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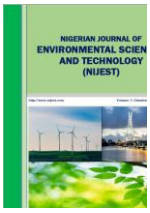

Factors Influencing the Maturity of Construction Consulting Firms for the Adoption of Building Information Modelling (BIM)

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ABSTRACT

The introducion of Building Information Modelling (BIM) into the consruction industry over two decades ago has led to numerous studies assessing the awareness and adoption of BIM among construction firms worldwide. However, studies on factors influencing the maturity of construction consulting firms for BIM adoption seems scarce in the literature, hence this study. This study hence assessed the factors inflencing the maturity of construction consulting firms in Nigeria for the adoption of BIM with a view to enhancing the adoption. The study population for this research comprised 163 Quantity Surveying firms, 459 Architectural firms, and 85 Structural Engineering firms registered with their respective professional bodies, and operating within Lagos State, anNigeria. A sample size of 272 for Architectural, Quantity Surveying, and Structural Engineering consulting firms, determined by purposive selection approach, was used for this research. A total of 235 valid responses were obtained and analysed using descriptive statistics (mean score and standard deviation) and inferential statistics (ANOVA). Findings from this study revealed that High Software Cost was the major factor affecting the maturity of Quantity Surveying (QS) and Structural Engineering (SE) firms with a Mean Square (MS) of 4.28;4.19 and Standard Deviation (SD) of 0.83;0.59, respectively. However, for Architectural (ARCH) firms, 'No Client Demand' was the major influence factor (MS=3.51, SD=1.45). Moreover, inadequate skill and training were the second-ranked factors influencing the adoption of BIM by QSFs and ARCHFs, respectively. Similarly, 'Resistance to Change' was the second-ranked factor for SEFs. Overall, there are statistically significant differences among the three groups of respondents in nine out of the ten (10) factors investigated. Based on these findings, it is concluded that construction consulting firms in the study area agree that the major factor influencing maturity for the adoptin of BIM was absence of client demand. It is hence recommended that construction clients be encouraged to patronise BIM-compliant consultants for enhanced BIM adoption and maturity.

Keywords: Adoption, Building Information Modelling, Consulting firm, Construction Industry, Maturity

1.0. Introduction

Maturity refers to the extent to which organizations have adopted and integrated BIM into their workflows, ranging from basic model creation (Level 0) to full lifecycle collaboration (Level 3) (Succar and Kassem, 2015). Maturity is a multidimensional construct that extends beyond the mere acquisition of software to encompass the depth of its integration into an organization's processes, culture, and collaborative practices. Fundamentally, maturity is not a binary state of adoption but a progressive journey along a continuum, often conceptualised through maturity models. Globally, frameworks such as the BIM Capability Maturity Model (BIM CMM) and the ISO 19650 standard provide structured pathways for this progression. Level 0 represents traditional 2D drafting with no collaboration, while Level 1 introduces a managed CAD system with some common data environment (CDE) elements. Level 2 signifies collaborative BIM, where project participants exchange standardised models, and Level 3 represents full integration of BIM across disciplines with real-time data sharing and cloud-based collaboration.

For Architectural firms, maturity has traditionally been associated with design proficiency and 3D visualisation capabilities. Yet, true maturity in this context is the ability to leverage models for advanced spatial coordination, clash detection, and performance analysis, even amidst challenges like intermittent bandwidth that may necessitate offline-working protocols. For Quantity Surveying (QS) firms, maturity transcends basic quantity take-offs. It embodies the integration of cost data with the model for real-time cost planning, estimation, and value engineering, requiring a shift from traditional measurement practices to data-rich, model-based quantification. For Structural Engineering firms, maturity is demonstrated through the use of models for structural analysis and simulation, ensuring design integrity and material efficiency, and seamlessly sharing analytical data with Architects and Contractors.

The adoption of Building Information Modelling in developing countries like Nigeria remains significantly low despite its global recognition as a transformative technology for improving data management, collaboration, and cost control (Babatunde *et al.,* 2020; Omokhua et al., 2025). While studies have emphasised the benefits of BIM, such as enhanced project delivery and reduced cost overruns, research on the maturity of construction consulting firms in adopting BIM remains sparse. Most studies have focused on awareness and perception of BIM adoption but have not comprehensively assessed the factors influencing the maturity of consulting firms, especially in Nigeria's consulting firms.

