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PROSPECT AND STRATEGIES FOR IMPLEMENTATION OF BUILDING INFORMATION MODELLING IN LAGOS METROPOLIS

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ABSTRACT

Purpose: The Nigerian construction industry has to overcome several challenges to achieve effective implementation of Building Information Modelling (BIM). This study seeks to investigate the application of BIM in the Nigerian construction industry. The specific objectives are to find out the prospect for BIM's adoption and strategies for implementation of BIM in Nigeria.
Design/methodology/approach: The population for this study was professionals who have been involved in BIM implementation on building construction projects in Lagos metropolis. A sample of 100 respondents were chosen out of the population using purposive sampling technique, and questionnaires were administered to them. A total of 55 questionnaires were correctly filled and returned, representing 55% response rate. Frequency, percentages and mean scores were used for the analysis.
Findings: The results indicated that there is good prospect for BIM adoption in Nigeria and revealed 18 strategies that can enhance its implementation. The study further reveals that creating awareness in the built environment and continuous employee training on BIM are topmost strategies that can enhance the implementation of BIM in Nigeria.
Research limitations/Implications: It is concluded that although there are some level of good prospect for the adoption of BIM in Nigeria, however, the prospect is more likely to be for large projects. The implication is that small organizations may not favour the implementation of BIM in Nigeria in the nearest future.
Practical implications: The study recommends that continuous employee trainings should be encouraged. This can be achieved via conducting workshops, seminars and other BIM-related events, which will be of advantage to BIM implementation.
Originality/value – The study established the prospect of BIM and strategies to improve its implementation in Nigeria.

Keywords: Building Information Modelling, Implementation, Prospect, Satisfaction, Strategy

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1. INTRODUCTION

The diverse tasks and decision-making chains in construction projects life cycle require new technologies to meet up with the complexities in modern day structures. According to Saka and Chan (2020), there have been evolving technologies and procedures over the years with the goal of enhancing productivity and providing value to the construction sector. The traditional two-dimensional (2D) strategy to project execution in the built environment profession hinders optimal interchange of information among all players throughout every phase of project production, specifically from conception to construction and finally to facility management (Rohena, 2011). One of the emerging technologies that have evolved over the past decade to plan, design, construct and manage operations is Building Information Modelling (BIM). Arayici and Aouad (2010) defined BIM as the application of information communication technology (ICT) to manage a construction project over the course of a building's lifecycle to improve the environments; building safety; productivity; in addition to increasing the efficiency of the construction process and with least negative impact on the environment. Although BIM implementation started in the middle of the 2000s, it has acquired significant pace in rich countries while its use is still quite restricted in developing countries. For instance, according to Nagalingam *et. al.* (2013), the Sri Lankan construction sector has not yet implemented it, which is similar to the scenario in Nigeria. In Nigeria, construction firms have not adopted BIM extensively, despite the industry's understanding of its potential advantages.

1.1. Objectives of the Study

Given the background above, the specific objectives are to:

i. find out the prospect for BIM's adoption
ii. examine the strategies for implementation of BIM in the Nigerian Construction Industry.

The outcome of the study is expected to enhance the implementation of BIM in Nigeria.

2. LITERATURE REVIEW

The application of BIM necessitates high level technical expertise and raises operational costs for enterprises due to implementation and training expenses. The rate of implementing BIM technology has typically been slowed down by these constraints with the construction industry's well-known aversion to change (Arayici *et. al.*, 2011). In this regard, Olugboyega and Aina (2018) found out that BIM operation is mainly for visualization in the Nigerian construction industry. The study discovered that the levels of generating 2D and 3D BIM were very high; and 3D architectural model, 3D architectural and structural model, and 3D architectural and building services model were the most developed variants of 3D BIM. The application of 4D, 5D and 6D were either low or very low. Hence, Elijah and Oluwasuji (2019) posit that computing skill, cost modelling skill, computer aided design skill, construction technology skill, coordination skill as the most essential skills required to improve adoption of BIM in Nigeria. Also, organising regular workshop, BIM conferences with BIM syllabus and hiring BIM specialist for staff training are significant measures. Additionally, appropriate facilities, such as internet connectivity, integrated computer systems and availability of BIM software are needed. Othman et. al. (2020) identified the barriers to BIM implementation in Malaysia as lack of awareness, costs, slow adaptation, unavailability of a clear guideline to assist organizations and policymakers and that BIM was not mandated in sufficient time. In the same vein, Bamgbose *et. al.* (2024) posits five key barriers in Nigeria as functionality and compatibility, risk and BIM resources unavailability, inadequate awareness of BIM,

