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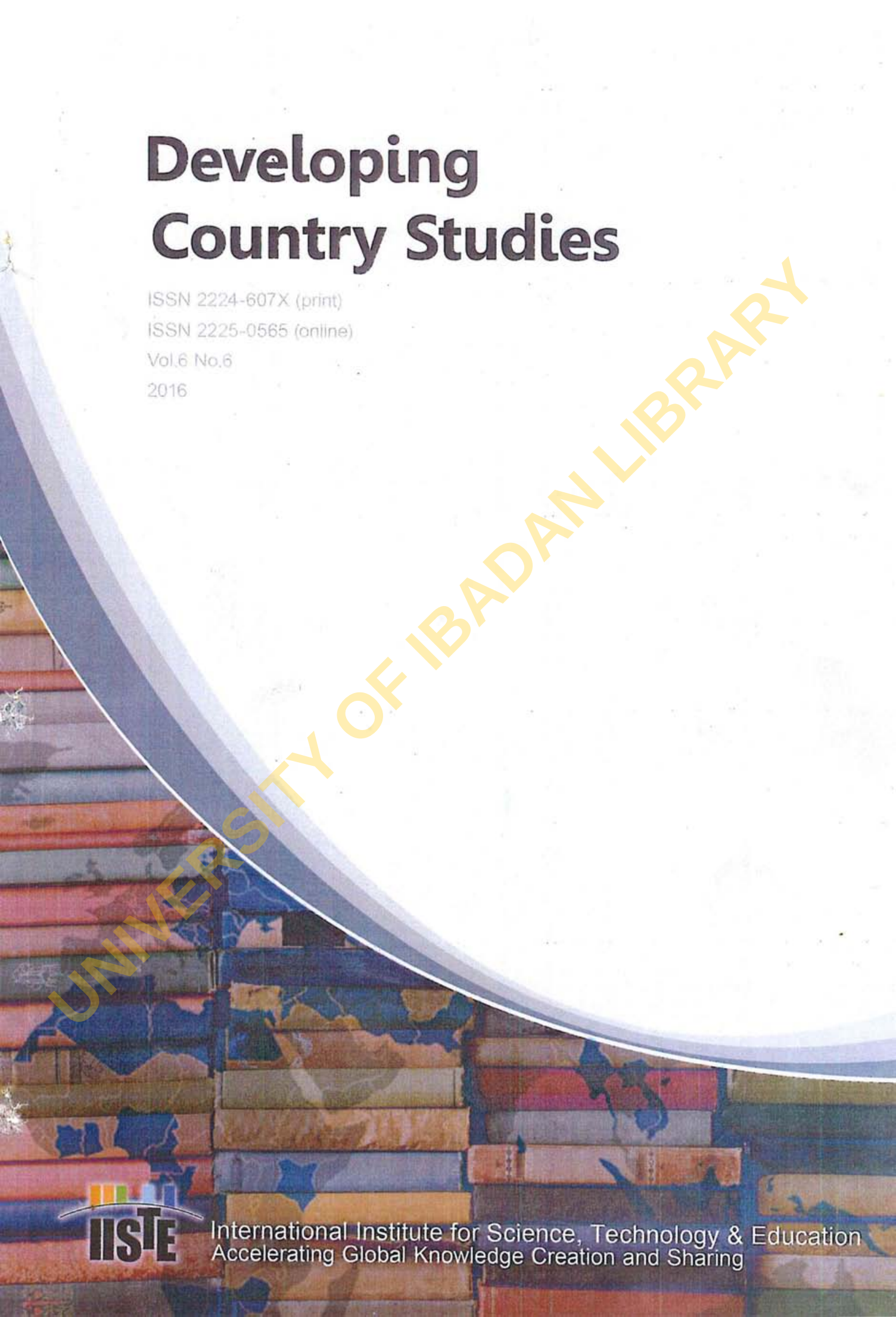

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Exploring New Directions for the Transformation of the Built Environment in Nigeria: The Role of Building Information Modeling

