

BUILDING INFORMATION MODELING (BIM) ROLES IN THE MALAYSIAN CONSTRUCTION INDUSTRY

ARYANI AHMAD LATIFFI, SUZILA MOHD, and JULIANA BRAHIM

*Department of Construction Management, Faculty of Technology Management and Business,
Universiti Tun Hussein Onn Malaysia, Johor, Malaysia*

Building Information Modeling (BIM) represents a new paradigm in the Malaysian architecture, engineering, and construction (AEC) industry. BIM technology provides virtual models (including 3-D models) to generate a building's entire lifecycle. The model can also be used for analyzing design clashes, project scheduling, cost estimation, and facility management. The use of BIM in construction projects can reduce time to develop a project, reduce construction cost, and increase project quality. This paper aims to explore roles of BIM in the Malaysian construction industry. Semi-structured interviews were conducted with project consultants and BIM consultants involved in two government projects. The projects were the National Cancer Institute (NCI) Malaysia and Sultan Ibrahim Hall (formerly known as the Multipurpose Hall of Universiti Tun Hussein Onn Malaysia, or UTHM). The interviews revealed effects of BIM in both projects and potential improvement in implementing BIM in construction projects in Malaysia. A literature review and the interviews revealed that BIM is increasingly used and accepted by construction players in Malaysia, and is expected to grow in future.

Keywords: Building Information Modeling (BIM), Malaysia, Roles, Effects, Government Projects.

1 INTRODUCTION

Building Information Modeling (BIM) is a new approach to design, construction, and facility management, where a digital representation of the building process is used to facilitate the exchange and interoperability of information in digital format (Eastman et al. 2008). According to the Construction Research Institute of Malaysia (CREAM) (2014), BIM is a virtual representation of a building. BIM contains all information required to construct the building by using computers and software. This approach is used by the architectural, engineering, and construction (AEC) industry to manage construction project effectiveness (Ahmad Latiffi et al. 2013).

In Malaysia, the implementation of BIM in construction projects has been encouraged by the Director of Public Works Department (PWD) (Ahmad Latiffi et al. 2013, Mohd and Ahmad Latiffi 2013, PWD 2013). The idea was initiated in 2007 when the PWD had become aware of BIM's potential for reducing construction problems. The PWD has also established a special committee called BIM unit project under the Complex Management Division, also known as PROKOM (PWD 2011). The

main purpose of establishing the BIM unit is to formulate Malaysia's BIM Roadmap and BIM Standard Manual and Guidelines (Ahmad Latiffi et al. 2013, PWD 2013). Revit families have been suggested by PWD as BIM tools to be applied in construction projects. Revit families is one of BIM tools, which consists of Revit architectural, Revit structural, Revit mechanical and electrical (M&E), and Navisworks (Ahmad Latiffi et al. 2013, PWD 2013).

The enhancement of BIM implementation in the Malaysian construction industry is due to the positive effects of BIM applications in construction projects (Zakaria et al. 2013), such as visualizing project models, previewing design clashes analysis, and assisting in preparing project design, cost estimation, and project scheduling (PWD 2011, Ahmad Latiffi et al. 2013, Barati 2013). BIM technology provides a platform for each key construction player to have effective communication before the construction starts (CREAM 2014). The implementation of BIM in the Malaysian construction industry is expected to increase due to its benefits to construction projects.

2 METHODOLOGY

A literature review and semi-structured interviews were conducted to collect data on BIM implementation in the Malaysian construction industry. The literature review was conducted to gather information on definitions, history, applications, and benefits of BIM. All data were collected from various sources such as books, journal articles, international conference papers, and materials available on the Internet.

Furthermore, semi-structured interviews were utilized as a method of data collection in order to explore BIM implementation in construction projects. The interviews were made with a project consultant for the National Cancer Institute (NCI) Malaysia, and a BIM consultant for the Sultan Ibrahim Hall of UTHM. The interviews were conducted in a face-to-face setting with both respondents separately.

A set of questions on purposes, process, and effects of BIM and the potential improvement of BIM in the Malaysian construction industry were asked to the respondents. All data gained were recorded, transcribed, and analyzed using content analysis and representation through text, images, as well as expressions.