inadequate clients' demands and support, and stakeholders' skills gaps. Similarly, Toyin and Mewomo (2022) discovered 27 significant barriers to BIM in Nigeria and shed light on the three most critical as unfamiliarity with BIM capacity, resistance to change and poor awareness of the advantages of BIM. However, several studies have demonstrated that BIM's advantages definitely exceed its drawbacks, which is why governments in various industrialized nations are pushing for its implementation (Succar & Kassem, 2015). Khosrowshahi and Arayici (2012) buttressed that government agencies and construction firms in several nations, including the United States, Finland, the United Kingdom, Sweden, Australia, Singapore, Canada and Norway, have already seen substantial productivity benefits as a result of implementing BIM. Unfortunately, mainstream construction organizations and projects are yet to fully reap the benefits of BIM (Morlhon *et. al.,* 2014). The truth is that proper implementation of BIM at an organizational level is necessary for the full realization of BIM benefits (Khosrowshahi & Arayici, 2012).

Porwal and Hewage (2013) investigated the implementation in public sector enterprises and discovered that interoperability concerns, together with contractual and legal issues, were the most influential factors in implementing BIM. In this regard, Lee *et. al.* (2015) classified the factors as individual-related and organizational, and discovered that perceived usefulness, perceived ease of use, personal competencies and the level of consent among organizational members were the most influential factors of BIM adoption. Similarly, Won *et. al.* (2013) examined crucial success factors associated with BIM adoption at the organizational in North America, Europe, Oceania and Asia. The study separated the elements into four categories and discovered that, especially during the early stages of adaptation, non-technical organizational elements are considerably more important than technical ones. Won *et. al.* (2013) also discovered that, contrary to popular assumption, the benefits of adopting BIM should take precedence over the costs; in other words, the investment cost of adopting BIM enhances the return on investment (ROI).

Moreover, Isa (2015) discovered twelve strategies to overcome BIM barriers. They comprise: improvement of BIM awareness and understanding; training by employers; outsourcing BIM experts; research and development; reduction in implementing costs; changes in procurement methods; provision of education at higher institutions; clients' demand for BIM; government legislations supporting BIM; government support; improving data exchange; and development of BIM guidelines. Due to the use of technology, BIM enables project stakeholders to model projects in order to identify any possible design, construction or operational difficulties. All project participants' functions are encouraged to be integrated through the use of process component, which facilitates tight cooperation. Bernstein and Pittman (2004) claim that the construction sector has not benefited from new technology in the same way as other sectors such as manufacturing, transportation, agriculture and finance. Unlike the seamless ties between the businesses that generate recurring goods and services in other sectors, businesses in the construction industry hardly ever work together to make one product. The focus of digital technologies in the construction process is on distinct, unconnected activities including drawing production, visualization, estimating, construction and bookkeeping for administration.

Furthermore, BIM Industry Working Group (2011) recommends the 'Push-Pull' strategy for the adoption of BIM. The Push concept connotes a scenario whereby BIM is supplied by the key actors to the industry to attain minimum performance in all aspects; while the Pull is when the clients specify, demand and implement the supplied data to derive value. The study further recommends leaving complexity and competition in the supply chain; supplying based on demands; measuring and utilizing outputs; appropriate support infrastructure; implementing progressive steps; and clarity of targets. BIM Industry Working Group (2011) opine that change attracts issues of barrier that require solutions for effective deployment of BIM. The issues and their respective solutions are - exploitation of digital capabilities: level index was proposed to articulate potential abilities; legal, contractual and insurance: adjust of fundamentals of the copyright law,

