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Unravelling the encumbrances to better information management among Quantity surveyors in the 4IR: A qualitative study

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Abstract

In the last decade, Building information modelling has become a topical issue of discussion in the construction industry. Its adoption has been researched from different perspectives. This is aimed at achieving a more productive and technologically driven construction industry. However, a dearth exists in the adoption among professionals in the construction industry. This paper investigates BIM adoption as a tool for an enhanced information management process in the fourth industrial revolution(4IR) among quantity surveyors in developing countries. The study adopted a qualitative research approach through interviews to achieve the study objectives. Using Nigeria as a case study, the study identified the peculiar encumbrances to BIM adoption among quantity surveyors in developing countries. Furthermore, the drivers and solutions to the identified challenges were identified. The data collected was analysed and discussed. The result was thematically discussed under two major categories – private stakeholders and the government. The study provides a deeper and robust knowledge of the peculiar dynamics among Quantity surveyors regarding BIM adoption in developing countries. The implementation of the study findings will enhance the quantity surveyor's value management function and be 4IR aligned.

Keywords

BIM adoption dynamics, Building Information modelling, developing countries, global south, information management, qualitative research, 4IR

1. Introduction

Building information modelling (BIM) is the new yardstick for collaboration and value delivery on construction projects in the construction industry. Many studies have established its benefits to the industry theoretically and via case studies (Bensalah et al., 2019; Bryde et al., 2013; Stanley & Thurnell, 2014). It has been established that it promotes cost efficiency, reduces conflict, aid accelerated project completion, enables more efficient designs, promotes collaboration among stakeholders, and other benefits. The adoption of this revolutionary technology in the construction industry has witnessed an upsurge as the UK, the US, and some other countries have witnessed a good level of adoption and implementation.

Despite this development witnessed in other parts of the world, studies have shown that many developing countries are still struggling and are faced with diverse challenges(Ofori, 2007). These challenges have made BIM adoption a challenge in developing countries. Consequently, if these challenges are not eliminated, the developing countries will not be well-positioned for the fourth industrial revolution and to compete globally. Ofori identified, among others, culture and 105nstandardize; the culture of working in isolation by the construction industry in the developing countries will not help them compete globally or achieve technological adoption. This is because technology has broken down international borders, and 105nstandardize has made it possible for foreign firms with superior resources to compete with indigenous firms.

The case of the Nigerian construction industry is not peculiar as regards slow adoption of innovation as the construction industry has generally been observed to be slow in technological adoption. This tradition has been established to affect the construction industry in general (Gerbert et al., 2016). Defending this tradition, Georgiadou, (2019) claimed that the uptake of new tools, techniques, and methods require significant time, skills and capital investment. The study also provided the solution out of this web, thus: readiness to build strategic leadership, capacity building, and development of the adequate capacity to operate in a digital environment.

However, it appears that the construction industry in other countries has been able to find its way out of this slow adoption stigma. A study by Jung and Lee, (2015) established a disparate level of BIM adoption. The study shows that among the six continents – North America, Oceania, Europe, Asia, the Middle East/ Africa, and South America; Middle East/Africa and South America are still considered at the beginner's phase of adoption. Similarly, a more recent classification was done by Adekunle et al., (2021) when they classified the digital transformation in the construction industry globally. The study opined that the Nigerian construction industry is a "DT contemplator" regarding digital transformation.

This study was embarked upon to understand better BIM adoption focusing on the quantity surveying profession. This study provides an insight into the state of the quantity surveying profession in the 4IR. It provides a framework of achieving better information management through BIM adoption by the quantity surveyors via the following objectives:

- To investigate the perceived encumbrances to BIM adoption among quantity surveyors
- To proffer a solution to promote better information management among the Quantity surveying profession in the 4IR

Although there have been different studies on BIM adoption in the construction industry, a dearth exists in the professional perspective. This study is different and required in its methodological perspective and focus. Previous studies on BIM adoption in the Nigerian construction industry were achieved through a quantitative research approach. This study adopted the qualitative research approach (phenomenology) to investigate the root cause and profer solutions. Furthermore, previous studies focused on diverse professionals as the respondents. However, considering the importance of the Quantity surveying profession to the construction industry, this study is quantity surveying profession focused.