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Abstract

Building Information Modelling (BIM) offers an alternative and better method of handling information for integrated project delivery approach to that of the traditional fragmented method of collaboration in the built environment. This paper is aimed at assessing the awareness and the prospects of adopting BIM in the professional Architectural practices in Nigeria using Akure as a case study. The rate of urbanisation and transformation of the built environment in the face of globalisation, calls for a new direction in the processing and handling of building information. This is particularly necessary as the current business model is inadequate for maximum productivity. The field investigation focused on determining the current business model of selected Architectural practice as well as assessing their awareness of Building Information Modelling and whether or not professionals are going to adopt it soon. The findings showed that the method of collaboration among professionals remain fragmented, the use of 3D software and even BIM software is limited to just 3D visualization and plan details. The study revealed that despite a good number of respondents already conscious of the benefit of using a BIM tool; their overall approach to project delivery remains fragmented. Awareness of the concept of BIM was a little above average among respondents but BIM implementation in professional practice is very low. It was discovered that challenges faced by respondents in the adoption of BIM is predicated on the attitudinal disposition of other professionals with whom they work and exchange building information with. These professionals do not work with BIM and coupled with inadequate knowledge of staff in the adoption of BIM workflow. The paper concluded that Building Information Modelling (BIM) has greater advantage than the existing traditional practice involving 2D drafting. BIM also has the inherent ability to foster integrated project delivery by creating a common platform for all professionals to work simultaneously on a project thereby minimising costly design and construction errors.

Keywords: Architectural practices, Building Information Modelling (BIM), collaboration, construction, urban transformations.

1. Introduction

The huge possibilities offered by BIM are not harnessed by many firms in the AEC industry especially those in Akure. Most firms still use the traditional CAD such as AutoCAD for their entire design process. Many tasks which are error prone like schedule and material quantity take off still have to be done manually. And as we all know, the process of design is iterative, changes made in any part of the design at any time will have to be manually reflected in all views/drawings affected by that change, there is no central database for the building project in which all professionals can add or retrieve building information without having to effect the changes in other related or dependent views/drawings. Thus, professionals do work fragmentally, i.e. the architect completes his designs without consulting with other professionals, and he hands over copies of the design to them to add their different information, these consultants otherwise works with the Architect's drawings separately without considering how their information clashes with that of the other consultants involved in the project. This method of working results in inadequate collaboration and poor teamwork between the stakeholders in the sector leading to possibilities of costly construction errors.

In order to foster productivity and integrated project delivery in architectural practice, investigation was conducted in the study area to assess the awareness of and the prospect of adoption of Building Information Modelling (BIM) in the workflow of design and construction of building for urban transformation. Current method of collaboration among professional were examined and the level of awareness of BIM as a collaborative tool was appraised to facilitate efficient project delivery in terms of design, management and construction of

project to meet the time frame and cost limit set by clients.

1.1 Methodology

Assessing the level of awareness of the concept of Building Information Modelling (BIM) and it inherent potentials amongst the professionals operating in the architecture, engineering, and construction (AEC) industry in Akure, Nigeria is the focus of this study. It evaluates the current method of collaboration among professional in this sector, it then analyse in-depth how this powerful workflow method can be used to improve efficiency and reduce costly design and construction errors in construction projects in Akure. The methodological approach towards this study include the theoretical framing of the research problem and collection of data involving field investigation focused on determining the current business model of selected Architectural practice as well as assessing their awareness of Building Information Modelling and whether or not professionals are going to adopt it soon. As part of the field investigation, 70 questionnaires are administered and 51 questionnaires were returned, to gather needed information from firms and companies engaged with architectural practice in Akure, Nigeria. Where possible, interview were conducted with the CEO of each company using the "snowball sampling principles" as put forward in Bijker's (1997) concept of "following the actor". This is with a view to collect the needed data about the awareness of Building Information Modelling (BIM) and the general method of collaboration among professionals in the Architectural, Engineering and Construction (AEC) sector for appropriate analysis. In addition, some selected software supporting the BIM workflow was reviewed to get information on how they fare in project delivery.

2. Literature Review

Buildings are becoming more complicated to build. They are taking more resources to construct and operate, and this translates to the increasing lifecycle cost for a building. As these costs and complexities escalate, we are flooded with more information and data to manage about the building (Krygiel and Bradley, 2008; Abanda, Vidalakis,, Oti, and Tah.,2015). Keeping up with trends like this requires better methods of coordinating and communicating this information to the various players involved in the industry, this justifies a new approach referred to as the Building Information Modelling. BIM foster integrated way of working that is backed up by digital technologies thereby giving ways for better method of designing, constructing and maintaining a facility. It contains 3-dimensional computer model and information about a facility that can assist in effective management of the facility throughout its life cycle. According to AGC, (2005), BIM represents the process of development and use of a computer generated model to simulate the planning, design, construction and operation of a facility. The resulting model, a Building Information Model, is a data-rich, object-oriented, intelligent and parametric digital representation of the facility, from which views and data appropriate to various users' needs can be extracted and analysed to generate information that can be used to make decisions and to improve the process of delivering the facility. A basic premise of Building Information Modelling is collaboration by different stakeholders at different phases of the life-cycle of a facility to insert, extract, update or modify information in the model to support and reflect the roles of that stakeholder (Davis & Songer, 2008).

