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ASSESSING FACTORS HINDERING BUILDING INFORMATION MODELLING (BIM) ADOPTION AMONG NIGERIAN FACILITIES MANAGEMENT PRACTITIONERS

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ABSTRACT

Building Information Modelling (BIM) offers significant potential to enhance performance, collaboration, and data management within the Facilities Management (FM) industry. However, its adoption in Nigeria remains limited. This study aims to assess the key factors hindering BIM adoption among Nigerian FM practitioners. A quantitative research approach was employed, drawing on both secondary data from literature and primary data from a structured questionnaire survey. Of the 120 questionnaires distributed, 102 valid responses were analyzed using descriptive statistics and factor analysis. The findings suggest that while BIM can substantially enhance FM operations, its adoption is hindered by several underlying issues. The five most critical hindering factors include the absence of best practices and guidelines, the unavailability of BIM experts, the lack of knowledge regarding BIM benefits, the high cost of adoption procedures, and the absence of technological experience among employees. Further factor analysis revealed that these challenges can be grouped into three major components: Data and Technology Systems–related, Cost–related, and Knowledge and Regulation–related factors. The study concludes that addressing these barriers through targeted training, institutional guidelines, and cost-reduction strategies is essential to foster BIM integration in FM practice. Improving awareness and policy support can enable Nigerian FM professionals to leverage BIM for enhanced operational efficiency and sustainable asset management.

KEYWORDS: *BIM Adoption, Building Information Modeling, Facility Management, Facility Management Practitioners.*

INTRODUCTION

Facility Management (FM) is a multidisciplinary profession that ensures the functionality of the built environment by integrating people, place, process and technology (Durdyev et al., 2022). FM roles include maintenance management, emergency preparedness, business continuity, communication, finance, project management, leadership, environmental stewardship, real estate, quality and technology (Okwe et al., 2023), and generally aim to improve the performance of facilities and assets (Okoro et al., 2020).

Despite FM's importance, conventional operating methods create inefficiencies and performance challenges (Olanreweju et al., 2021). These inefficiencies contribute to significant costs through poor operation and asset management (Arayici et al., 2012). Digital technologies have been proposed to reduce such losses; authors note that tools like BIM (Building Information Modelling), blockchain, and the Internet of Things can improve FM processes (Acre and Wyckmans, 2015; Newman et al., 2020; Li et al., 2019; Olanrewaju et al., 2021). In particular, BIM supports data exchange and virtual interoperability and can serve as a database for maintenance management (Zhao et al., 2019: Eastman 2011; Pärn et al., 2017). Other documented benefits include improved FM performance and efficiency (Kassem et al., 2015), competitive advantage (Naghshbandi, 2016), cost and value benefits with reduced maintenance problems (Aziz et al., 2016), knowledge repository functions (Succar and Sher, 2014), and better data management and project quality (Motamedi et al., 2014).

While BIM's benefits across the project life cycle are well documented, its use remains concentrated in pre-construction and construction phases (Bamgbose et al., 2024; Durdyev et al., 2022; Okwe et al., 2022; Arayici et al., 2012), leaving FM largely unexplored (Edirisinghe et al., 2016; Olanrewaju et al., 2021). Therefore, this study addresses the gap by assessing the underlying factors hindering BIM adoption among Nigerian FM practitioners, to strengthen the evidence base and inform policy and practice to improve BIM uptake in FM. Findings will contribute to academic knowledge and offer practical guidance for policymakers and FM professionals.

LITERATURE REVIEW

Factors hindering building information modelling adoption in the facilities management industry

The criteria that permit or impede the adoption of Building Information Modelling (BIM) in the Facilities Management (FM) industry have been identified as BIM Adoption Factors (Ullah et al., 2020). Whereas Hochscheid and Halin (2018) noted that BIM implementation forms part of a lengthy and challenging innovation process, it is important to distinguish between the determinants of BIM adoption and the factors that enable or hinder its success. Previous studies have increasingly examined the level of BIM adoption and the benefits associated with its implementation in FM (Bonanomi et al., 2016; Kassem et al., 2015). Although BIM offers significant advantages, numerous factors have limited its use within FM. To improve its application in the FM phase, BIM should extend beyond the design and construction stages (Lin et al., 2014), as its wider utilization can reduce costs linked to software, hardware, and staff training (Migilinskas et al., 2013). Studies across countries show that adoption drivers differ by context. In the United Kingdom, competition and client demand have been key motivators for BIM adoption (Eadie et al., 2013), while in South Korea, governmental support was the most critical factor (Kim et al., 2016). Similarly, awareness, innovation readiness, and ease of implementation were highlighted in Australia (Hong et al., 2016). These findings suggest that local context strongly shapes adoption patterns, emphasizing the need to explore Nigeria's FM environment, where institutional structures and technological preparedness remain evolving.