8. BIM Adoption in Nigeria

According to Olawumi and Chan, (2019), the first BIM education conference for construction professionals in Nigeria was in 2016. Unfortunately, the Nigerian construction industry is still struggling with BIM awareness years after. At this same period, other construction industries are developing frameworks, roadmaps and maturity models for BIM (Olawumi & Chan, 2019). These BIM leading countries are already reaping the benefits of adopting BIM. Searching literature for BIM studies in Nigeria, the focus has been mainly on factors affecting BIM awareness in Nigeria. Table 1 gives a record of BIM adoption-related studies carried out in the Nigeria Construction industry (NCI); these studies identified many barriers to BIM adoption in the Nigerian construction industry. The factors identified include lack of government support, cost issues, infrastructure, lack of awareness, lack of technical know-how, among others. It is interesting to note that many of these factors were derived through quantitative studies. The quantitative approach adopted is not wrong; however, it limits respondents to the options presented to them, thus providing a limited knowledge of the studied phenomena. Also, quantitative study is disadvantaged because it cannot go into depth about issues and subjects(Kumar, 2011). The previous quantitative studies identified the barriers to BIM adoption, including cost, 106nstandardized106, infrastructure deficiency, education, and training.

Consequently, this study was embarked upon to unearth the peculiar barriers to BIM adoption in developing countries from Quantity surveyors perspective using Nigeria as a case study. The study decided to adopt Quantity surveyors because the profession is needed on every construction project; it plays a central role in the construction process as its roles cannot be relegated. Consequently, Quantity surveyors interface with all professionals in the construction industry, thus possessing a well-rounded knowledge of the industry through association.

Table I: Barriers to BIM adoption in the Nigerian Construction Industry (NCI) from literature

Author	Findings
Ozorhon and Karahan, (2016)	standard platforms for integration and communication, cost of development, education and training, 106nstandardized106 (product and process), clear definition and understanding of users' requirement
Ibem *et al.*, (2018)	high level of awareness of BIM among architects in Lagos (common BIM software packages used are Autodesk Revit Architecture, AUTOCAD, and Google Sketchup.)
Olapade and Ekemode, (2018)	low level of awareness, low-level adoption of BIM for FM
Hamma-Adama, Kouider and Salman, (2018)	key players are generally not familiar with the term "Building Information Modelling" or "BIM" although mostly aware of some of its tools (i.e. AutoCAD, Revit, etc.), low level of using BIM tools, no legislative provision on BIM adopting or regulation, lack of experts on BIM
Ugochukwu, Akabogu and Okolie, (2015)	Poor knowledge of BIM application among professionals, Use of BIM in projects is non-existent, lack of BIM awareness

Ryal-Net and Kaduma, (2015)	low level of BIM knowledge, low level of awareness, low level of 107 nstandardi amongst stakeholders
Ezeokoli, Okoye and Nkeleme, (2016)	Structure/culture of the industry, Level of Knowledge and Awareness index, Availability of the appropriate Technology and Infrastructure, Individual/Personal Disposition
Akerele and Moses, (2016)	low level of awareness.
Onungwa and Uduma-Olugu, (2017)	lack of infrastructure, lack of skilled workers, lack of awareness, lack of support from leadership in the offices and lack of belief in the usefulness of the software.
Amuda-Yusuf *et al.*, (2017)	Clients' low level of awareness, lack of funding, poor power supply, legal uncertainty, lack of transparency.
Fadason, Danladi and Akut, (2018)	Lack of BIM education, Lack of Information on BIM, Lack of Investment in BIM Technology, Lack of Government Support through legislation, Lack of Standards to Guide Implementation, Lack of sufficient ICT Infrastructure
Abubakar *et al.*, (2014)	social and habitual resistance to change, legal and contractual constraints, High cost of integrated software, Lack of enabling environment (policies and legislations of government towards the adoption), lack of trained professionals
Mansur Hamma-Adama and Tahar Kouider, (2018)	Low level of BIM adoption, Reasonable level of awareness, lack of policy and guideline, serious lack of experts
Usman and Said, (2014)	Culture, policy, cost
Adekunle, Aigbavboa and Ejohwomu, (2020)	Transparency, infrastructure

2. Research Methodology

A phenomenological approach was adopted to understand better the BIM implementation among the quantity surveying professionals in the Nigerian construction industry. The phenomenological inquiry approach is adopted when uncovering meaning through respondents' experience is adopted. The results of the phenomenology approach in qualitative research is considered rich and detailed (Creswell, 2014). It is also believed to unearth the root cause of a challenge (Ebekozien et al., 2021). This study believes this approach will achieve the purpose of the study, which is to unearth the peculiar encumbrances and understand the BIM adoption dynamics among quantity surveyors. Firstly, an extensive study of literature on previous works about BIM barriers in the Nigerian construction industry highlighted the erstwhile established barriers. Afterwards, the study adopted a qualitative approach to investigate the peculiar barriers to BIM adoption in developing countries. This approach was adopted to provide a deeper knowledge through the experiences of those who have directly experienced the phenomenon under study (Castleberry & Nolen, 2018), in this case, the barriers to BIM in developing countries. Qualitative studies do not thrive on large sample size, unlike quantitative studies. According to Kumar, (2011), "the numbers of people you are going to contact depend upon the attainment of the data saturation point during the data collection process…which can provide you, as far as possible, with the detailed, accurate and complete information that you are looking for". To this end, there has been various discussion on the accepted number of respondents. Researchers have adopted different numbers of respondents in a qualitative study (Boddy, 2016; Dworkin, 2012; Hennink & Kaiser, 2022). These literature suggests that 5 to 50 respondents are adequate for a qualitative study. The most significant factor for selecting respondents is their depth of experience of the problem being studied and the concept of saturation. Adopting this method overcomes the drawbacks of willingness and the busy schedules of respondents to be available for interviews.

