



# Drivers Affecting the Adoption of Building Information Modelling in Construction Consultancy Firms in Abuja, Nigeria

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## KeyWords

Building Information Modelling, BIM, Contract documents, Construction Consultants, tertiary education, Drivers, Collaborative Model Server

## ABSTRACT

Abstract: Construction consultants are specialist, skilled and expertise with various roles and categorizations of responsibilities to handle and satisfy the construction performance and quality to attain a construction project goal. It is also part of their role to ensure that they administered the contract as described in the contract document. Therefore, their approaches to modern tools need to be improving significantly for collaborative activity to enhance the construction process. The aim of this study is to assess the driving factors affecting the adoption of Building Information Modelling (BIM) by construction consultants with a view to sensitizing the consultants in Abuja, Nigeria. Sixty six (66) structured questionnaires were administered to construction consultants through Quantitative research method. The research revealed that incorporating BIM in tertiary education curriculum RII = 0.90, increasing the awareness level of the benefit of using BIM in construction projects RII = 0.89, and the establishment of national BIM road map RII = 0.87, are the most significant drivers required to accelerate the adoption of BIM, but they (consultant) declined to consider "mandate BIM for Public sector RII = 0.54, and registration with international bodies" RII = 0.51 as the significant initiatives to drive the adoption. Thus, the study recommends that the government should provide ways of incorporating BIM in the curriculum of tertiary institutions offering relevant courses there by, establishing a clear standards and guide on the use of BIM and to provide more tailored training to future students and practitioners.

## 1 INTRODUCTION

The construction industry is dynamic in nature due to unforeseen activities arisen during construction project [1]. It is also been described as complex, highly fragmented with adversarial business environment [2]. [3] Asserted that, any organizations failing to adapt and respond to the complexity of the new environment tend to experience survival problems. The construction sector faced so many criticisms across the globe for its inefficiency and lack of productivity [4]. According to [5] the success of the industry depends on a number of factors, such as project complexity, contractual arrangements, relationships between project participants, and the competency of project managers.

[6] Affirm that, organized building practice in Nigeria which began in the 1930s is still saddled with a lot of inherent challenges. [7] Further clarifies that Nigerian building project is still grappling with a deep-rooted challenges, ranging from inadequate technical and managerial know-how to insufficient financial, material, modern tools and equipments. [8] Describe that the Nigerian construction sector as "hesitant" to IT adoption. Although, present-day literatures showed that the IT adoptions are significantly improving at construction consultancy firms in Nigeria.

It is very vital to understand construction consultant's services, during construction project, the owner usually employs consultants' services and engaged them to oversee and control the construction process from inception to completion [9] in the same vein [10] emphasizes that, the construction consultants have a wider variety of roles to play during the construction process. Construction consultants are specialist, skilled and expertise with various roles and categorizations of responsibilities to handle and satisfy the construction processes performance and quality to attain construction project goal. It is also part of their role to ensure that they administered the contract as described in the contract document. [11] Outlined the roles necessary for consultant to be involve-in during construction project such as the standard form consultant contracts, the role of the consultant during the design stage, the role of the consultant during bidding & negotiations, Construction contract administration and Post-completion inspection.

With the advent of the current global construction technology, [10] reported that, Nigerian construction consultants are utilizing BIM packages in their in-house at individual level without collaborations with other disciplines in the production process. The global construction revolution have set new challenges for the collaborative activity of different parties in construction projects and enhances the construction process, to obtain buildings of better quality, minimize project cost and time and improve productivity.

With the growth of information technologies in the construction sector over the years, numerical building information modeling and process simulation has been accepted and widely used tool for project [2]. Building Information Modelling (BIM) is a collaborative way of working, underpinned by the digital technologies which unlock more efficient methods of the construction processes [13]. Building Information Modeling (BIM) is a combination of different technologies and ways to organise construction projects to develop and increase the work capacity amongst different actors in a construction project [14].