A number of studies have been conducted in the areas of BIM adoptin (Ibem et al., 2018; Omokhua et al., 2025), factors influencing BIM adoption, BIM maturity (Ahuja et al., 2018; Abu Awwad et al., 2020; Venter et al., 2021; Isa & Anifowose, 2023; Adetoro et al., 2025), and factors influencing BIM maturity (Alaghbandrad, 2015; Babatunde et al., 2019; Oyesode et al., 2022; Alankarage et al., 2023). Ibem et al. (2018) investigated the impact of BIM on Architectural firms in Lagos, Southwest, Nigeria. The objectives of the study were to determine the level of awareness; the most used BIM software packages; the aspect of Architectural work supported by BIM; and the benefits derived in Architectural practice. The study reported that the level of BIM awareness was high and that Autodesk Revi Architecture, AUTOCAD, and Google Sketchup were the software packages mostly used in the study area. It was also reported that BIM enhanced the overallproductivity of Architectural firms in the study area. Omokhua et al. (2025) also evaluated the current level of BIM implementation within Nigerian Architectural firms and the key factors constraining its uptake. The study concluded that the major barriers to the implementation of BIM were high software acquisition and maintenace costs, limited tectnical expertise, and insufficient organisational readiness. It was hence recommended that there was need for urgent government incentives, capacity-building programmes and digital skill development to stepup BIM uptake.

On factors influencing BIM adoption, Ahuja et al. (2020) examined the factors responsible for the diffusion of BIM in emerging markets in the context of Indian Architectural firms. The study adopted three dimensional framework of Technology – Organisation – Environmet (TOE) and on-line questionnaire survey to elicit data from respondents. The major findings of the study were that the full potentials of BIM have not yet been explored in India mainly because its full potentials are unclear to practioners, high setup cost, and inadequate incentives. Abu Awwad et al. (2020) explored the critical success factors (CSFs) influencing BIM level 2 implementation in Small and Medium Enterprises (SMEs) in the UK construction industry using qualitative approach. Data for the study were collected from 25 experts in three SMEs using semi-structured questionnaires. The study reported three new additional factors to the existing 12 in the literature. Venter et al. (2021) also determined the critical factors influencing the adoption of BIM in the South African construction and built environment (CBE) from Quantity Surveyors' perspectives. The study reported a slow adoption rate of BIM by Quantity Surveyors due to inadequate incentives and investment towards BIM adoption.

Similarly, Isa and Anifowose (2023) evaluated the factors influencing the intention to use BIM among construction professionals in Abuja, Nigeria with the view to understanding the variables that influence BIM adoption. Data for the study were collected from 4,195 construction professional registered with the Federal Inland Revenue Service (FIRS). Findings from the study indicated that the intention to use BIM in the study area is mainly due to clients' interest and perceived benefits. It was concluded that there was no statistically significant difference in the scoring of the respondents. Adetoro et al. (2025) conducted a critical analysis of the factors influencing BIM implementation for public projects in Malawi using sysytematic literature review

approach and questionnaire survey with a view to facilitating BIM implementation. The study hence developed a theoretical framework for evaluating factors influencing BIM implementation in low-incme countries.

Regarding BIM maturiry, Alaghbandrad (2015) assessed the BIM competencies of project participants with a view to determining their capacities for specific BIM uses via literature review and focus group discussions. Findings from the study led to the development of BIM maturit model for selecting project team members so as to reduce project cost and time, and increase quality. Moreover, Babatunde et al. (2019) assessed and compared the curret level of BIM maturity among Achitectural, Engineering and Construction firms in Nigeria using Architectural, Quantity Surveying, Structural Engineering, and Facilities Mnagement firms. The study adopted both qualitative and quantitative approaches. The study reported that Architectural firms were at BIM level 2, Quantity Surveying and Structural Engineering firms at level 1, and Facilities Management firms at level 0. Oyesode et al. (2022) assessed the BIM maturity level of Architectural firms in Lagos State, Nigeria using a non-experimental research design method. Quantitative data were collected from140 Architectural firms in the study area. The study conclude that 14.3% of the firms have the IT infrastructure require for BIM maturity level 3 but that 3.6% of these are BIM level 3 compliant with project documentation process. Similarly, 62.1% hae IT infrstructure required for level 2 and 22.1% of these have required project documentation processes. Alankarage et al. (2023) carried out a systemmatic literature review of existing studies to compare BIM maturity model development, application, and validation. The study used 32 papers published between 2010 and 2021 from Scopus, Web of Science, and ProQuest databases. Results from the research led to further studies in BIM maturity models development and application.

From the above studies, it is evident that knowledge gaps exist in the area of factors influencing the maturity of construction consulting firms for the adoption of BIM. The few studies on BIM maturity are either on Architural firms or a comparison of current levels of BIM maturity among AEC firms in Nigeria. This leaves a yarning gap in factor influencing BIM maturity the literature, hence this study. Besides, this study is needed in Nigeria which is reported to have a low uptake of BIM as one of the low-income countries. It is hence necessary to know the factors responsible for the low maturity of consulting firms in Nigeria for BIM adoption.

