ASSESSING THE LEVEL OF READINESS TO ADOPT BUILDING INFORMATION MODELLING (BIM) AMONGST BUILT ENVIRONMENT PROFESSIONALS IN SELECTED NORTHERN NIGERIAN STATES

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ABSTRACT

Globally, the adoption of BIM by building professionals has tremendously increased over the last decade owing to the many benefits it provides in construction projects such as improved productivity, reduction of rework, reduction of conflict amongst building professionals and saving of funds. In spite of these benefits, in the Nigerian context, the adoption of BIM amongst built environment professional is still very low. Thus, this study assesses the level of readiness of building professionals in using BIM by exploring the factors guiding the acceptance of new technologies; awareness, performance expectancy, effort expectancy, social influence and facilitating conditions with the view to encourage BIM adoption. The objective of the study was achieved by conducting in-depth interviews with 36 building professionals in Niger state, Abuja and Kaduna. This study discovered that the Nigerian building professionals are nowhere near ready to adopting Building Information Modelling (BIM) and there is a dire need for Nigerian buildings professionals to restore their good name and regain their sense of professional pride in providing the highest quality buildings and structures.

Keywords: *Built environment, Building Information Modelling, Building Professional, Effectiveness, Efficiency*

1 INTRODUCTION

Shelter is considered a fundamental human right for the over six billion human beings living in the world today (Franz *et al.*, 2015; Mukhtar *et al.*, 2016; Seneviratne *et al.*, 2017). Building professionals have the honour and privilege of participating directly in the provision of this great societal need, as well as other vital building infrastructure such as hospitals, schools, and office complexes (Chou *et al.*, 2015; Jallow *et al.*, 2017). Unfortunately as of 2015, over 1.6 billion people worldwide did not possess adequate housing (Homeless World Cup Foundation, 2019), which means that building professionals have a lot of work to do in fulfilling their crucial mandate.

Leeds (2016) argued that there are two major challenges hampering the ability of the global construction industry to provide quality and much-needed housing and infrastructure projects: project performance and sustainability concerns. Project performance refers to the seeming inability of construction firms to finish projects on time and within budget, with an Accenture study showing that only 30% of large projects are completed within budget, and only 15% are completed on time (Leeds, 2016). Additionally, a 2015 KPMG survey revealed that half of all construction firms globally reported at least one underperforming project in the previous year (Leeds, 2016). As for the issue of sustainability, the global construction industry is responsible for about 40% of carbon emissions yearly, and this is dangerous for the environment (Leeds, 2016). It is thus incumbent for the global construction industry to become more efficient and effective in the way it estimates and uses needed building materials (Leeds, 2016).

Based on this backdrop, it is reasonable to assume that any innovation that can improve the effectiveness and efficiency through which buildings are designed and constructed would be welcomed with all interest by building professionals (Fedoruk *et al.*, 2015; Hossain, 2017). This is where the concept of Building Information Modelling (BIM) comes into play.

There are over thirty definitions of BIM that have been propounded in the construction literature (Matejka & Tomek, 2017; Zhang *et al.*, 2017). However, a critical examination of these definitions revealed that BIM has been conceptualized as one of three categories; a technology, a method or a methodology (Matejka & Tomek, 2017). For the purpose of this study, BIM is considered a digital technology following the example of The National Building Information Model Standard Project Committee in the USA who defined BIM as "a digital representation of the physical and functional characteristics of a facility. It is a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle; defined as existing from earliest conception to demolition" (Zhang *et al.*, 2017).