contract and insurance; delivery standards and processes: specific contractual formats for targeted deliverables; education, training and support: a strong hybrid provider from universities accrediting bodies, industry best practice and vocational trainings; improved information handover: a proper information transmission system would ensure the integrity and uniqueness of information prior to its usage; information use and benefits: development of assessment procedure to enable constant recording of project performance and improvement of BIM; communications and institutional support: consensus agreement among stakeholders and institutions will enhance the deployment of BIM; investment: institutional and government investment in BIM in addition to proper monitoring team will enhance its usage; and programme: a good programme propagating industry change would help in this regards. Similarly. Successful application of BIM include developing a BIM action plan involving analysis and implementation. The analysis comprises existing processes identification and analysis, technology analysis, personnel analysis, cost analysis, timeline, personnel changes and training plan. Successful implementation will also require shared vision of change and buy-in by every staff of the organization seeking the implementation.

3. METHODOLOGY

A cross-sectional survey was used as the study design. Lagos metropolis was the study area. This study area was chosen because it constituted a large concentration of construction professionals and numerous ongoing construction activities. Construction professionals working for consulting and contracting companies in Lagos State constituted the study's population. The targeted respondents sought for this study were professionals who have adopted BIM on their projects. A sample of 100 respondents from the population were chosen using purposive sampling technique. Researchers adopting purposive sampling technique pick the units to be included in their samples by exercising good judgement strategy (Umeh, 2018). Self-administered questionnaires were used to collect data from the respondents and 55 copies of the questionnaires were correctly filled and returned, representing 55% response rate. The instrument for data collection comprised four sections. Section A consists of demographic profile of the respondents' and their organisations. Section B comprised structured experience-based questions on the prospect of BIM technology in Nigeria, including clients' request for BIM; cost of BIM projects executed; extent of BIM adoption; degree of satisfaction; and readiness to use BIM. Section C assesses respondents' satisfaction with 34 hypothesized BIM's prospect factors in their organizations, with 1 denoting not satisfied, 2 denoting slightly satisfied, 3 denoting more satisfied and 4 denoting most satisfied. The fourth section comprised an open-ended question on strategies that can enhance effective implementation of BIM in Nigeria construction industry. The retrieved questionnaires were analysed with the aid of statistical package for social sciences (SPSS) version 23.0. The statistical tools deployed were frequency distribution, percentages and mean scores.

4. PRESENTATIONAND DISCUSSION OF RESULTS

4.1. Demographic Information

The demograhic information of the respondents and organisations are shown in Table 1 which reveals that 69.1% of the respondents work in consulting organizations, 24.6% work in contracting organizations, while 7.3% work in client organizations. 12.7% of the respondents work in firms that are between 1-10 years old in the construction industry, 16.4% work in organizations that are between 11-20 years old, 70.9% work in firms that are above 20 years old. The respondents' profile further shows that 13% of the respondents have Higher National Diploma (HND) qualification, 45% holds either a B.Sc. degree, 40% have Masters qualification and 2% have PhD degree. Additionally, 16.36% of the respondents are members of the Nigerian Institute of Building (NIOB), 34.55% are members of the Nigerian Institute of Quantity Surveyors (NIQS), 34.55% are

members of the Nigerian Institute of Architects (NIA), while 14.55% are members of the Nigerian Society of Engineers (NSE). Also, 34.55% are Architects, 16.36% are Builders, 34.55% are Quantity surveyors, while 14.55% of the respondents are Engineers. Besides, 27.27% of the respondents have work experience of between 1-5years, 34.55% have 6-10 years, 14.55% have 11-15 years, 9.09% have between 16-20 years, while 14.55% of the respondents have above 20 years.

Table 1: Demographic Information

Description	Frequency (n)	Percentage (%)
Type		
Consulting	38	69.1
Contracting	13	23.6
Client	4	7.3
Total	**55**	**100**
Years in Business		
1 – 10	7	12.7
11 - 20	9	16.4
Over 20 years	39	70.9
Total	**55**	**100**
Academic Qualification		
HND	7	12.73
B.Sc.	24	43.64
M.Sc.	22	40.0
PhD	2	3.64
Total	**55**	**100**
Professional Body		
NIA	19	34.55
NIOB	9	16.36
NIQS	19	34.55
NSE	8	14.55
Total	**55**	**100**
Designation		
Architect	19	34.55
Builder	9	16.36
Quantity Surveyor	19	34.55
Engineer	8	14.55
Total	**55**	**100**
Experience		
1 - 5	15	27.27
6 - 10	19	34.55
11 – 15	8	14.55
16 - 20	5	9.09
Over 20 years	8	14.55
Total	**55**	**100**

4.2. Prospect of BIM adoption in Nigeria

The prospect of BIM implementations in Nigeria was investigated by first looking at some BIM's issues in organizations and secondly, examining the satisfactory level of

some factors (BIM's prospect factors) that could determine the prospect of adoption in the nearest future.