BIM is a digital construction technology but its adoption is much slower than anticipated in Nigerian construction sector. Several research works have been executed by the construction practitioners on BIM uptake in Nigeria but the adoption and implementation were very insignificant compare to current global challenges. Construction consultants are the early adopters of BIM in Nigerian construction sector and their adoption level mostly managed three dimensional (3D), times scheduling (4D), and project cost (5D) but does not support collaboration. For a successful adoption of BIM, an organization needs to be multidisciplinary model-based collaborative project [4]. [15] Concluded that the adoption of BIM in Nigeria is not rapid as expected compare to advanced economic countries where the strength of adoption is high. [16] Claimed that, BIM has been renowned as construction industry transformer many construction firms are still cautious about adoption but substantiated the fewer adopters in Nigeria to be consultant Architects, Engineers and project managers. Therefore, this study aimed at assessing the drivers affecting the adoption of Building Information Modelling (BIM) by construction consultants with a view to sensitizing the consultants in Abuja, Nigeria. [17] found out that BIM adoption rates have increased in the last decade, between 2007 and 2012 the adoption has gone from 28% in 2007 to 71% in 2012. It was also found that in 2009; only 27% of those who adopted BIM were heavy users, however, the number of heavy users is forecasted to approach 60% of users by 2014.

[18] gave the preferential order of whom of the construction actor to drive the adoption of BIM after the researched ways are developed. The benefits with BIM are ultimately most benefitted by the owner of the project while the consultants and contractors benefits from more efficient information sharing, their improvements in efficiency is ultimately benefitted. [19], identified the following factors as the drivers that could increase the pace of BIM adoption in Malaysian construction industry: establishment of national BIM roadmap, standard and common practice, awareness, training and education, product information & BIM libraries, BIM guidelines, information exchange, changing procurements process, special interest groups, research & development, forming BIM committee, registration with international bodies, mandate BIM for public sector, collaboration of BIM activities among government

agencies & professional bodies, use government procurements to drive the adoption and BIM reference center. Similarly [20] identified government support through legislation, clients' interest, software availability, cooperation and commitment of professional bodies, and collaborative procurement methods as the drivers to BIM adoption. He further clarifies that, all these have to be in place to enable successful transition of the industry to BIM adoption. [21] Identified drivers for BIM adoption and ranked them in order of importance. The paper highlights the importance of the UK Governments BIM adoption Strategy It also suggests that other Governments, nationally and internationally would benefit from adopting this strategy. However, once BIM is implemented the importance of operational drivers becomes evident. government pressure, client/competitive pressure, desire for innovation to remain competitive, improving the capacity to provide whole life value to client, streamlining design activities and improving design quality, designing health and safety into the construction process, improving communication to operatives, cost savings and monitoring, time savings, accurate construction sequencing and clash detection, automation of schedule/register generation, facilitating increased pre-fabrication, facilitating facilities management activities. [1] Rated the following as the driving forces to accelerate technological (BIM) adoption. Innovation cash for knowledge, long term cost benefit, competitive advantage, time savings, quality improvement and education. This result clearly reflects competitive nature of the industry and saying that "time is money". Less important drivers comprise cash for knowledge, education and the sake of innovation itself.

[22] Identified factors for successful BIM adoption across disciplines, such as data management and information exchange, including standards, security, and responsibility issues. [23] asserted that, factors that have top management priority for successful accomplishment of a task are termed positive factors. [24] stated that, Some of the driving factors of BIM adoption in Architectural, Engineering, and Construction industry (AEC) are collaboration, communication, and analysis instead of drafting, best practices set-up, training of staff, raising the understanding of BIM, and resolving how to operate in this global change. [3] showed that nontechnical issues, including inter organizational issues such as willingness to share information, master BIM model team/ managers, effective collaboration between project participants, and organizational structure to support BIM, were regarded as positive drivers to BIM adoption, although several technical factors, such as abundant BIM libraries, and collaboration management tools were also considered important but relatively lower in priority

## 2 METHOD

The overall strategy used to answer the research problems in this study was quantitative method approach through field survey; structured questionnaires were used in collecting descriptive information in the construction consultancy firms in Abuja. The study adopted the five point Likert scale rating comprising a range of one (1) = strongly disagree to five (5) = strongly agree with a neutral phrase in the middle.

The target populations of this study were construction consultants offering design and construction services. Sixty six (66) structured questionnaires were administered through purposive non-probabilistic sampling techniques. Fifty four out of sixty six questionnaires were retrieved and represent 81.8%, with 4 questionnaires being rejected due to incomplete filling out and it represents 6%. Therefore a total of 50 properly filled questionnaires were used for analysis which represents 75.8% response rate. The questions asked for this study were relevant and straight forward and the alpha test was run to determine the reliability of the scales and the value obtained was > 0.7. Therefore, comparing this result (> 0.7) with the work of [24] (2011) indicates acceptable and reliable testing instrument.