Building professionals and experts around the globe who have utilized BIM have proclaimed several benefits it has provided regarding increased efficiencies and effectiveness: It reduces rework (Li *et al.*, 2017; Teo Ai Lin *et al.*, 2017); It improves productivity (Atazadeh *et al.*, 2017; Nguyen & Hadikusumo, 2017); It reduces conflict amongst the building professionals (Chen & Luo, 2014; Forsythe *et al.*, 2015), and it saves time and money (Gheisari & Irizarry, 2016; Chong *et al.*, 2017). It is in recognition of these benefits that countries like Australia (Bridge & Carnemolla, 2014), Denmark (Kim & Kim, 2009), Finland (Tulenheimo, 2015), Russia (Chernykh & Yakushev, 2014), the autonomous territory of Hong Kong (Pan *et al.*, 2017), Singapore (Ho & Rajabifard, 2016), South Korea (Won *et al.*, 2016), Sweden (Hooper, 2015), the UAE (Mehran, 2016), the UK (Gledson & Greenwood, 2016) and the US (Shelbourn *et al.*, 2017) have mandated the adoption of BIM by building professionals for public sector construction.

According to the Unified Theory of Acceptance and Use of Technology (UTAUT), the adoption of any new technology by a professional is dependent on four factors: The degree to which the professional believes the new technology will improve his or her performance (performance expectancy), how easy the professional feels the technology will be to use (effort expectancy), other experts' opinions about the importance of using the technology (social influence), and the degree to which the professional believes that the necessary infrastructure exists to support the use of the new technology (facilitating conditions) (Urpelainen & Yoon, 2017; Aklin *et al.*, 2018; Tanner *et al.*, 2018). However, an important pre-requisite to these four factors is that the professional first be aware of the existence of the new technology (Elmustapha *et al.*, 2018). There are thus five factors that need to be in place before a professional will adopt a new technology: Awareness; Performance expectancy; Effort expectancy; Social influence, and Facilitating conditions.

With the above critical factors in place and favorable, the building professionals' chances of BIM adoption may likely increase. As it relates to BIM adoption by building professionals, for those countries described in an earlier paragraph where BIM has been mandated for public sector construction, it is no surprise to see that the adoption of BIM by building professionals has significantly increased over the last few years. For example, the percentage of building companies in North America that adopted BIM in 2007 was 28%; this more than doubled to 49% in 2009 and then leapt to 71% in 2012 (Quirk, 2012). A contributing factor for this rapid increase in BIM adoption by building professionals in these countries is the fact that BIM adoption has been mandated (Succar & Kassem, 2015). For building professionals in these countries interested in partaking in lucrative public sector construction contracts, the adoption and effective utilisation of BIM becomes a necessity (Arunkumar *et al.*, 2018; Liao & Ai Lin Teo, 2018). Additionally, once these professionals have taken the time, effort and resources to integrate BIM into their processes, it becomes logical that they will transfer this technology into their private construction projects as well (Jung & Lee, 2015; Singh & Holmstrom, 2015; Howard *et al.*, 2017).

However for countries like Nigeria where BIM adoption has not been mandated, there is no extrinsic factor to encourage building professionals to invest the time and resources necessary to effectively adopt BIM. In order for Nigerian construction professionals and other building professionals in other countries where BIM adoption is not mandated to reap the many benefits of BIM usage in construction projects, the motivation to adopt must be intrinsic; each professional must be aware, willing and able to integrate BIM into existing building strategies (Chang & Howard, 2014; Juan *et al.*, 2017). There can be no denying that widespread BIM adoption by Nigerian building professionals would dramatically improve the efficiency and effectiveness of the building construction processes (Wang *et al.*, 2015; Ezeokoli *et al.*, 2016). It thus becomes important that Nigerian building professionals' level of readiness to adopt BIM be ascertained in order to improve the efficiency of the industry and reduce or eliminate most of the challenges confronting the industry, and that is the ultimate aim of this study.

2. Literature Review

The National Building Information Model Standard Project Committee in the USA defines BIM as "a digital representation of the physical and functional characteristics of a facility. It is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life cycle; defined as existing from earliest conception to demolition" (Zhang *et al.*, 2017). Over the last decade, several studies have explored the BIM adoption process in various contexts (Gu & London, 2010; Mom *et al.*, 2014; Chen *et al.*, 2017), from three major perspectives: the micro level; the meso level, and; the macro level. This review describes these three conceptualizations of BIM adoption, and discusses how BIM adoption is conceptualized in this study given the Nigerian context.

