.

[19] NBIMS. (2007). National building information model standard project committee Retrieved 5th March, 2013, from http://www.buildingsmartalliance.org/index.php/nbims/faq/

[20] Ogunmakinde, O. and Umeh, S. (2018). Adoption of BIM in the Nigerian Architecture Engineering and Construction (AEC) Industry. Presented at the 42nd Australasian Universities Building Education Association (AUBEA) Conference: Curtin University, Singapore.

[21] Ryal-Net, M. B. & Kaduma, L. A. (2015). Assessment of Building Information Modelling (BIM) Knowledge in the Nigerian Construction Industry. International Journal of Civil and Environmental Engineering, 15(6), 60-69.

[22] Smith, P. (2014). BIM Implementation – Global Strategies. Procedia Engineering, 85, 482-492. http://dx.doi.org/10.1016/j.proeng.2014.10.575

[23] Usman, J. (2015). Assessing the Readiness of the Client Sector to Adopt BIM Technologies in their Project Delivery Process. (BSc), Ahmadu Bello University, Zaria, Nigeria, Nigeria.

[24] Wong, K., Wong, K. F. & Nadeem, A. (2011). Building information modeling for tertiary construction education in Hong Kong, Journal of Information Technology in Construction

[25] Yahaya, M. I. & Muhammad, A. (2016). A 3 – Day workshop/ annual general meeting of the Nigerian Institute of Quantity Surveyors, Port-Harcourt. Department of Quantity Surveying Ahmadu Bello University, Zaria, 1-49.