4.2.1. Likelihood of BIM's adoption.

The likelihood of adoption of BIM presented in Table 2 was determined using clients' request for BIM; cost of BIM projects executed; level of BIM adoption; degree of satisfaction; and readiness to use BIM. Table 2 indicates that 18.2% of the respondents stated they often had clients request to use BIM, 20.0% of the participants opined sometime, 38.2% rarely had clients request to use BIM and 23.6% of the respondents stated they have never had clients request to use BIM. It can be inferred that BIM technology has not gain sufficient recognition or acceptability, hence, its prospect is low, suggesting that majority of construction companies in Nigeria do not intend the adoption of BIM currently. Also, results from Table 2 shows that 29.1% of the respondents indicated the cost range of projects, in Nigerian Naira (₦), completed employing BIM as ₦1-50 million, 16.4% indicated ₦51-250 million, while 54.5% indicated ₦250 million above. It thus suggests the adoption of BIM on mega or capital-intensive construction projects, indicating the sort of projects with high prospect for BIM in Nigeria. Additionally, Table 2 indicates that 7.3% of the respondents' assessment on the level to which the BIM technology have been adopted in Nigeria as very good, 23.6% of the assessment was good; 50.9% was poor; and 18.2% was very poor. Thus, majority of the respondents' assessments (i.e. 69.1%) indicated either poor or very poor adoption of BIM technologies in Nigeria. Moreover, Table 2 also indicates that 1.8% of the respondents stated that their level of satisfaction with the performance of BIM technology in Nigeria was excellent, 16.4% indicated very good satisfaction, 29.1% indicated good, whilst 41.8% indicated poor and 10.9% indicated very poor satisfaction. More than half of the respondents are dissatisfied with the performance of BIM in Nigeria. This may not indicate a good prospect for BIM, however, it could be due to the bottlenecks in BIM's implementation in their organizations. A good approach to its implementation could definitely enhance their satisfaction on BIM's performance as recorded in other developed countries that have all the facilities favourable for BIM. Lastly, Table 2 shows that 29.1% of the respondents opined that their companies are not ready or likely to use BIM in the nearest future, 30.9% indicated somewhat likely and 40.0% indicated very likely. At least many respondents are very likely to use BIM the future, signalling some level of prospect for the applications of BIM in the Nigerian construction industry.

Table 2: BIM's Experience and Satisfaction

	Frequency (n)	**Percentage (%)**
Client Request for BIM		
Often	10	18.2
Sometimes	11	20.0
Rarely	21	38.2
Never	13	23.6
Total	**55**	**100.0**
Cost of BIM Project Executed		
N 1-50 million	16	29.1
N 51-250 million	9	16.4
N 250 million above	30	54.5
Total	**55**	**100.0**
Level of BIM Adoption		
Very Good	4	7.3

	Frequency (n)	Percentage (%)
Good	13	23.6
Poor	28	50.9
Very Poor	10	18.2
Total	**55**	**100.0**
Degree of Satisfaction		
Excellent	1	1.8
Very Good	9	16.4
Good	16	29.1
Poor	23	41.8
Very Poor	6	10.9
Total	**55**	**100.0**
Readiness to Use BIM		
Not Likely at All	16	29.1
Somewhat Likely	17	30.9
Very Likely	22	40.0
Total	**55**	**100.0**

4.2.2. *Factors suggesting the prospect for BIM (BIM's Prospect Factors) implementation in construction organizations.*

The level of satisfaction with the status of some BIM's prospect factors in the respondents' organizations were examined, thereby indicating the prospect for BIM implementation in those organizations. Thirty-four BIM's prospect factors were rated by the respondents in four categories, namely: management, development, technology and personnel. Table 3 presents the result as follows:

