Navigating the Hurdles of Building Information Modeling (BIM) Implementation in Construction Projects

Olowolayemo, Oluwaseun Ebenezer[1]; Williams, Opeyemi Samuel[2]; Ogunbode, Akintoye Benson[3]; Mohammed, Mulikat Alake[4]; Kehinde Abiodun[5]
[1,2,3]Department of Quantity Surveying, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria' [4]Department of Quantity Surveying, Osun State Polytechnic, Iree, Osun State, Nigeria; [5]Department of Architecture, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria
Corresponding E-mail: olowoseuneben@gmail.com

Abstract
The construction sector continues to grapple with persistent issues such as cost overruns, inefficiencies, and structural deficiencies. Building Information Modeling (BIM) offers a potential solution by enhancing efficiency through reduced design errors and improved collaboration among stakeholders. This study navigates the hurdles of Building Information Modeling (BIM) implementation by examining the primary obstacles hindering BIM adoption in building project development in Ondo State, Nigeria. Out of 100 structured questionnaires distributed to construction professionals, 71 were completed and returned for analysis. The study identifies insufficient training, expensive BIM software, and inadequate government backing as the primary obstacles to BIM implementation. Additional challenges include a lack of skilled professionals, inefficient data handling, and resistance to adopting new methods. To overcome these barriers, the study recommends strengthening training initiatives, offering governmental incentives, developing standardized BIM protocols, upgrading infrastructure, encouraging cooperation among stakeholders, and providing continuous technical support and security measures.

Keywords: *BIM adoption, construction industry, developing countries, implementation challenges, stakeholder collaboration*

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1.0 Introduction

Building Information Modeling (BIM) is described by the National Building Information Modeling Standard (NBIMS, 2007) as a digital depiction of a facility's physical and functional attributes, serving as a centralized knowledge resource to support informed decision-making throughout the entire project lifecycle. Eastman, Teicholz, Sacks, and Liston (2018) assert that BIM enhances communication, precision, and overall efficiency across both design and construction phases.

Through virtual simulations, BIM facilitates the evaluation of building performance in advance, allowing for the early detection of conflicts and inefficiencies (Azhar, 2011). Hardin and McCool

(2015) emphasize that it strengthens stakeholder coordination and encourages decisions that support sustainability. According to McGraw-Hill Construction (2014), the implementation of BIM has led to notable improvements in project delivery outcomes, particularly in developed economies.

Nevertheless, as highlighted by Kassem and Dawood (2020), BIM utilization in developing countries such as Nigeria remains constrained by challenges related to limited infrastructure, insufficient training, and weak policy backing. This study aims to examine and prioritize the major obstacles impeding the successful implementation of BIM in building projects across Nigeria.

2.0 Literature Review

The adoption of Building Information Modeling (BIM) presents numerous advantages, such as minimizing rework, enhancing clash detection, and improving cost management (Zhao, 2017; Zhang, Teizer, Lee, Eastman, & Venugopal, 2020). As highlighted by Azhar, Khalfan, and Maqsood (2012), BIM supports early decision-making through access to integrated project information.

However, despite its promising benefits, BIM implementation encounters several critical challenges. Aibinu and Venkatesh (2014) note that the substantial initial expenses linked to purchasing software, acquiring licenses, upgrading hardware, and providing training serve as major obstacles, particularly for small- and medium-sized enterprises (SMEs). In agreement, Succar, Sher, and Williams (2017) observed that financial constraints consistently pose barriers across various regions.

Another major issue is the shortage of professionals proficient in BIM. In South Korea, for example, Won, Lee, and Kim (2018) reported that, despite supportive government initiatives, the lack of adequately trained personnel continues to hinder progress. Similarly, Eadie, Browne, Odeyinka, McKeown, and McNiff (2015) stressed the importance of developing technical skills as a prerequisite for effective BIM adoption. Resistance to abandoning conventional construction practices also persists in many organizations. Gerges, Austin, Mayouf, Ahiakwo, Jaeger, and Saad (2017) argue that, in the absence of strong leadership and structured training programs, such resistance hampers innovation. In Nigeria, Ugochukwu, Adebayo, and Adedeji (2022) found that although many industry professionals are aware of BIM, they often lack the institutional support necessary for practical implementation.