Therefore, six quantity surveyors were interviewed through purposive and snowball sampling. These two sampling methods were employed to choose qualified participants. Their suitability for this study was based upon their exposure in the Nigerian construction industry (size and nature of construction projects handled, among others).These respondents have experience on international projects and work with firms that support ICT with between 20 –30 employees. Their firms are also among the highest paying in the land; thus, it can be inferred that the firms' turnover is impressive. Respondents and their firms are always available and visible at the Quantity surveyors professional parent body (Nigerian Institute of Quantity Surveyors) events. This also indicates the firm's support for research and development. Lastly, all respondents were professionally 107nstandard members of the Quantity surveyors governing body in Nigeria: Nigerian Institute of Quantity Surveyors (NIQS).

This study employed virtual interviews due to the COVID-19 pandemic ravaging the world. This was adopted to overcome the associated challenges of getting an appointment and avoiding physical contact with correspondents. Also, to afford respondents flexibility: to respond at their convenience. This method also ensured the ease and accuracy of record-keeping on dialogues. Respondents were first contacted to request their audience and willingness. Those that signified their willingness were interviewed for the study.

Interview questions focused basically on assessing BIM awareness level in the construction industry, the encumbrances to BIM penetration among quantity surveyors, and the drivers to BIM adoption. The responses were collated and transcribed appropriately. The process of achieving a good analysis of qualitative data using thematic analysis was adopted according to (Castleberry & Nolen, 2018). They established five steps; they are: compiling (transcribing the data), disassembling (making meaning out of the data), reassembling (putting data into context for the study), interpreting (establishing themes) and concluding. The study discussed the results under two main themes categories. Questions were asked from respondents individually, and the validity was through logic. The analysis was carried out manually based on the main themes (Castleberry & Nolen, 2018; Kumar, 2011).

3. Results and Discussion

3.1 BIM awareness level of Quantity surveyors

Firstly, the study established the BIM awareness level in the construction industry. The respondents unanimously agreed that the BIM awareness level in the Nigerian construction industry is very low. Although a respondent mentioned an upsurge in inquiries; however the inquiries lack depth. Respondents opined that the awareness level must be improved to achieve a good implementation level in the Nigerian construction industry. Also, respondents were unanimous in stating that the industry has been working in isolation. Thus the efforts have been in silos, and the impact is not evident in the industry.

3.2 Encumbrances and drivers to BIM adoption by Quantity surveyors

The study's findings were 108 nstandardi and discussed under two focused themes: private stakeholders and government. This classification is from the perspective of the government and the governed. Under these themes, there exist many sub-themes and their interwoven relationships. A brief discussion of this classification is provided below:

Theme 1: *Private stakeholders*

It was established that people are currently clueless and working in isolation. The cluelessness, according to respondents, is implementation related in an environment void of infrastructures supporting BIM adoption. Furthermore, respondents' responses classified people as all construction professionals, clients, contractors, academia and professional bodies. Identified barriers among the people are ego, unhealthy rivalry and 108 nstandardized information-sharing protocols. Other challenges identified include rigidity (a respondent said: "all stakeholders fully decide to move away from the traditional ways of construction and embrace technology in its entirety". Another respondent said, "Learning is difficult for most people. Even with the availability of the software if the willingness to learn is not there then it becomes useless"), high cost of operations required, 108 nstandardized turnover and 108nstandardiz size, and cluelessness. It was reported that the cost management professionals are behind in the BIM implementation. A respondent stated that "Amongst the professionals, we have large disparity on knowledge about BIM. Architects / Engineers are far ahead of others because they are currently using some of the BIM tools"

Theme 2: *Government*

The respondents considered the government to be clueless at the moment regarding BIM implementation. This cluelessness is unrelated to the lack of awareness of the government. Good knowledge of the benefits of BIM to the economy and the effective delivery of infrastructural projects will be a good incentive for the government. However, most of the respondents opined that adequate knowledge of BIM would encourage the government to provide an enabling environment that makes BIM implementation cheaper and affordable for stakeholders. Most of the Respondents stated that government policy and legislation are required to implement BIM fully. Others advocated for a collaborative front between the government and other stakeholders for the BIM implementation drive. The government has been advocated for as the major stakeholder based on the success recorded in the UK driven by government policies.