Technological Barriers

Technological barriers remain a major challenge to BIM adoption in FM. Interoperability difficulties between BIM and existing FM software have been consistently reported (Kassem et al., 2015; Naghshbandi, 2016; Singh et al., 2017; Olanrewaju et al., 2021). In Nigeria, FM organizations often depend on fragmented digital tools, making integration difficult. Data is rarely centralized, leading to disjointed information systems that limit collaboration and decision-making (Dixit et al., 2019). Furthermore, the absence of best practices, guidelines, and standard procedures for BIM use in FM reduces consistency and confidence (Naghshbandi, 2016;Eastman et al., 2011). Limited technological experience among FM employees also slows digital transformation, while concerns about data ownership and privacy risks further discourage adoption (Kassem et al., 2015). These technological limitations indicate that Nigerian FM firms require both capacity development and clearer standards to ensure interoperability and data reliability (Olapade and Ekemode, 2018)

Organizational Barriers

Organizational challenges also hinder BIM adoption. FM professionals' unfamiliarity with BIM tools (Lin, 2014; Olapade and Ekemode, 2018) and the unavailability of BIM experts in the FM sector (Jang and Collinge, 2020) have resulted in low operational readiness. In many Nigerian organizations, there is limited upper management support and a lack of strategic direction for digital adoption (Toyin and Memowo, 2023). Traditional practices remain deeply rooted and are often viewed as more trustworthy (Sahil, 2016; Araszkiewicz, 2017). Moreover, the late engagement of FM stakeholders in project planning and design phases prevents them from influencing BIM integration strategies early enough (Jang and Collinge, 2020). This organizational inertia contributes to the continued reliance on conventional approaches and reduces opportunities for innovation in Nigerian FM practice.

Cost and Policy Constraints

The financial burden associated with BIM adoption is one of the strongest deterrents in the FM sector (Ahmed, 2018). High software and hardware costs and expensive training requirements discourage firms, particularly small and medium-sized FM enterprises (Kassem et al., 2015; Ahmed, 2018; Ma et al., 2019). Similarly, the high cost of the overall adoption process (Sun et al., 2017) and uncertainty regarding return on investment make it difficult for practitioners to justify transitioning from traditional methods. From a policy perspective, the lack of comprehensive legal frameworks (Liu and Issa, 2013) and insufficient government support contribute to slow adoption in developing contexts. In Nigeria, where BIM mandates and standardized policies are still emerging, these gaps amplify the challenges faced by FM organizations. Strengthening regulatory frameworks and offering incentives could therefore play a key role in improving BIM uptake.

Summary and Link to Nigerian FM Context

Overall, the reviewed literature shows that technological limitations, organizational resistance, and cost-policy constraints collectively hinder BIM adoption in FM. While these barriers are consistent with global findings, their impact is more pronounced in Nigeria due to limited digital literacy, high implementation costs, and the absence of national standards. This underscores the need for context-specific strategies tailored to Nigeria's FM environment to encourage BIM integration and improve operational efficiency.

The factors hindering BIM adoption in the FM industry have been compiled and presented in Table 1.