Currently, the method of collaboration among professionals in the AEC sector in Akure does not facilitate adequate teamwork. Through the combination of these apparently distinct entities into a single industry, architects, engineers and contractors can work more expeditiously to achieve a common goal (Staub-French, & Khanzode, 2007; Schevers, *et al* 2007). In sourcing and exchanging of information within the industry to bring coactions and teamwork as well as standardization to these different sectors, a unified digital process - the Building Information Modelling is essential. BIM's offers the ability to virtually realize the building through all of the stages of the design process in the form of a database (Horne, Roupé, & Johansson 2005). This allows us to simply view the database in different ways to gain different pictures of the building. These views can take the form of plans, elevations, sections, or schedules (see Figure 1). Everything added to the building database can also be counted and quantified. By leveraging this method of reporting information, we can visualize the same project in a variety of ways to save time in communicating design information (Francom & El Asmar, 2014; Bouchlaghem, Shang, Whyte, & Ganah 2005).

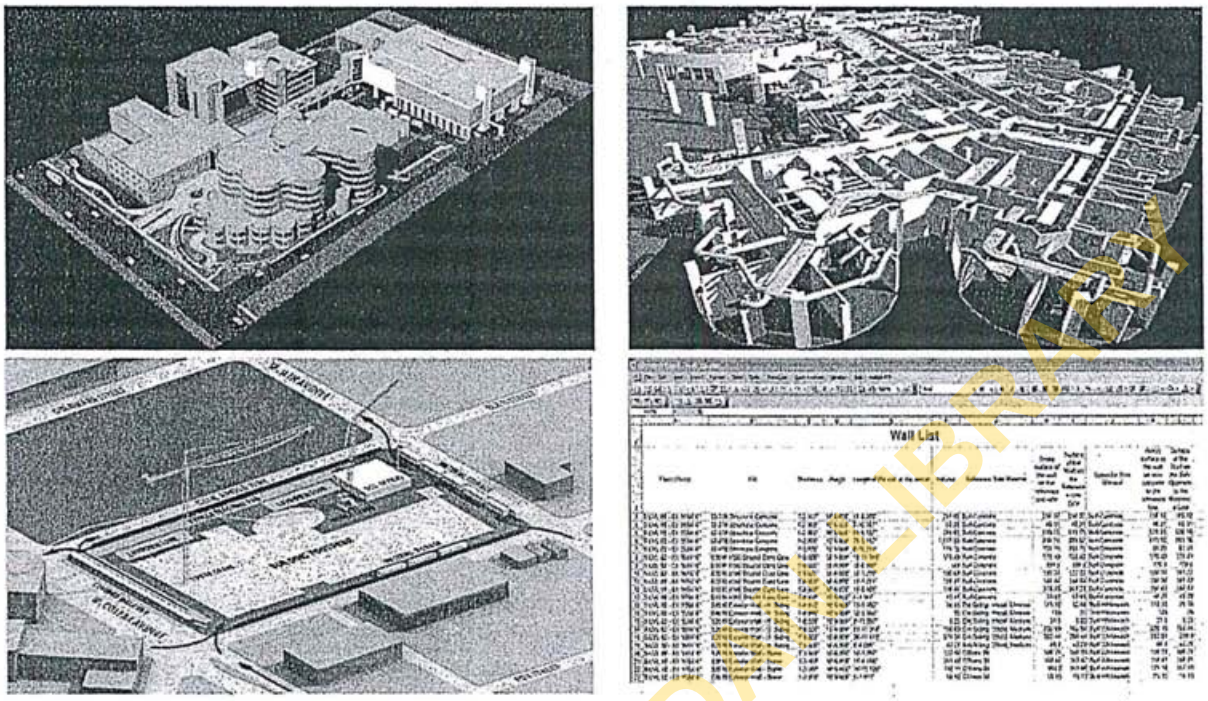

Figure 1: Different Components of a Building Information Model (CRC Construction Innovation 2007)