Management: the three topmost factors in this category are "top managements' interest in employing BIM" (3.15); "documented successes of BIM in construction" (3.07); and "management consciousness of BIM's benefits to the construction industry" (3.07). It can be inferred that industry managers are interested in employing BIM, indicating their readiness to embrace its adoption on construction projects. This gives positive signal of a more successful integration of BIM in the nearest future. The project owners' demands for more project visibility at lower costs and improved risk management have caused significant transformation in the building construction sector, increasing the usage of new technology in project execution. BIM is predicted to increase the output quality and features, with positive influence on the construction sector. This signifies that there is prospect for the adoption of BIM in the construction industry in the nearest future. The high level of awareness on the successes recorded by the application of BIM tools in the construction business was also indicated. As it were, BIM is most proficient in completing construction projects in the most efficient way, as one of the best digital modelling systems. Khanzode, Fischer and Reed (2008) opine that BIM technology has been tested and proven to be effective. Least ranked included "adequate financial resources to facilitate BIM's implementation" (2.53) and "motivation plans for BIM's implementation" (2.47). These issues seem only to have attained slight satisfactory status, though could be improved on, but at least not completely non-existent. The availability of the required finance or development of motivation strategies that will drive successful BIM adoption in our organization must be improved to enhance its prospect.

Development: the two highest ranked factors in this category include "integration of design and construction" (3.36), and "faster and cost-effective business processes" (3.35).

BIM has so much to offer the construction industry such as capturing reality, maintain control and improving collaboration. Yan and Damian (2010) established that countries round the globe have made significant progress in construction via BIM technology. Least ranked here are "improvement of current practices to accommodate BIM" and "availability of web-based information sharing systems" (2.58 each). These issues satisfactory status is above average, thus implying good prospect for BIM.

Personnel: the three leading factors in this category are "expertise and skills to use BIM tools (3.18); recognition of relevant trainings" (3.16); and "acknowledgement of the importance and benefits of BIM" (3.11). Inference drawn from these, points towards a high level of preparedness by the construction organizations in adopting the BIM technology. This could be attributed to the fact that expectations of clients are changing and moving towards enhanced performance in projects, in terms of quality, time and cost among other things. The expectations are easily achievable with the adoption of BIM. These facts have been recognized by the construction industry in recent times and as such, the trend sees the construction organizations fostering a construction environment that would facilitate the adoption of BIM, such that meeting client expectations would no longer be high hurdles. Ranking least here but above average as well include "adequate knowledge of the business processes that requires BIM tools" (2.65); "qualified IT staff that can manage BIM operations with other professionals" (2.60); and "disposition to specific training methods and activities on BIM" (2.45). Inference drawn from this outcome suggests a gap in the acquisition of knowledge required for business processes with BIM. It thus implies that the competence level of staff needed for the adoption of BIM, needs be upgraded to the expected standard through the acquisition of knowledge which can be enacted by training. This would give birth to the advent of increased number of qualified staffs that can manage BIM operations with other professionals.

Technology: highest ranked is "adequate experience on specialized software programs" (3.24). This is deemed to create an enabling environment for the use of such technology as BIM to thrive. The ability to use specialist software applications would contribute so much to the adoption of BIM technology in the construction industry, thereby ensuring projects get completed with quality within the cost budgeted and specified period. Even the least factor is "well-defined IT programs" with a mean of 2.91, almost 3 on a scale of 4, that is, more satisfied. This suggests adequacy regarding the IT programs in use.

Conclusively, it can be ascertained from this result that there is a bright prospect for BIM adoption in Nigeria, because the mean scores of all the 34 BIM's prospect factors ranged between 2.45 and 3.36 (on a maximum scale of 4), suggesting over 61% for the least factor in terms of their satisfactory status in the various organizations.