Studies that conceptualized BIM adoption from a macro perspective sought to determine to what extent BIM had been adopted by a specific building industry (Hossein *et al.*, 2015; Kim *et al.*, 2016; Gokuc & Arditi, 2017), by an entire country across several industries (Chen *et al.*, 2017; Herr & Fisher, 2017; Hore *et al.*, 2017) or across several countries (Jung & Lee, 2015; Chong *et al.*, 2016; Kassem & Succar, 2017). The objective of these studies was to provide a holistic assessment of how much BIM usage had diffused across the building industry and beyond (Walasek & Barszcz, 2017).

As for studies that adopted a meso perspective of BIM adoption, their objective was to understand BIM adoption from an organizational point of view (Gledson, 2016; Gurevich *et al.*, 2017; Monko *et al.*, 2017). Simply put, they adopted case studies of specific firms (Linderoth, 2010; Arayici *et al.*, 2011; Ahuja *et al.*, 2016) or surveyed a number of organizations from the same industry (Rogers *et al.*, 2015; Edirisinghe *et al.*, 2016; Khodeir & Ness, 2017) in order to understand the various factors affecting BIM adoption in those firms.

Finally, representing the distinct minority of studies reviewed, were those that conceptualized BIM adoption from a micro perspective by attempting to understand BIM adoption from the point of view of individual building professionals (Ding *et al.*, 2015; Singh & Holmstrom, 2015; Addy *et al.*, 2017). It is no surprise that the vast majority of studies reviewed either adopted a macro or meso perspective to understanding BIM adoption. This is because most of this studies were carried out in developed nations such as the US (Gokuc & Arditi, 2017), UK (Gledson & Greenwood, 2017) and Australia (Chong *et al.*, 2016) where BIM is no longer a new phenomenon. There is thus no need to understand BIM adoption from an individual building professional's perspective because it has already become a standard part of building practice (Loveday *et al.*, 2016). This is further buttressed by the fact that BIM adoption is mandated for a lot of public construction in these countries (Chen *et al.*, 2017).

However, for developing countries like Nigeria, where this current study took place, BIM is not a widespread phenomenon (Wang *et al.*, 2015; Ezeokoli *et al.*, 2016). BIM use is not mandated nor has it diffused sufficiently amongst Nigerian building professionals to warrant conceptualizing BIM adoption from a macro or meso perspective. It is for these reasons that this study conceptualized BIM adoption from the point of view of the individual Nigerian building professional. It is only once the readiness of these individual building professionals to adopt BIM are ascertained, and the obstacles hindering their adoption of BIM are identified and resolved that diffusion of BIM can really take place. It is hoped that the findings of this study will be an important first step towards widespread diffusion of BIM usage amongst building professionals in Nigeria, which hopefully will lead to dramatic improvements in how buildings are built and maintained in this country.

3. Theoretical Framework

The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed in 2003 by American-based scholars, Viswanath Venkatesh, Michael Morris, Gordon Davis and Fred Davis. The theory states that there are four key constructs that influence new technology adoption: 1) Performance expectancy, 2) Effort expectancy, 3) Social influence, and 4) Facilitating conditions. Addy *et al.* (2017) utilized the constructs of UTAUT to study the factors that facilitated BIM adoption amongst quantity surveyors in Ghana.

Ten theories were discussed that served as the 'population' of theories from which one would be selected. As BIM was defined as a technology in this study, only theories that specifically addressed new technology adoption were considered appropriate for this study, rather than theories that addressed general behavioural concepts. This led to the elimination of six of the ten theories as potential theories for this study (TRA, TPB, ANT, CLT, CST and MHN). This left four theories as contenders for adoption by this study (TAM, TOE theory, UTAUT and DOI).