According to CRC Construction Innovation (2007), BIM was described as carrying all information related to the building, including its physical and functional characteristics and project life cycle information, in a series of "smart objects" (Abhijit & Pravin 2016). For example, an Air conditioning unit within a BIM would also contain data about its supplier, operation and maintenance procedures, flow rates and clearance requirements (Hergunsel 2011). Bazjanac (2006) corroborated BIM's underlying idea by stressing that building information model characterizes "the geometry, spatial relationships, geographic information, quantities and properties of building elements, cost estimates, material inventories and project schedule". It was added that this model can be used to demonstrate the entire building life cycle. In consideration of what can quickly be achieved with BIM, by stating that quantities and shared properties of materials can be readily extracted. Scopes of work can be easily isolated and defined (Azhar, Hein and Sketo 2008; Brandon, Li, & Shen 2005). Systems, assemblies, and sequences can be shown in a relative scale with the entire facility or group of facilities. The construction documents such as the drawings, procurement details, submittal processes and other specifications can be easily interrelated. These are immediate benefits from the use of BIM in a project.

3. Discussion of Findings

The research questions in the questionnaire and structured interviews conducted, was fashioned in such a way that relevant data regarding the level of awareness of BIM and its potential role in the transformation of the built environment were collected and analysed. The research question include the following: a) What are the specialties of the various AEC firms questioned? b) What are the primary software tools used by this firms? c) What are the primary uses of this software tool? d) What is the method of storing and exchanging information within the firm and with other firms or stakeholders?

3.1 Primary Software used in Respondents Firm:

Looking at table 1, it is not surprising that AutoCAD is the primary software tool used by most of the respondents firm getting 66.7% of the total number of frequency. This software has been at the heart of the traditional method of collaboration, it is apparent that it will continue to be the major tool used for professional practice in the AEC industry until BIM gains momentum. 15.7% uses other software that was not listed and this ranges from MS Excel, MS Word, QSCAD, MB3 etc. It was observed that some of the respondents use the combination of some of this software in their firms. It should be noted that some firms are already using a BIM tool like ArchiCAD and Revit although from the data collected, it use is limited and can be likened to the traditional business model that is characterised by fragmentation in project delivery.

Table 1 Primary use of software in Respondents Firm

	Frequency	Percent	Cumulative Percent
Drafting and documentation	26	51.0	51.0
Modelling and conceptual design	11	21.6	72.5
Collaboration and communication	13	25.5	98.0
Parametric detailing	1	2.0	100.0
Total	51	100.0	

Table 1 shows that primary use of software in respondents firms is drafting and documentation as it has 51%, while 21.6% use it for modelling and conceptual design, and 25.5% use it for collaboration and communication.

Table 2 shows that 43.1% uses both paper copies and digital copies to store and exchange data with other stakeholders within the firm while 52.9% uses both method to store and exchange data with other stakeholders outside the firm.

3.2 Medium used to store and exchange data with other Stakeholders:

From table 2, 43.1% of respondent's firm uses both paper copies and digital copies to store and exchange data with other stakeholders within their firm while 41.2% uses paper copies to store and exchange data with other stakeholders outside their firm, 52.9% uses both method to store and exchange data with other stakeholders outside the firm.

Table 2: Medium used to store and exchange data with other stakeholders

		Frequency	Percent	Cumulative Percent
Within the firm	Paper copies	10	19.6	19.6
	Digital copies	19	37.3	56.9
	Both	22	43.1	100.0
	Total	51	100.0	
Outside the firm	Paper copies	21	41.2	41.2
	Digital copies	3	5.9	47.1
	Both	27	52.9	100.0
	Total	51	100.0	

This indicates that both digital and paper copies are widely employed in storing and exchanging information in the industry. BIM implementation will be relatively easy by leveraging the already existing digital media of exchanging information within the industry.

4. Recommendations

The insight gained from the study has informed the following recommendations. Training and retraining of AEC professionals in the area of digital technology cannot be over emphasised at all. The world is going digital; sectors that refuse to follow will be left behind. Digital technology in the form of BIM has abundant application in the AEC industry, why should it be ignored? The Architect is the head of the building team; he conceives the design and decides how it should be built. He definitely wants to ensure productivity in the projects he undertakes; therefore he needs to be the front runner in the adoption and use of BIM tools which stimulates productivity.