2.0. Methodology

Cross sectional quantitative survey research design was used for this study. Quantitative method was used because it is deemed appropriate for gathering measurable data. To compare the data collected, three groups of respondents were used. The study was carried out in Lagos State due to its commercial and economic status. Akinradewo et al., (2022) reported Lagos State as the commercial hub of Nigeria and host of the highest concentration of construction activities and professional consulting practices in Nigeria. It is one of the top economic hubs in Africa contributing about 18.38% of the National Economy in 2023 (Lagos Economic Development Update (LEDU), 2025). Besides, there are a sizable mixture of construction consulting firms in the State. The choice of Lagos State is based on pilot survey which suggested massive building and infrastructure developments to support its teeming population.

The population of this study comprised construction consulting firms operating within Lagos State, Nigeria. These firms include Architectural, Quantity Surveying, and Structural Engineering firms, all of which play key roles in the planning, design, costing, and structural delivery of building and infrastructure projects. In this study, the sampling frame comprised 707 construction consulting firms made up of 163 Quantity Surveying firms, 459 Architectural firms, and 85 Structural Engineering firms registered with their respective professional bodies, and operating within Lagos State, Nigeria. Using purposive sampling technique, 272 respondents were selected for the study comprising 161 architects, 73 quantity surveyors, and 38 structural engineers. Primary data were collected for this study using structured quesuestionnaire designed to elicit data on the study objectives. The questionairre were constructed using a 5-point likert scale. Respondents were asked to score the ten (10) variables investigated on a scale of 1 to 5, 5 for extremely influential, 4 for very influential, 3 for moderately influential, 2 for slightly influential, and 1 for not influential. Closed-ended questons were used to facilitate quantitative analysis. The survey was administered on the respondents personally and collected at latter date by appointment. Data collected was analysed using Mean Score, Standard Deviation, ANOVA, and Factor Analysis. Specifically, Analysis of Variance (ANOVA) was applied

to examine whether significant differences existed in the factors affecting maturity levels of architects, quantity surveyors, and structural engineers. To ensure validity and reliability, expert review and pilot testing of the questionnaire was done. The qusetions were aligned with the objectives of the research to ensure content validity. Reliability is measured using Cronbach's Alpha with target of 0.5 or higher representing acceptable internal consistency.

3.0. Results and Discussion

3.1 Profiles of Respondents and Firms

The profiles of the respondents and firms surveyed for the study are presented in Table 1. Regarding qualifications, the Table shows that most respondents have B.Sc./B.Tech degree (59.6%), followed by M.Sc./M.Tech (34.0%), while only 6.4% have OND/HND. Moreover, none of the respondents have less than 10 years cognate experience in construction project delivery in addition to handling a minimum of three (3) BIM projects in the last three years. These suggest highly educated and experienced respondent base, consistent with industry requirements for professional registration and practice. Moreover, the profiles of the respondents also suggest the high reliability of the data provided for this study.

Table 1: Profiles of Respondents and Firms

Profiles	Frequency	Percent	Valid Percent	Cumulative percent
Categories of firm				
Quantity Surveying	58	24.7	24.7	24.7
Architectural	145	61.7	61.7	86.4
Structural Engineering	32	13.6	13.6	100.0
Total	235	100.0	100.0	
Number of employees				
1 - 10	122	51.9	51.9	51.9
11 - 20	37	15.7	15.7	67.7
21 - 30	53	22.6	22.6	90.2
31 and above	23	9.8	9.8	100.0
Total	235	100.0	100.0	
Highest academic qualification				
OND/HND	15	6.4	6.4	6.4
B.Sc./B.Tech	140	59.6	59.6	66.0
M.Sc./M.Tech	80	34.0	34.0	100.0
Total	235	100.0	100.0	
Years of operation	Frequency	Percentage	Midpoint (x)	Fx
0 - 5 years	55	23.4	2.5	137.5
5 - 10 years	95	40.4	7.5	712.5
10 - 15 years	36	15.3	12.5	450
15 - 20 years|	23	9.8	17.5	402.5
20 - 25 years	21	8.9	22.5	472.5
25 and above	5	2.1	27.5	137.5
Total	235	100.0		2,312.5
			Mean = 10 years	
Number of Project BIM is used in the last 3 years				
0	44	18.7	0	0
1 - 5	149	63.4	3	447
6 - 10	29	12.3	8	232
11 and above	13	5.5	13	169
Total	**235**	**100.0**		**848**
			Mean = 3.61 projects	

Findings on BIM projects are consistent with previous studies which noted that BIM awareness in Nigeria are at the conceptual level (Babatunde *et al.,* 2020). This is because experience on handling three BIM projects in three years means one project every years.