Table 1: Summary of the factors hindering BIM adoption in the FM industry and their literature sources

S/N	Factors Hindering BIM adoption	Literature sources
1.	Unavailability of BIM experts	Jang and Collinge (2020), Olanrewaju et al., 2021
2.	Absence of best practices	Naghshbandi (2016), Karji et al., 2020; Okwe et al., 2023
3.	Interoperability difficulties between FM and BIM software	Naghshbandi (2016), Park and Kim (2017), Singh *et al*. (2017), Olanrewaju *et al.* (2021)
4.	Digital software poses a privacy risk	Kassem *et al*. (2015), Azmi et al., 2024
5.	High cost of adoption procedure	Sun *et al*. (2017) , Ikediashi et al., 2025
6.	No organizational support	Ahuja et al., 2020; Georgiadou, 2019
7.	Design and construction are primary BIM markets	Edirisinghe *et al*. (2016), Duryev et al., 2022
8.	Lack of knowledge regarding BIM benefits	Ahmed (2018); Okwe, et al., 2023
9.	BIM software and hardware are expensive	Ahmed(2018), Okoro et al., 2020
10.	High cost of training FM stakeholders	Kassem *et al*. (2015), Ahmed (2018), Ma *et al*. (2019)
11.	Existing contractual processes not suitable	Sahil, (2016), Araszkiewicz, (2017)
12.	Data not centrally kept due to disjointed systems	Dixit *et al*. (2019), Durdyev et al., 2022
13.	Absence of technology-use experience	Eastman et al. (2011), Olapade and Ekemode (2018)
14.	Return on investment uncertainty	Sun *et al*. (2017), Ikediashi et al., 2025
15.	Hesitancy of FM stakeholders to embrace BIM	Kim *et al*. (2016), Li et al., 2019
16.	Delay in engagement of major stakeholders	Jang and Collinge (2020), Auja et al., 2020
17.	Unwillingness to modify traditional practices	Eastman *et al*. (2011), Ahmed (2018), Ma *et al*. (2019), Dixit *et al*., (2019).
18.	Research on BIM benefits is lagging	Liu and Issa (2013), Singh *et al*. (2017)

RESEARCH METHODOLOGY

Research Approach and Compilation of Factors Hindering BIM Adoption in FM

This study adopted a quantitative survey approach to evaluate the factors hindering Building Information Modelling (BIM) adoption in Facilities Management (FM) practice in Lagos and Abuja, Nigeria. The quantitative design enabled systematic measurement of practitioners' perceptions and statistical analysis of underlying relationships. The factors included in the instrument were compiled from a comprehensive review of prior studies (see Table 1), drawing on established research on BIM challenges within FM contexts (Eastman et al., 2011; Ahmed, 2018; Dixit et al., 2019; Okwe et al., 2023).

Respondent Selection and Sample Sizing Strategy

The sampling frame consisted of FM firms registered under the International Facility Management Association (IFMA) Corporate Membership in Nigeria, as they represent key professional stakeholders engaged across facility lifecycles (IFMA). A total of 120 structured questionnaires were distributed to professionals across management levels in selected firms, and 102 valid responses were retrieved and used for analysis. This response rate was considered sufficient for statistical reliability and aligns with prior FM-based quantitative studies (Okwe et al., 2023).

Questionnaire Design and Data Collection Process

The research instrument was a 5-point Likert scale questionnaire, developed from the literature review and validated through expert input to ensure contextual relevance to Nigerian FM operations(Ilesanmi et al., 2025). The questionnaire was divided into sections capturing respondents' background information and their level of agreement with 18 identified hindering factors. The use of a questionnaire was appropriate for efficiently gathering perceptual data from a dispersed professional population (Karji et al., 2020). Data collection was carried out through both electronic and physical administration in Lagos and Abuja.

Data Analysis and Statistical Techniques

Data were analyzed using both descriptive and inferential statistical methods. Descriptive statistics, including frequency, percentage, mean score (MS), and ranking, were used to determine the most critical barriers to BIM adoption. Reliability testing using Cronbach's alpha ensured the internal consistency of measurement scales. Subsequently, Principal Component Analysis (PCA) was performed to identify the underlying factor structures among the 18 items. PCA was considered suitable for this study because it reduces data dimensionality and groups related variables into interpretable components (Karji et al., 2020). These analyses together provide both practical insights and empirical validity for understanding the key challenges affecting BIM adoption among Nigerian FM practitioners.