Table II: Summary of peculiar barriers

Stakeholders	Peculiar barriers	Common barriers
Consulting professionals	Ego, unhealthy rivalry, 108nstandardiz turnover/size, high cost of operation, unreliable information sharing, 108nstandardized operation procedure, the rigidity of professionals	Rigidity, 108 nstandardiz turnover/size, high cost of operation
Client	Organisation turnover	
Academic	Overhaul of the existing syllabus to incorporate BIM education	
Contracting 108nstandardiz	Organisation turnover/size, the rigidity of contracting 108nstandardiz, high cost of operation	
Professional bodies/ other stakeholders	Rigidity	

Table III: Peculiar broad challenge to adoption

Identified drivers	Identified common challenge
Government Private stakeholders	Cluelessness, lack of awareness, isolated efforts

The identified drivers by respondents are government and other private stakeholders (professional bodies, academia, contracting 109nstandardiz, consulting professionals, among others) in the industry. However, the identified common challenges include cluelessness, lack of awareness and isolated efforts. Thus, collaboration is the solution to overcoming the challenges of BIM adoption in the industry. Stakeholders and the government must present a concerted effort to overcome the difficulties identified in the industry. However, professional bodies across all construction professions need to intensify awareness campaigns and educate the government. Academia should provide roadmaps through research to fully adopt BIM in the Nigerian construction industry. This will solve the challenge of cluelessness and lack of awareness in the industry. Table IV provides the solution to other challenges confronting the Nigerian construction industry.

Table IV: Solution to peculiar challenges

Themes	Solution
Ego/ Unhealthy rivalry	The traditional fragmented approach in projects and the drive to gain competitive advantage among professionals and firms must have given birth to this. Ego and unhealthy rivalry breed mistrust, a barrier to collaboration. The readiness of stakeholders to jettison with perceived differences and operate healthy collaboration is essential to adopting BIM.
Organisation turnover/size; High cost of operation	The earning strength determines the purchasing power of businesses. Adoption hasn't been possible due to the inability of stakeholders to fund the high cost of BIM tools and infrastructures, staff training, and low financial turnover. Stakeholders stand to gain a massive return on investment as BIM offers value, competitive advantage, and efficiency, making them earn more than the investment cost.
Unreliable information sharing	Poor record-keeping was identified as the major cause. Stakeholders are to keep accurate information as BIM thrives on the accuracy of shared information. Meticulous records keeping of project information is essential
Unstandardised operation procedure	There should be a 109nstandardiz operational procedure among consulting organisations. This will aid information accuracy. Also, it will provide 109 nstandardiz, common and formal information keeping procedure.
Rigidity of professionals	Professionals are observed not to be flexible and receptive to change. Many are still holding on to the traditional approach; some are not ready to learn new software. Professionals should change their mindset and attitude towards adopting recent technological trends and developing international standards responsible for achieving a competitive edge.
Overhaul of the existing syllabus	Respondents opined that the current academic syllabus is outdated compared to the technological revolution presently being experienced. Thus, the current syllabus is to be overhauled and restructured to incorporate BIM education

Conclusion

The study investigated the dynamics involved in BIM adoption in developing countries using the Nigerian construction industry as a case study. The study observed a not too encouraging level of awareness and cluelessness among the Nigerian Construction Industry (NCI) stakeholders. This is the main barrier to implementing BIM in the Nigerian Construction Industry (NCI); hence it is not surprising to observe a very low level of readiness to implement BIM in the industry due to the current awareness level. Also, it was established that there exist rigidity and unwillingness to learn among professionals. They are unwilling to move with technological advancement. The study also observed some peculiar challenges among professionals in the Nigerian Construction Industry (NCI), including the isolated nature of efforts among professionals, ego/unhealthy rivalry, and 109 nstandardized work protocol/unreliable information transmission.

Consequently, for full BIM implementation in the Nigerian Construction Industry (NCI), the study recommends the need for the government and every stakeholder in the industry to collaborate and drive BIM implementation. The existing isolated pockets of efforts should be collapsed to achieve a concerted drive for better results. Willingness to learn among professionals and the discontinuation of the traditional ways of doing things is also encouraged. Also, it revealed that professionals in the industry have more to do to help the industry overcome its awareness and cluelessness challenges. The study has built on previous studies and thus provided a comprehensive

knowledge of the Nigerian Construction Industry (NCI) adoption dynamics, thus providing a better perspective to Building Information Modeling adoption.

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