In order to select the most suitable theory from the four remaining theories, the Japanese management concept of "kaizen" was adopted (Cannas *et al.*, 2018). "Kaizen" means continuous improvement, and the concept was utilized in selecting a theory for this study by considering which of the four theories had made the most improvements after learning from the criticisms of prior technology-adoption theories. DOI was developed in 1962, TAM was developed in 1989, while TOE theory was developed in 1990. On the other hand, UTAUT was developed much later in 2003 and critically considered the drawbacks of the other three earlier theories (Li *et al.*, 2018). UTAUT could thus be considered the latest and 'most improved' theory of technology adoption, and thus UTAUT was selected as the most appropriate theory for this study.

UTAUT served as the foundation for this study's theoretical framework. To reiterate, UTAUT posits that technology adoption is influenced by four factors: 1) Performance expectancy, 2) Effort expectancy, 3) Social influence, and 4) Facilitating conditions (Addy *et al.*, 2017).

A critical examination of these four factors reveals that UTAUT makes an assumption that the individual is “aware” that the technology exists. This is because awareness of the technology is an obvious pre-requisite before an individual can have any perception as to how effective and easy the technology can potentially be (Elmustapha *et al.*, 2018). As alluded to by Wang *et al.* (2015), this assumption of awareness cannot be taken for granted as regards BIM adoption amongst Nigerian building professionals. For this reason, this study adds “awareness” as a fifth factor in exploring the level of readiness to adopt BIM amongst building professionals in Niger State, Abuja and Kaduna State. Therefore a modified version of the unified theory of acceptance and use of technology (UTAUT) was adopted to understand the factors that would help the researcher investigate how ready building professionals in Niger state, Abuja and Kaduna state are to adopt BIM. These factors were: 1) Awareness of BIM, 2) Performance expectancy, 3) Effort expectancy, 4) Social influence, and 5) Facilitating conditions. Interview questions had to be developed to measure each factor, and for this reason a semi-structured interview approach was adopted guided by these five factors. The following subsections describe the question-development process and the pilot-test procedure to reinforce the validity and reliability of the questions developed.

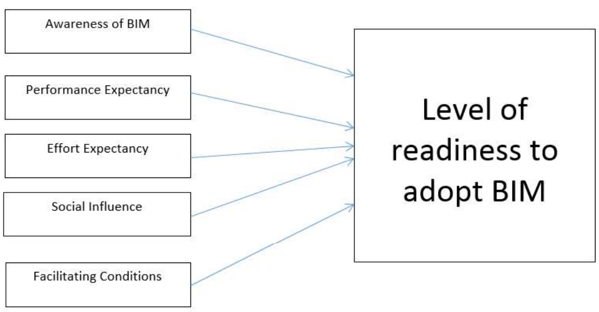

Figure 1: Theoretical Framework to explore BIM adoption amongst building professionals in Niger state, Kaduna state and Abuja.

4. Research Methodology

This study adopted an exploratory and qualitative research design rather than a confirmatory research design due to the fact that as far as the researchers are aware, this was the first study to investigate BIM readiness amongst Nigerian building professionals in Niger state, Abuja and Kaduna state. The researchers thus had no expectations which the study could confirm, rather the objective was to explore and discover how ready building professionals in Niger state, Abuja and Kaduna state were to adopt BIM.

Similarly, a qualitative research paradigm was adopted rather than a quantitative approach because the use of semi-structured interviews enabled the researchers to dig deep into the mind-set of the selected building professionals as to their awareness of BIM, their performance and effort expectancies towards BIM usage, as well as their perception regarding whether or not the facilitating conditions existed in this region for BIM to be fully implemented (La Marca, 2011; Trott, 2012).

The population for this study were represented by quantity surveyors, architects, builders and civil engineers registered with their respective professional bodies practicing in Niger state, Abuja and Kaduna. Being registered with a professional body was important because this accreditation serves as stamp of approval regarding the credibility and competence of the building professional. Getting the exact number of registered building professionals in these three regions proved abortive as the professional bodies informed the researcher that membership was not categorized by location. Additionally, there was reluctance on the part of these bodies to reveal the entire number of registered building professionals in the entire country. These two reasons prevented the researcher from obtaining the actual population size for this study. This serves as a limitation of this study.