RESULTS

Demographic Information of the Respondents

The demographic characteristics of the study participants are presented in Table 2. In terms of educational qualification, most respondents (53.92%) hold a Master's degree, followed by Bachelor's degree holders (30.39%), HND holders (7.84%), and PhD holders (7.84%). This indicates that the respondents are highly educated and capable of providing reliable information for this study. Regarding firm size and number of employees, over half of the participating firms (56.86%) have between 1 and 50 employees, while 22.55% have more than 101 employees and 20.59% have between 51 and 100 employees. Based on firm categorization, 37.25% are medium-sized, 36.27% large, and 26.47% small firms, suggesting that small and medium firms dominate the Nigerian FM industry (Table 2). In terms of years of FM experience, 46.08% of respondents have 5–10 years of experience, 25.49% have less than five years, 20.59% have 11–15 years, 4.90% have over 21 years, and 2.94% have 16–20 years of experience. This distribution shows that the participants are well-experienced professionals, adding credibility to the study's findings. Finally, most firms (65.69%) serve private clients, while 34.31% cater to government clients, indicating that the FM industry in Nigeria is primarily driven by private sector demand.

Table 2: Demographic information of the study participants

Variables		Frequency	Percentage (%)
Academic qualification	B.Sc.	31	30.39
	HND	8	7.84
	M.Sc.	55	53.92
	PhD	8	7.84
	Total	**102**	**100**
Number of employees	1 - 50	58	56.86
	51-100	23	22.55
	101 and above	21	20.59
	Total	**102**	**100**
Size of firm	Large	37	36.27
	Medium	38	37.25
	Small	27	26.47
	Total	**102**	**100**
Years of FM experience	11 - 15 years	21	20.59
	16 - 20 years	3	2.94
	21 years and above	5	4.90
	5 - 10 years	47	46.08
	Less than 5 years	26	25.49
	Total	**102**	**100**
Main client	Government	35	34.31
	Private	67	65.69
	Total	**102**	**100**

Factors Hindering BIM Adoption in Facilities Management Practice

Table 3 presents the descriptive analysis of the eighteen factors hindering BIM adoption among Facilities Management (FM) practitioners. The mean scores range from 3.32 to 4.31, showing that respondents generally agreed with most of the listed barriers. The standard deviation (SD) values, which range between 0.76 and 1.20, indicate a moderate spread of opinions, suggesting some variation but overall agreement among participants (Moyanga et al., 2024). The top five factors with the highest mean scores are absence of best practices and guidelines, and issues with data quality (MS = 4.31, SD = 0.76), unavailability of BIM experts in the FM industry (MS = 4.29, SD = 0.84), lack of knowledge regarding the benefits of BIM in FM (MS = 4.28, SD = 0.84), high cost of BIM adoption procedures (MS = 4.22, SD = 0.80), and absence of technological experience among employees (MS = 4.08, SD = 0.84). Out of the eighteen factors, thirteen were statistically significant ($p < 0.05$), signifying their substantial influence on BIM adoption challenges in FM, consistent with findings by Ilesanmi et al. (2025).

These results indicate that institutional, financial, and knowledge-related constraints are the most pressing barriers to BIM integration in Nigeria's FM sector. Conversely, the lowest-ranked factor, unwillingness to modify traditional practices (MS = 3.32, SD = 1.20), shows that while cultural resistance exists, it is less influential than the structural and technical challenges identified. These findings align with Ikediashi et al. (2025), who also emphasized that limited expertise, lack of awareness, and inadequate support systems remain major obstacles to BIM adoption in developing FM industries.

Table 3: Descriptive statistics and ranking factors hindering bim adoption in facilities management practice