Table 3: BIM's Prospect Factors

BIM's Prospect Factors	1	2	3	4	N	TS	MS	GR	OR
Management									
Top management interest.	2	11	19	23	55	173	3.15	1	7
Documented successes of BIM in construction.	6	6	21	22	55	169	3.07	2	11
Management consciousness of BIM's benefits to the construction industry.	2	11	23	19	55	169	3.07	2	11
Awareness of BIM's significance in construction planning.	5	9	19	22	55	168	3.05	4	14
Readiness for adaptation of business processes in favour of BIM.	8	10	14	23	55	162	2.95	5	16
Acceptability of BIM-based practices as management strategies.	13	9	22	11	55	141	2.56	6	30
Training and capacity building policies	13	13	16	13	55	139	2.53	7	31
Adequate financial resources to facilitate BIM's implementation.	12	12	21	10	55	139	2.53	7	31
Motivation plans for BIM's implementation.	13	12	21	9	55	136	2.47	9	33
Development									
Integration of design and construction.	2	7	15	31	55	185	3.36	1	1
Faster and cost-effective business processes.	1	8	17	29	55	184	3.35	2	2
Flexible process	4	9	21	21	55	169	3.07	3	11
Inadequacies of current practices.	6	9	25	15	55	159	2.89	4	20
Interdisciplinary/inter-organizational collaborations.	6	14	21	14	55	153	2.78	5	23
Availability of specific BIM tools.	10	13	19	13	55	145	2.64	6	25
Improvement of current practices to accommodate BIM	12	12	18	13	55	142	2.58	7	28
Availability of web-based information sharing systems.	9	14	23	9	55	142	2.58	7	28
Personnel									
Expertise and skills to use BIM tools	1	9	24	21	55	175	3.18	1	4
Recognition of relevant trainings.	3	7	23	22	55	174	3.16	2	6
Acknowledgement of the importance and benefits of BIM.	4	8	21	22	55	171	3.11	3	9
Adequate knowledge of 3D CAD/BIM tools.	6	4	24	21	55	170	3.09	4	10
Adaptability to change	5	7	24	19	55	167	3.04	5	15
Willingness to train on the use BIM	6	8	24	17	55	162	2.95	6	16
Ideal setting for the implementation of BIM.	4	13	20	18	55	162	2.95	6	16
Commitment to resolving bottlenecks to use BIM.	4	12	25	14	55	159	2.89	8	20
Necessary manpower to handle BIM applications and tools	8	10	21	16	55	155	2.82	9	22
Designated and clearly defined responsibilities and tasks on BIM.	8	12	20	15	55	152	2.76	10	24
Adequate knowledge of the business processes that requires BIM tools	9	15	17	14	55	146	2.65	11	26
Qualified IT staff that can manage BIM operations with other professionals	9	14	22	10	55	143	2.60	12	27
Disposition to specific training methods and activities on BIM	10	21	13	11	55	135	2.45	13	34
Technology									
Adequate experience on specialized software programs.	2	8	20	25	55	178	3.24	1	3
Efficient intranet and internet utilities.	2	10	19	24	55	175	3.18	2	4
Adequate facilities (computer hardware & software) to support BIM adoption.	3	11	16	25	55	173	3.15	3	7
Well-defined IT programs.	3	17	17	18	55	160	2.91	4	19

1= Not satisfied, 2= Slightly satisfied, 3= More satisfied, 4= Most satisfied, MS= Mean Score, N=Number of respondents, GR= General Ranking, OR= Overall Ranking