Additionally, the absence of uniform regulatory guidelines and coherent digital policies significantly restricts BIM adoption in government-led projects (Kassem & Dawood, 2020). Carvalho, Schmidt, and Bragança (2021) further observed that efforts to incorporate life cycle environmental impact analysis through BIM are often limited by inadequate data management systems and poor interoperability among different software platforms.

3.0 Methodology

This research employs a quantitative survey method utilizing structured questionnaires, which is deemed suitable for evaluating perceptions and prioritizing challenges (Tanzeh, 2009). The study targeted professionals such as quantity surveyors, architects, civil engineers, and builders working in Ondo State, Nigeria.

A total of 100 questionnaires were randomly distributed, out of which 71 valid responses were received, resulting in a response rate of 55.46%. The design of the questionnaire was guided by previous studies, including Azhar, Khalfan, and Maqsood (2012), Who navigated the hurdles of Building Information Modeling (BIM) by identifying key challenges for data collection purposes. Additional references that informed the survey structure include Gerges, Austin, Mayouf, Ahiakwo, Jaeger, and Saad (2017), as well as Zhao (2017).

A 5-point Likert scale was used to assess the perceived challenges. The resulting data were analyzed using descriptive statistical methods, including mean scores and the Relative Importance Index (RII).

4.0 Findings and Discussion

A total of one hundred questionnaire copies were distributed to Quantity Surveyors, Architects, Engineers, Builders, and other professionals within the study area. Out of these, seventy-one completed questionnaires were retrieved and utilized for the analysis, representing a response rate of 71%. Table 1 presents the distribution of the returned questionnaires across the various organizations that comprised the study population.

Table 1. Questionnaire distributed and retrieved

Type of response	Frequency	Percentage
Number distributed	100	100
completed and returned	71	71
Number not returned	29	29

Table 2 indicates that 44 respondents (62%) are male, while 27 respondents (38%) are female. The predominance of male participants reflects the gender distribution commonly observed within the construction industry.

Table 2: Respondents' gender

Variable	Frequency	Percent
Male	44	61.97
Female	27	38.03
Total	**71**	**100.0**

Table 3 below shows that 46 respondents have between 1 and 5 years of work experience, 12 respondents have 6 to 10 years, 4 respondents have 11 to 15 years, and 9 respondents have 16 to 20 years of experience. The average work experience is six years, corresponding to the group of 12 respondents.

Table 3: Years of experience in the construction industry

Variable	Frequency	X	FX
1-5 Years	46	3	138
6-10 Years	12	8	96
11-15 Years	4	13	52
16- 20 years	9	18	162
Total	**71**		**448**

Mean = $\frac{\sum fx}{\sum f}$ = $\frac{448}{71}$ = 6.31

Table 4 below shows that fifty-eight respondents (82%) hold a Higher National Diploma or Bachelor of Science degree, seven respondents (10%) possess a Master of Science degree, and six respondents hold a Doctor of Philosophy degree. This indicates that the majority of respondents have Higher National Diploma or Bachelor's qualifications, while the smallest group consists of Doctor of Philosophy holders.

Table 4: Respondent's highest academic qualification

Variable	Frequency	Percent
Higher national diploma/bachelor of science holders	58	81.69
Master of science	7	9.86
Doctor of Philosophy	6	8.45
Total	**71**	**100.0**

Table 5 presents the professional distribution of respondents, with eighteen identified as

Architects, twenty as Quantity Surveyors, twenty as Builders, ten as Engineers, and three representing workers and other related professions.