S/N	Factors	MS	SD	t-value ($\mu = 3.5$)	*df*	Sig. (2-tailed)	Rank
F2	Absence of Best Practices and Guidelines and issues with the quality of information and data	4.31	0.76	10.85	101	0.00*	1st
F1	Unavailability of BIM Experts	4.29	0.84	9.55	101	0.00*	2nd
F8	Lack of knowledge regarding the benefits of BIM in the FM Industry	4.28	0.84	9.46	101	0.00*	3rd
F5	The high cost of adoption procedure	4.22	0.80	8.99	101	0.00*	4th
F13	Absence of Technology use experience	4.08	0.84	6.95	101	0.00*	5th
F19	Research on BIM benefits for the FM industry is lagging compared to the design and construction	4.03	1.06	5.06	101	0.00*	6th
F15	Data is not centrally kept because of the kind of disjointed systems	4.00	0.92	5.47	101	0.00*	7th
F6	No organisational support, especially from upper administration	3.91	0.89	4.67	101	0.00*	8th
F9	BIM software and hardware is expensive	3.89	0.93	4.25	101	0.00*	9th
F10	High cost of Training FM stakeholders for BIM utilisation	3.77	0.96	2.88	101	0.01*	10th
F17	Delay in the engagement of major stakeholders in FM	3.76	0.90	2.96	101	0.00*	11th
F3	Conventional FM and BIM software have interoperability difficulties	3.73	0.81	2.81	101	0.01*	12th
F16	FM stakeholders are hesitant not to embrace BIM	3.67	1.04	1.62	101	0.11*	13th
F11	Existing contractual processes may not be suitable for BIM in FM	3.63	1.00	1.28	101	0.20	14th
F7	Design and construction are the primary markets for BIM	3.57	1.16	0.60	101	0.55	15th
F14	Return on investment uncertainty	3.57	1.09	0.63	101	0.53	16th
F4	Digital software poses a privacy risk (data ownership problems)	3.56	0.99	0.60	101	0.55	17th
F18	Unwillingness to modify traditional practices in the FM industry	3.32	1.20	-1.49	101	0.14	18th

Note: Sig. = Level of significance; SD = Standard Deviation; MS = Mean Score, Likert Scale items used where
1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree; *df*= degrees of freedom, *Significant at the 95% level ($p < 0.05$)

Principal Component Analysis of Factors Hindering BIM Adoption among Facilities Management Practitioners

To further classify the significant factors into a manageable group for a streamlined problem-solving approach aimed at enhancing the use of BIM in Facility Management (FM) practice, Principal Component Analysis (PCA) was employed to reduce the 18 variables into key underlying dimensions (Aliu et al., 2025). This technique identifies patterns and clusters among correlated items, ensuring a data-driven grouping of factors influencing BIM adoption.

Table 4 presents the appropriateness of the dataset for factor analysis. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy value of 0.78 indicates that the sample was adequate for PCA, while Bartlett's Test of Sphericity (BTS) was significant (χ^2 = 386.92, p = 0.00), confirming that the correlation matrix was not an identity matrix (Oke et al., 2025). These results justify the suitability of the data for factor extraction, indicating sufficient interrelationships among variables for PCA (Field, 2013; Hair et al., 2010). The result indicates that the dataset meets the minimum statistical requirements for factorability, validating the appropriateness of PCA for this study (Aliu et al., 2025).

Table 4: KMO and Bartlett Test for Factors Hindering BIM Adoption among FM Practitioners

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.78
Bartlett's Test of Sphericity	Approx. Chi-Square	386.92
	Df	78
	Sig.	0.00

The total variance explained by the extracted components was displayed in Table 5. Based on the Eigenvalue greater than one criterion, three components were retained, cumulatively explaining 55.53% of the total variance. The first component accounted for 31.87%, the second for 13.22%, and the third for 10.43% of the total variance. After rotation, the three components explained 22.50%, 16.78%, and 16.25% of the variance, respectively, resulting in clearer interpretability of the factor structure. The three retained components jointly explain over half of the total variance, suggesting that the identified constructs effectively represent the main barriers to BIM adoption in FM practice (Ilesanmi et al., 2025).

Table 5: Total variance explained for factors hindering BIM adoption among Facility Management practitioners

Comp.	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	4.14	31.87	31.87	4.14	31.87	31.87	2.93	22.50	22.50
2	1.72	13.22	45.10	1.72	13.22	45.10	2.18	16.78	39.28
3	1.36	10.43	55.53	1.36	10.43	55.53	2.11	16.25	55.53
4	0.96	7.39	62.92						
5	0.92	7.09	70.01						
6	0.78	5.96	75.97						
7	0.66	5.06	81.03						
8	0.59	4.53	85.56						
9	0.46	3.56	89.12						
10	0.41	3.13	92.24						
11	0.40	3.04	95.29						
12	0.34	2.65	97.93						
13	0.27	2.07	100.00						

Extraction Method: Principal Component Analysis.