4.3. Strategies that can enhance the implementation of BIM in Nigeria

Table 4 presents 18 strategies suggested by the respondents to enhance the implementation of BIM in Nigeria. The results in Table 4 show that 13 of the respondents suggested creating awareness in the built environment, thereby making it the topmost strategy suggested to enhance the implementation of BIM in Nigeria. Seven respondents believed that continuous employee training is a strategy that can enhance the implementation of BIM in Nigeria. These findings are consistent with those of Berchin, *et. al.* (2018); and Manzoor *et. al.* (2021) who were of the opinion that public awareness created through workshops, conference events and seminars are vital strategies for BIM implementation. Also, undertaking BIM trainings and seminar is a strategy for BIM implementation (Kiani *et. al.*, 2015; Chan *et. al.,* 2019). Additionally, six respondents proposed creation and enforcement of government policies/regulatory bodies geared towards BIM adoption. In the same vein, Raut and Valunjkar (2017) and Olatunji (2011) corroborates that government may impose BIM improvement practices, arrange trainings and also supply the necessary resources. Stakeholders' participation is also key to implementing BIM. Five respondents also recommended that the BIM software should be made available at reasonable costs. To this, Rogers, Chong and Cristopher (2015) and Kiani et al. (2015) established that subsidizing the price of the BIM software is a strategy of BIM adoption. Four respondents endorsed advancement in BIM utilization; while three respondents each encouraged incorporation of technologies in the area of BIM from developed countries; reduction in the acquisition cost of BIM tools; and new staffing with BIM knowledge. Moreover, two respondents believed that public and private collaboration is a strategy that can enhance the implementation of BIM in Nigeria; while nine respondents suggested nine strategies, namely: providing supports for BIM experts; conducting more researches on BIM; senior management supports; provision of additional incentives on BIM adoption for projects; provision of better information on the benefits and costs of adopting BIM; continuous improvement of BIM standards; improving internet and power supply infrastructure; stakeholders' participation; and improving the complexity and integration of BIM platform. Obviously, majority of the respondents emphasised creating awareness to enhance the implementation of BIM in Nigeria. These are supported by the findings of Smith (2014) and Azhar *et. al.* (2012) that BIM cannot function without the participation of stakeholders. Such collaboration will further foster its implementation on building projects. Additionally, Love *et. al.* (2013); Gerrish *et. al.* (2014) added that communicating the benefits of effective implementation to key industry players is a strategy to enhance BIM adoption on building projects. Moreover, by employing competent staff to operate BIM software could aid its

Table 4: Strategies that can enhance the implementation of BIM in Nigeria

Strategy	N	%	R
Creating awareness in the built environment	13	23.6	1
Continuous employee training on BIM	7	12.7	2
Creating and ensuring the enforcement of government policies/regulatory bodies geared towards BIM adoption	6	10.9	3
Availability of software at reasonable cost	5	9.1	4
Advancement in BIM utilization	4	7.3	5
Incorporation of technologies in the area of BIM from developed countries	3	5.5	6
Reduction in the acquisition cost of BIM tools	3	5.5	6
New staffing with BIM knowledge	3	5.5	6
Public and Private Collaboration	2	3.6	9
Providing supports for BIM experts	1	1.8	10
More researches on BIM	1	1.8	10
Encouragement from senior management	1	1.8	10
Additional incentives on BIM adoption	1	1.8	10
Better information on the benefits and costs of adopting BIM	1	1.8	10
Continuous improvement of BIM standards	1	1.8	10

Strategy	N	%	R
Improving internet and power supply infrastructure	1	1.8	10
Stakeholders participation	1	1.8	10
Improving the complexity and integration of BIM platform	1	1.8	10
Total	**55**	**100.0**	

5. CONCLUSION AND RECOMMENDATIONS

The study investigated the application of BIM in Nigeria. The study gathered the views of construction stakeholders on building projects. Each stakeholder's response was processed and analysed. Based on the premises, the study draws the conclusion that:

1. There are some good levels of prospect for the adoption of BIM in Nigeria, however, the prospect is more likely to be for large projects. The implication is that small organizations may not favour the implementation of BIM in Nigeria in the nearest future.
2. There are 34 BIMs prospect factors, the most satisfactory in the organizations is the design integration and construction process of BIM, which suggest the prospect for the use of BIM. The implication is that companies who have or are working towards acquiring these factors have a likely prospect to use BIM.
3. As many as 18 key strategies can be engaged to enhance the implementation of BIM, however, creating awareness in the built environment and continuous employee training on BIM are the most prominent. This implies that proper awareness through frequent organization of seminars, workshops will further increase BIM patronage among professionals for building projects.

Based on the inferences made from the study's conclusions, the following recommendations are made:

1. Continuous employee trainings should be encouraged. This can be achieved via conducting workshops, seminars, and other BIM-related events which will be of advantage to BIM implementation.
2. The variables impacting the adoption of BIM technology in Nigeria's construction sector should be the main emphasis, acting as a catalyst for their incorporation into construction organization. This can be achieved by making the factors necessary requirements for bidding for projects.
3. The construction industry should work to increase the level of satisfaction with the deployment of BIM in the Nigerian construction industry so that it may be more widely adopted in project construction. This can be done by publicising the gains from BIM's implementations on projects.

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