The data generated for this study were subjected to analyses using mean score and standard deviation, SPSS version 21 was used as tool for the analysis. The data were further subjected to ranking analysis to determine the firm's perception of the significant drivers affecting the adoption of BIM in the construction consultancy firms. Relative Importance Index Method (RII) was used in this research and the formula was computed as

$$\text{Relative importance index (RII)} = \sum w / (A \times N) \dots, (0 \leq \text{index} \leq 1)$$

Where:  $w$  = weighting given to each factor by the respondents,

$A$  = highest weight (i.e. 5 in this case), and

$N$  = total number of respondents (i.e. in this case 50).

The rating of all the factors for degree of significance will be based on the value of their respective relative importance index (RII). The item with the highest RII is ranked first followed by the next and so on. Therefore, this research adopted the method of RII ranking used by [10] where he rank RII above 0.85 to be very significant and RII of 0.54 to be not significant at all

## 3 RESULT

Table 1 shows responses of respondents on strategies capable of driving BIM adoption. From the table, it can be seen that the most significant initiatives capable of driving BIM adoption by consultants are introducing BIM in tertiary (RII =0.900), increase awareness of the benefit of using BIM (RII=0.892), establishment of national BIM road map (RII=0.872), establishment of BIM promotion agency and forming special interest group both with RII of 0.830 were considered the most significant drivers, while research and development fund (RII=0.822), establishment of BIM reference center (RII=0.782), forming BIM committee (0.772), mandate BIM for public sector (RII = 0.764) were considered to be fairly significant factors. Also, registration with international bodies (RII = 0.748) was considered not significant initiatives capable of driving BIM adoption.

The findings suggest that government has a pivotal role to play in BIM adoption in the construction sector by implementing

BIM in the tertiary curriculum. Increase awareness of the benefit of using BIM to all construction practitioners and establishment of national BIM road map were considered most acceptable strategy to promote BIM adoption by consultants. This is also obtainable in countries such as Malaysia and Singapore where a timeline has been set to establish BIM road map.

**Table 1: Perception of Consultants on Strategies Capable of driving BIM Adoption**

S/n	Factors	Mean	RII	Rank
1.	Introducing BIM in tertiary edu. Curriculum	4.50	0.90	1 <sup>st</sup>
2.	Increase awareness of BIM benefit	4.46	0.89	2 <sup>nd</sup>
3.	Establishment of National Road Map	4.36	0.87	3 <sup>rd</sup>
4.	Establishment of BIM Promotion Agency	4.16	0.83	4 <sup>th</sup>
5.	Forming Special Interest Group	4.16	0.83	5 <sup>th</sup>
6.	Research and Dev. Found	4.10	0.82	6 <sup>th</sup>
7.	Establishment of BIM reference centre	3.92	0.78	7 <sup>th</sup>
8.	Forming BIM Committee	3.86	0.77	8 <sup>th</sup>
9.	Mandate BIM for Public Sector	3.17	0.54	9 <sup>th</sup>
10.	Registration with Intr. Bodies	3.11	0.51	10 <sup>th</sup>

#### 4 CONCLUSION

The study aimed at assessing factors affecting the adoption of BIM by construction consultants in Abuja, Nigeria. The study information was collected from both the primary and secondary sources. The BIM drivers affecting BIM adoption were tested using mean score, standard deviation (SD) and the relative importance index (RII). The study found out that, introducing BIM in tertiary education curriculum, increased awareness of the benefits of using BIM and establishment of national BIM road map are the most significant factors capable of driving BIM adoption by the consultants. This is in accordance with the conclusion reached by Haron (2013) in studying barriers to BIM adoption and the work of [25] in studying status advantages, barriers and strategies to enhance BIM implementation in Malaysian construction industry and [26] in studying business drivers For BIM, in Australia. All of them identified incorporating BIM in tertiary institutions as the major driver to accelerate BIM adoption. It also contradicted the work of [27] who identified the research and development Found as the greatest drivers to promote BIM adoption. The findings suggest that government has a pivotal role to play in BIM adoption by mandating BIM in some tertiary institutions who offered construction related programs and this was considered the most acceptable strategy to promote BIM adoption. [15] in his study on barriers to BIM adoption in Nigeria highlighted the role of government as the major catalyst in promoting BIM adoption in the construction industry.

The research revealed that incorporating BIM in tertiary education Curriculum, increased awareness of the benefit of using BIM and establishment of national BIM road map are the most significant drivers required to accelerate the BIM adoption, as such government has a crucial role to play in promoting BIM adoption in the construction sector in general by implementing BIM as a course of its self in the tertiary institutions across the country. There by, establishing a clear standards and guide on the use of BIM and to provide more tailored training to future students and practitioners

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