Marshal *et al.* (2013) stated that when it comes to determining an ideal sample size of the population to study, there is a distinct difference between quantitative and qualitative studies. Elliot *et al.*, (2018) reiterated that for quantitative studies, the main concern is ensuring that the sample is representative of the entire population. For qualitative studies like this current study however, the main concern is achieving saturation (Buckley, 2018).

Because of the in-depth interviews utilized in this current study, saturation is reached when interviewing one more building professional will not provide any additional information to the study (Guest *et al.*, 2017). Further, this helps answers the question, ‘What is the ideal number of in-depth interviews to conduct?’ (Guest *et al.*, 2017). Although according to Bolkvadze (2017), there is no scholarly consensus on what this ideal number of interviews, Wong-Parodi and De Bruin (2017), Kosonen and Kim (2018) and Weller *et al.* (2018) however reported that majority of scholars suggest between 10-15 interviews is usually ideal. In this study, there are four categories of building professionals represented: quantity surveyors, architects, builders and civil engineers. The professionals are spread across three regions: Niger state, Abuja and Kaduna state. For this reason, the researchers’ objective was to ensure that each professional category was equally represented in each of the three regions whilst making sure that the upper saturation limit of 15 interviews (Weller *et al.*, 2018) was at least attained. The table below shows how these two objectives were achieved.

Table 1: Building professionals interviewed by region

		Location	
Building Professional	**Niger State**	**Abuja**	**Kaduna State**
Quantity surveyor	3	3	3
Architect	3	3	3
Builder	3	3	3
Civil Engineer	3	3	3
Sub-Total	12	12	12
Total		**36**	

In order to mitigate the problem of interviewees giving socially-desirable answers regarding their awareness of BIM, the researchers decided to follow the suggestion of Tucker and Parker (2018) by using audio-visual aids to measure awareness rather than asking the interviewees directly. Specifically for this study, a short three-minute video introducing and showcasing the uses of BIM was downloaded. The table below shows the final set of interview questions used for the actual study to determine how ready BIM professionals in Abuja, Niger state and Kaduna state are to adopt BIM. It also depicts the interview administration process:

Table 2: Final interview questions and administration process

S/N	Factor	Interview Questions
1.	Awareness	1. Are you aware of BIM? 2. [If yes]: Can you explain your understanding of it? Show video after answer. 3. [if no]: Show video immediately
	Filler question to aid interview flow	1. What do you think of the video you have just seen?
2.	Performance expectancy	1. How has BIM improved your effectiveness and efficiency? (those already using BIM) 2. How do you think BIM could improve your effectiveness and efficiency? (those not using BIM)
3.	Effort expectancy	1. How easy was it to implement BIM? (those who have already implemented) 2. How easy do you think it will be to implement BIM? (those who have yet to implement BIM)
4.	Social Influence	1. Does your professional body encourage the use of BIM? 2. [if yes], how?
5.	Facilitating conditions	1. Do you have the necessary resources (expertise, technology, funding) to effectively implement BIM?

5. Results and Discussions

5.1 Demographic characteristics of participants

The table below presents the demographic characteristics of the 36 building professionals interviewed for this study. It includes their gender, age groups, level of professional experience, academic qualifications and the professional bodies they belong to.