Comp. = Component

Furthermore, Table 6 presents the Rotated Component Matrix, showing the factor loadings after Varimax rotation. Only items with factor loadings ≥ 0.50 were retained for interpretation. The PCA reduced the 18 original factors to three distinct components, each reflecting a thematic dimension of the barriers to BIM adoption. Component 1 (Data and Technology Systems Related) includes factors linked to system integration, data management, and technological readiness. Component 2 (Cost Related) groups items describing financial burdens and resource constraints. Component 3 (Knowledge and Regulation Related) covers issues of awareness, expertise, and institutional frameworks. The PCA identified three dominant factor components summarizing the key barriers to BIM adoption in FM practice. Component 1 highlights data management and technological integration gaps as major technical barriers. Component 2 reflects the high financial implications of BIM deployment, particularly the costs of training and hardware/software acquisition. Component 3 emphasizes knowledge and institutional constraints such as the lack of experts, absence of standardized practices, and unsuitable contractual frameworks. Collectively, these insights point to the need for integrated policies that strengthen technical competence, reduce cost barriers, and promote knowledge dissemination for BIM-driven FM in developing contexts.

Table 6: Rotated component matrix for factors hindering BIM adoption for FM industry

	1	2	3
Factor Component 1: Data and Technology system-related factors	_	_	_
Interoperability difficulties between FM and BIM software	0.820	_	_
Digital software poses a privacy risk	0.730	_	_
Data not centrally kept due to disjointed systems	0.680	_	_
Absence of technology-use experience	0.670	_	_
Delay in engagement of major stakeholders	0.560	_	_
Research on BIM benefits is lagging	0.539	_	_
Component 2: Cost Related Factors	_	_	_
High cost of adoption procedure	_	0.858	_
BIM software and hardware are expensive	_	0.748	_
High cost of training FM stakeholders	_	0.712	_
Return on investment uncertainty	_	0.658	_
No organizational support	_	_	_
Component Factor 3: Knowledge and Regulation Related Factors	_	_	_
Unavailability of BIM experts	_	_	0.796
Absence of best practices	_	_	0.773
Design and construction are the primary BIM markets	_	_	0.734
Lack of knowledge regarding BIM benefits	_	_	0.601
Existing contractual processes are not suitable	_	_	0.598
Hesitancy of FM stakeholders to embrace BIM	_	_	0.564
Unwillingness to modify traditional practices	_	_	0.532

Rotation Method: Varimax with Kaiser Normalization.

Extraction Method: Principal Component Analysis.

In addition, Figure 1 shows the scree plot for factors hindering BIM adoption among Facility Management practitioners. It can be seen that components one to three are within the elbow region of the line, making them reliable.

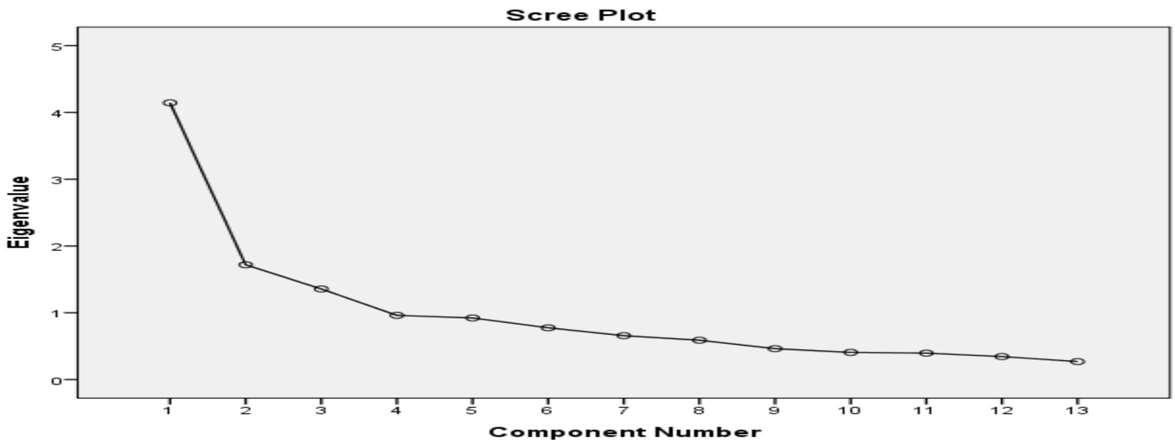

Figure 1: Scree plot for factors Hindering BIM adoption among facility management practitioners.