3.2 *Factors Influencing BIM Maturity of Construction Consulting Firms*

Table 2 presents the results of the analysis of data on factors influencing maturity of construction firms for the adoption of BIM. Out of the 10 variables investigated, three are shown to be very influential (Mean Score 3.56 to 3.70, aproximately 4.0) on a 5-point likert scale while the other seven are moderately influential (Mean Score 2.67 to 3.42, approximately 3.0). Overall, the Table shows that high software costs is the lead factor influencing maturity of construction consulting firms for the adoption of BIM with a mean score (MS) of 3.70 on a 5-point likert scale. It is followed by no client demand (MS=3.63), lack of training (3.56), among others. The list variable influencing maturity of construction consulting firms for the adoption of BIM is resistance to change (MS=2.67). ANOVA further shows that there is statistically significant difference at 95% confidence level among the three groups of respondents in their scoring of 9 out of the 10 variables investigated. This means that the assessment of the 9 variables are not the same, meaning that the 9 variables influence consulting firm BIM maturity differently. However, there is no statistically significant difference among the three variable on only one variable, no client demand. In other words, the three groups agree that no client demand is the only variable influencing construction consultance maturity for the adoption of BIM in the study area.

Findings from this study are partly not aligned with previous studies. For example, Isa and Anifowose (2023) concluded that clients are interested in using BIM whereas, this study found that there is no demand for Bim by clients. However, some findings from this study partly aligned with extant literature. For example, high set up cost and lack of government incentives were also reported by Ahuja et al. (2018). Similarly, high software acquisition and maintenance cost and limited technical experties were reported as key factor constraining the uptake of BIM in Nigeria by Omokhua et al. (2025). Moreover, Oyesode et al. (2022) concluded that 14.3% of Architectural firms have the infrastructure requires for BIM maturity level 3, while on 3.6% are BIM level 3 compliant.

Table 2: Factors Influencing BIM Maturity of Construction Consulting Firms

		Overall			Quantity surveying firms			Architectural firms			Structural engineering firms			ANOVA	
S/N	Variables	MS	SD	R	MS	SD	R	MS	SD	R	MS	SD	R	F	Sig.
1	High software costs	3.70	1.04	1	4.28	.83	1	3.37	1.05	3	4.19	.592	1	23.78	.000*
2	No client demand	3.63	1.44	2	3.93	1.31	4	3.51	1.45	1	3.63	1.54	5	1.79	.169
3	Lack of training	3.56	1.07	3	3.93	.86	3	3.39	1.14	2	3.66	.87	3	5.80	.003*
4	lack of local technical support	3.42	1.04	4	3.84	1.06	6	3.22	.97	4	3.56	1.11	6	8.28	.000*
5	Lack of skilled personnel	3.33	1.17	5	3.98	1.01	2	2.99	1.16	6	3.66	.87	3	18.65	.000*
6	Limited internet access	3.26	1.15	6	3.71	1.16	8	3.08	1.10	5	3.28	1.20	9	6.34	.002*
7	Weak IT infrastructure	3.17	1.23	7	3.90	1.02	5	2.81	1.14	7	3.44	1.32	8	19.76	.000*
8	Lack of Government Support	3.03	1.41	8	3.79	1.30	7	2.63	1.31	9	3.47	1.41	7	17.93	.000*
9	Unreliable electricity	3.00	1.38	9	3.59	1.11	9	2.74	1.45	8	3.16	1.14	10	8.59	.000*
10	Resistance to change	2.67	1.35	10	3.33	1.23	10	2.15	1.18	10	3.84	1.02	2	39.23	.000*

*MS = Mean Score; SD = Standard deviation; R = Rank; * Sig at p < 0.05*

4.0 Conclusion

This study assessed the factors influencing BIM maturity of construction consulting firms in Lagos State. From the findings, it is concluded that the three factors out of the ten investigated are highly influential while the remaining seven are moderately influential. The three highly influential factors are high software cost, no client demand and lack of raining. However, ANOVA established that three groups of respondents agreed that only one factor influence BIM maturity of consulting firms in the study area. This factor is "no client demand". Findings from this study may have limited application to other state of Nigeria due to variation in experience, practice and exposure of different firms. Moreover, the generalization of the findings may also be limited due to the use of purposive sampling technique. This study, nevertheless, provides implications for enhancing the BIM of construction consulting firms. It is hence recommended that further studies be carried out in other locations for enhanced generalization.

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