Table 3: Demographic characteristics of participants

Demographics		Niger state n = 12					Abuja n = 12					Kaduna state n = 12					Overall Total N = 36
		A	B	C	Q	**T**	A	B	C	Q	**T**	A	B	C	Q	**T**	
Gender	Male	3	3	3	3	**12**	2	3	2	3	**10**	2	3	3	3	**11**	**33 (92%)**
	Female	0	0	0	0	**0**	1	0	1	0	**2**	1	0	0	0	**1**	**3 (8%)**
Age	20-29	0	0	0	0	**0**	0	0	1	0	**1**	1	0	2	0	**3**	**4 (11%)**
	30-39	2	1	2	0	**5**	2	2	1	1	**6**	2	2	1	3	**8**	**19 (53%)**
	40-49	1	2	1	3	**7**	1	0	1	2	**4**	0	1	0	0	**1**	**12 (33%)**
	>=50	0	0	0	0	**0**	0	1	0	0	**1**	0	0	0	0	**0**	**1 (3%)**
Experience	<5year	0	0	0	0	**0**	0	1	1	0	**2**	2	1	2	0	**5**	**7 (19%)**
	5-10 years	2	0	2	1	**5**	2	1	0	1	**4**	0	1	0	3	**4**	**13 (36%)**
	11-20 years	1	2	1	2	**6**	1	0	1	2	**4**	1	0	1	0	**2**	**12 (33%)**
	>20 years	0	1	0	0	**1**	0	1	1	0	**2**	0	1	0	0	**1**	**4 (12%)**
Acad. Quals.	HND/Diploma	0	0	0	0	**0**	1	0	0	0	**1**	0	0	0	0	**0**	**1 (3%)**
	First Degree	0	3	1	0	**4**	1	3	1	3	**8**	0	2	2	0	**4**	**16 (44%)**
	Masters	3	0	2	3	**8**	1	0	2	0	**3**	3	1	1	3	**8**	**19 (53%)**
	PhD	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	**0 (0%)**
Prof. Body	NIA	2	0	0	0	**2**	2	0	0	0	**2**	2	0	0	0	**2**	**6**
	ARCON	1	0	0	0	**1**	1	0	0	0	**1**	1	0	0	0	**1**	**3**
	NIQS	0	0	0	2	**2**	0	0	0	2	**2**	0	0	0	3	**3**	**7**
	QSRBN	0	0	0	1	**1**	0	0	0	1	**1**	0	0	0	0	**0**	**2**
	COREN	0	0	3	0	**3**	0	0	0	0	**0**	0	0	2	0	**2**	**5**
	CORBON	0	3	0	0	**3**	0	3	0	0	**3**	0	1	0	0	**1**	**7**
	NSE	0	0	0	0	**0**	0	0	3	0	**3**	0	0	1	0	**1**	**4**
	NIB	0	0	0	0	**0**	0	0	0	0	**0**	0	2	0	0	**2**	**2**

5.2 BIM Awareness

The table below shows the level of BIM awareness amongst the 36 building professionals interviewed for this study. Other subsections of the study discussed BIM awareness by location, BIM awareness by profession, and overall BIM awareness as well as all the other factors explored guiding the acceptance of new technologies; performance expectancy, effort expectancy, social influence and facilitating conditions

Table 4: BIM awareness amongst building professionals in Niger state, Abuja and Kaduna state.

	Niger State		Abuja		Kaduna State		Total	
	Aware	Not aware	Aware	Not aware	Aware	Not aware	**Aware**	**Not aware**
Architects	3	0	2	1	2	1	7 (78%)	2 (22%)
Builders	1	2	1	2	0	3	2 (22%)	7 (78%)
Civil Engineers	1	2	0	3	1	2	2 (22%)	7 (78%)
Quantity Surveyors	0	3	1	2	3	0	4 (44%)	5 (56%)
Total	5 (42%)	7 (58%)	4 (33%)	8 (67%)	6 (50%)	6 (50%)	**15 (42%)**	**21 (58%)**