DISCUSSION OF FINDINGS

The findings from the factor analysis grouped the eighteen variables hindering BIM adoption in Facilities Management (FM) into three major component factors: Data and Technology Systems–Related Factors, Cost–Related Factors, and Knowledge and Regulation–Related Factors. Each component captures unique but interlinked barriers that collectively explain the slow diffusion of BIM in Nigeria's FM sector. This discussion interprets these factors in relation to prior international evidence to provide deeper analytical insight beyond the descriptive results.

Component 1: Data and Technology Systems–Related Factors

This component captures technological and infrastructural barriers that affect how BIM tools integrate with FM operations. The interoperability difficulties between FM and BIM software remain one of the major issues, as highlighted by Okwe et al. (2023) and Kassem et al. (2015). These incompatibilities hinder seamless data exchange between platforms, limiting collaborative workflows. Similarly, digital software privacy risks raise concerns over data security and ownership, making organizations hesitant to share facility data across BIM environments (Kassem et al., 2015). Disjointed data systems exacerbate these issues, as the absence of centralized databases results in data duplication and inefficiency (Dixit et al., 2019). Limited technology-use experience among FM employees, as noted by Eastman et al. (2011) and Olapade & Ekemode (2018), also restricts their operational capacity to engage BIM tools effectively. In addition, Jang & Collinge (2020) mentioned that the delay in engaging key FM stakeholders early in the project lifecycle weakens BIM integration at post-construction stages, while the limited research on BIM benefits for FM restricts the availability of context-specific evidence to promote adoption (Liu & Issa, 2013).

International comparison shows similar technology-related barriers elsewhere. For instance, Li et al. (2019) found that Chinese FM organizations struggle with system interoperability and inconsistent data standards, echoing Nigeria's challenges. Conversely, in the south Africa, Okoro et al., (2020) observed progress in data centralization and standardization through the government's BIM Level 2 mandate, demonstrating that regulatory alignment can significantly reduce such technological fragmentation. This comparison highlights that Nigeria's BIM-FM ecosystem remains largely unstructured, relying on fragmented systems rather than integrated data environments (Okwe et al., 2023).

Component 2: Cost–Related Factors

This component emphasizes the financial and resource-driven obstacles impeding BIM adoption. The high cost of adoption procedures (Sun et al., 2017) and expensive software and hardware requirements discourage many FM firms, particularly small and medium enterprises, from embracing BIM tools (Ahmed, 2018). Furthermore, as opined by Migilinskas et al. (2013), Ma et al. (2019), training FM stakeholders demands significant investment in both time and resources. The uncertainty of return on investment makes it difficult for management to justify the financial outlay. Lastly, insufficient organizational support limits institutional commitment to BIM integration (Shen et al., 2016; Shehzad et al., 2019).

In comparison, global studies confirm that cost barriers are among the most persistent obstacles. For example, Durdyev et al. (2022) in New Zealand reported that small firms often perceive BIM implementation as financially burdensome, while Ahuja et al. (2020) in India noted similar hesitancy due to unclear cost-benefit projections. However, developed economies have mitigated these challenges through incentive-based frameworks, such as government subsidies and public-sector BIM mandates, which are largely absent in Nigeria (Okwe et al., 2023). This contrast suggests that policy-driven financial support mechanisms could significantly accelerate BIM adoption among Nigerian FM firms.