Table 5: Respondent's profession

Variable	Frequency	Percent
Architects	18	25.35
Quantity Surveyors	20	28.17
Builders	20	28.17
Engineers	10	14.08
Others	3	4.23
Total	**71**	**100.0**

Table 6 indicates that four respondents are aged between 18 and 24 years, while the largest group of forty-three respondents (61%) fall within the 25 to 35 age range. Additionally, twelve respondents (17%) are aged between 36 and 45, and another twelve respondents (17%) are between 46 and 55 years old.

Table 6: Respondents' age

Variable	Frequency	Percent
18 - 24	4	5.63
25 – 35	43	60.56
36 – 45	12	16.90
46- 55	12	16.90
Total	**71**	**100.0**

The study's objective regarding the impact of Building Information Modeling on project cost was assessed using a 5-point Likert scale to capture respondents' opinions on the identified variables, where 5 represents strongly agree, 4 agree, 3 neutral, 2 disagree, and 1 strongly disagree.

Table 7: Navigating the Hurdles of Building Information Modeling (BIM) Implementation in Construction Projects

Strategy	Mean	RII
Insufficient training and education on BIM	4.347	**1st**
The high cost of BIM software	4.310	2nd
The lack of government support BIM adoption	4.296	3rd
The difficulty in finding BIM trained personnel	4.292	4th
Data management and storage capabilities	4.292	4th
The lack of standardization in BIM implementation	4.278	6th
Limited availability of BIM compatible software and tools	4.278	6th
Lack of skilled personnel	4.236	8th
The resistance to change from the traditional methods	4.222	9th
The limited availability of internet connectivity	4.181	10th
The lack of collaboration and communication among stakeholders	4.167	11th
The complexity of BIM software	4.153	12th
The complexity of building project	4.139	13th
The need for cybersecurity measures to protect BIM data	4.139	14th
The need of ongoing support and maintenance	4.125	15th

Table 7 indicates that insufficient training and education on BIM (mean of 4.347) is ranked 1st based on the level of training of Building Information Modeling in Nigeria. The high cost of BIM software is ranked 2nd (mean of 4.310). The lack of government support for BIM adoption is ranked 3rd. The difficulty in finding BIM-trained personnel and data management and storage capabilities is both ranked 4th. Limited availability of BIM-compatible software and tools, along with the lack of standardization in BIM implementation, are both ranked 6th. Lack of skilled personnel is ranked 8th, resistance to change from traditional methods is ranked 9th, and limited availability of internet connectivity is ranked 10th. The lack of collaboration and communication among stakeholders is ranked 11th, complexity of BIM software is ranked 12th, complexity of building projects is ranked 13th, the need for cybersecurity measures to protect BIM data is ranked 14th, and finally, the need for ongoing support and maintenance is ranked 15th.

Conclusion

The study identifies insufficient training and education on Building Information Modeling (BIM) as the foremost obstacle to its effective implementation. This is closely followed by the high expenses associated with BIM software and the lack of governmental support. Other significant challenges include difficulties in finding skilled BIM professionals, problems with data management and storage, and the absence of standardized BIM practices. Additional issues such as resistance to change, limited internet access, and poor stakeholder collaboration further hinder BIM adoption. These findings highlight the complex and varied barriers that need to be addressed to enable successful BIM integration in the construction projects.

Recommendation

To encourage broader use of BIM, it is crucial to develop and implement extensive training and educational initiatives to enhance the skills of construction professionals. Governments should play a proactive role by introducing supportive policies and financial incentives to alleviate software costs. Creating uniform standards for BIM implementation will address inconsistencies and improve system compatibility. Improving infrastructure, especially internet connectivity, will facilitate better collaboration and information exchange. Promoting a mindset open to technological innovation and improving communication among stakeholders are also essential. Lastly, ensuring ongoing technical support and robust cybersecurity protections will help sustain BIM systems throughout project durations.

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