5.3 Summary of Findings

Table 5: Summary of the study

S/N	Objective	Findings
1.	BIM Awareness	Only 42% of building professionals were aware of BIM.
2.	BIM Performance Expectancy	100% of building professionals felt adopting BIM would enhance their efficiency and effectiveness.
3.	BIM Effort expectancy	Only 44% of building professionals felt that integrating BIM into their existing practices would be easy.
4.	BIM Social Influence	Only 42% of building professionals felt that their professional bodies encouraged the use of BIM.
5.	BIM Facilitating Conditions	Only 19% of building professionals believed their organizations had the necessary resources to successfully implement BIM.
	Conclusion	**Building professionals in Niger state, Abuja and Kaduna state are not close to being ready to adopt BIM in the foreseeable future.**

4. Conclusion and Recommendations

4.1 Conclusion

TheNigerian building professionals needs to be willing and able to adopt new technologies like BIM in order to drastically harmonize and improve performance as well as project delivery of construction works in the country.There is a dire need for Nigerian buildings professionals to restore their good name and regain their sense of professional pride in providing the highest quality buildings and structures that will keep people and property safe. An important first step in restoring their standing as the providers of the fundamental human right of shelter is to embrace technologies like BIM that will enhance their effectiveness and efficiency. It is hoped that this study will help galvanize the Nigerian building profession to seek greatness once again.

4.2 Recommendations

There is a need for the building professionals in Nigeria to be more aware of technologies that can help propel the practice of the building profession such as Building Information Modelling (BIM) amongst other important issues .As it relates to the curriculum developers, junior and secondary schools in Nigeria should be a point of focus by targeting subjects that are baselines subjects to courses of Engineering/Environmental technology. One of such subjects in focus should be “construction technology”. Identified subjects such as construction technology should be taught digitally rather than through the traditional use of the drawing board. This will afford the students to better understand the concept of BIM early on. Curriculum developers at states and federal levels should set up at least one (1) standard computer lab with no less than ten (10) computers, a power back-up system (inverter) with solar panels in all government owned junior and secondary schools through Universal Basic Education **(UBE)** funding with counterpart support funding from the state

government. Secondary schools teachers, who are to teach the identified subjects digitally, should be trained and retrained by the government through **UBE** or other sources as deemed appropriate by states governments. At the tertiary institution level, courses that are crucial for the adoption of **BIM** in the construction industry such as construction technology, engineering design and architectural courses should be pre-requisites taught with relevant software at different levels in the universities or tertiary institutions in construction related disciplines. This will help the students see the existing linkages and relevance of the use of BIM and collaborating with other construction professionals in the construction industry.

As it relates the professional bodies for building professionals, the study’s results showed that many of the building professionals felt that these organizations did not do enough to encourage the adoption of such innovations and technologies like BIM. Besides merely discussing in seminars and workshops, professional bodies such as ARCON, NIA, NIQS, RQSBN, COREN, ESTABORN etc. should enforce the use of **BIM** through regulations of their members and memberships in the industry. If admission into these bodies is dependent on BIM implementation, it will ensure that building professionals are strongly encouraged to adopt such new technologies which will improve the efficiency and effectiveness of the entire industry. An additional step these professional bodies can take is to draft a bill for the national assembly seeking a law mandating the adoption and use of BIM by the construction industry professionals from the design stage through implementation and handover of a construction project of a defined magnitude or complexity.

Finally, NIA had done a good job establishing an agreement with AutoDesk whereby their members can purchase BIM related software at a discounted rate. Other professional bodies can follow their examples and establish similar partnerships with manufacturers of BIM software. These partnerships can be expanded to include BIM trainings and even internships for Nigerian building professionals.

A crucial stakeholder for the advancement of the Nigerian building industry through the adoption of innovative technologies like BIM is the Nigerian government. The reality is that for BIM to be effectively integrated and utilized by building professionals, there are certain basic infrastructure such as stable electricity and high-speed internet that are a must-have. Until and unless the government is able to establish such basic, but crucially important, infrastructure, widespread BIM adoption in the Nigerian building industry might remain an unattainable dream. Other policies the government can enact include the encouragement of the development of innovative building software by local Nigerian software developers and making it mandatory for Nigerian building professionals to utilize such locally-developed software when bidding for government building projects.

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