Component 3: Knowledge and Regulation–Related Factors

The third component represents human expertise, institutional framework, and cultural resistance within the FM sector. The shortage of BIM experts and the absence of standardized best practices mean that organizations often lack the technical leadership necessary to drive innovation (Jang & Collinge, 2020; Naghshbandi, 2016). Moreover, FM's secondary position to design and construction in the BIM value chain results in minimal stakeholder involvement during early project stages. The lack of knowledge regarding BIM benefits (Ahmed, 2018; Okwe et al., 2023) and unsuitable contractual frameworks (Sun et al., 2017; Araszkiewicz, 2017) further discourage collaboration. Behavioral inertia also persists through hesitancy to embrace BIM and unwillingness to modify traditional FM practices (Eastman et al., 2011; Ahmed, 2018). Comparatively, evidence from the UK and Malaysia underscores the same professional and regulatory limitations. Georgiadou (2019) found the UK's BIM adoption stalled due to weak policy enforcement and limited practitioner knowledge, while Azmi et al. (2024) in Malaysia observed similar issues with fragmented regulations and a lack of trained personnel. This comparison reveals that Nigeria's situation aligns more closely with emerging BIM economies, where policy frameworks are underdeveloped and skill shortages are widespread. Targeted professional training and the establishment of national BIM guidelines would therefore be crucial steps toward improving FM integration.

In summary, the three component factors, Data and Technology Systems–Related, Cost–Related, and Knowledge and Regulation–Related, collectively explain the complex interdependencies hindering BIM adoption in Nigeria's FM industry. While technological and cost constraints dominate short-term challenges, the deeper issues lie in regulatory gaps and professional inertia (See Figure 2). Comparing these results with international experiences underscores the importance of policy intervention, standardization, and continuous professional training to enable effective BIM-FM integration across Nigeria's built environment.

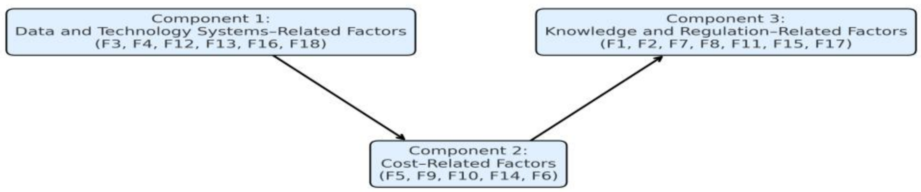

Figure 2: Components influencing BIM adoption among Nigerian Facilities Management practitioners:

CONCLUSION AND RECOMMENDATION

The persistent underutilization of Building Information Modelling (BIM) in Nigeria's Facilities Management (FM) sector underscores a critical gap in technological integration, regulatory support, and professional capacity. This study was conducted to identify and analyze the major factors hindering BIM adoption in FM practices, with the ultimate goal of providing actionable insights for improving digital transformation in the industry. Using a structured questionnaire and statistical analyses, including Mean Item Score (MIS) ranking and factor analysis, the study examined the perceptions of FM professionals regarding BIM-related barriers. The MIS results revealed that the most critical barriers include high software costs, inadequate BIM expertise, interoperability challenges, and limited awareness of BIM's long-term benefits. The factor analysis further grouped the eighteen identified variables into three major components: Data and Technology Systems–Related Factors, Cost–Related Factors, and Knowledge and Regulation–Related Factors. These three components together explain the structural and behavioral issues that continue to constrain BIM implementation in FM practices across Nigeria.

The findings imply that addressing BIM adoption challenges requires more than just financial investment; it demands an integrated approach involving policy reform, institutional support, and skill development. For Nigeria's FM industry, this means that professional bodies such as the Estate Surveyors and Valuers Registration Board of Nigeria (ESVARBON) and the Nigerian Institute of Building (NIOB) should collaborate with government agencies to develop national BIM guidelines and standard operating procedures for FM integration. Similarly, training institutions and universities should embed BIM-FM applications into their curricula, supported by continuous professional development programmes. Policymakers should also introduce incentive schemes, such as tax reliefs or grants, to reduce the high cost of BIM software and training for FM firms. This study contributes to the growing body of BIM-FM literature by empirically classifying adoption barriers within the Nigerian context, thereby offering a framework that can inform practical interventions. However, the study is limited by its reliance on self-reported data from a relatively small sample of FM professionals, which may not fully capture the perspectives of all industry stakeholders. Future research should therefore expand the geographical scope, include longitudinal assessments of BIM adoption trends, and explore the effectiveness of specific policy or training interventions. In conclusion, overcoming the barriers to BIM adoption in Nigeria's FM industry will require collective action from practitioners, regulators, and educators. By prioritizing digital competence, regulatory alignment, and sustained awareness, the FM sector can progressively transition toward data-driven, efficient, and sustainable facility management practices.

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