3 RESULTS AND FINDINGS

Both respondents had experience in BIM. The project consultant was a consultant on behalf of the NCI Malaysia client, and was the head of BIM unit of Complex Management Division (PROKOM) under PWD. The project consultant was the head of the design team that managed BIM aspects and prepared a BIM Statement of Needs. The project consultant also had four years of experience in managing BIM projects. NCI Malaysia was his first experience as a project consultant using BIM.

For the other respondent, the BIM consultant was a project coordinator for Sultan Ibrahim Hall of UTHM. The BIM consultant was responsible for preparing the 3-D project model and the clashes-analysis report by using Revit families. The BIM consultant had eight years of experience in BIM. The Sultan Ibrahim Hall of UTHM was the consultant's first experience as a BIM consultant in a government project. For further discussion in this paper, the project consultant will be coded as PC, while the BIM consultant will be coded as BC. Table 1 shows the respondents' background.

Table 1. Respondents' Background.

No	Respondent's Designation	Position	Project	Experience Using BIM (Years)
1.	Project Consultant (PC)	Head of BIM Unit of Complex Management Division (PROKOM).	NCI Malaysia	4
2.	BIM Consultant (BC)	Project designer in Integrated Project Management Solution (IPMS) Sdn. Bhd.	Sultan Ibrahim Hall of UTHM	8

3.1 Background of Projects

NCI Malaysia and Sultan Ibrahim Hall of UTHM are the Malaysian Government's projects using BIM. NCI Malaysia is located in Putrajaya, Malaysia, while the Sultan Ibrahim Hall is located in Parit Raja, Batu Pahat, Johor, Malaysia. Figure 1(a) and 1(b) show both projects.



1(a)

1(b)

Figure 1. (a) NCI Malaysia and (b) Sultan Ibrahim Hall.

The NCI Malaysia is the early initiation of the government in using BIM. For Sultan Ibrahim Hall, the contractor recommended to the client to use BIM during contractor selection. More information about the projects is in Table 2.

Both projects used the design-and-build method in their project delivery method. The main contractor was responsible for preparing a project design and construction. The NCI Malaysia project was completed in three years and the Sultan Ibrahim Hall in two. The total project cost for the NCI Malaysia project was RM 690,000,000, and for the Sultan Ibrahim Hall RM 37,261,396.20. The purpose of the NCI Malaysia project is to be Malaysia's first cancer institute that provides comprehensive care, treatment, and referrals. The purpose of the Sultan Ibrahim Hall is to host events, such as convocations and examinations, of at least 3,000 people.

Table 2. Details of the Projects.

Project:	National Cancer Institute (NCI) of Malaysia	Sultan Ibrahim Hall of UTHM
Client:	Ministry of Health Malaysia	Universiti Tun Hussein Onn Malaysia (UTHM)
Contract Value (MYR):	RM 690,000,000.00	RM 37,261,396.20
Project Duration:	3 Years	2 Years
Contract Type:	Design and Build	Design and Build
Main Contractor:	Kiara Teratai Sdn. Bhd., Kuala Lumpur, Malaysia.	Hamidah Fazilah Sdn. Bhd., Johor Bahru, Johor, Malaysia.
BIM Consultant:	Precision Design Solutions (PDS) Sdn. Bhd., Petaling Jaya, Selangor, Malaysia	Integrated Project Management Solution (IPMS) Sdn. Bhd., Johor Bahru, Johor, Malaysia.

3.2 The Effects of BIM Implementation

Five main positive effects of BIM implementation on the projects are shown in Table 3, in terms of cost, time, project design, project process, communication, and collaboration:

Table 3. The Effects of BIM Implementation.

No.	Effect	NCI Malaysia	Sultan Ibrahim Hall of UTHM
1.	Avoiding increased construction cost	√	√
2.	Avoiding project delay	√	√
3.	Increasing accuracy in project design	√	√
4.	Improving construction project process	√	√
5.	Improving communication and collaboration among construction players	√	√

According to the PC, the roles of BIM in the NCI Malaysia project were to visualize project models, review designs, and analyze design clashes for the whole project. These roles were similar to the Sultan Ibrahim Hall project, which also included design coordination especially for roof designs, roof structures, and site coordination.

The PC and BC also explained that the ability of BIM in detecting design clashes early in the design stage facilitated the construction process. They also stated that BIM minimized design changes and rework that could happen due to uncoordinated designs during the construction stage. They also argued that BIM increased the quality of structure and mechanical, electrical, and plumbing (MEP) installation during construction. The process of installation ran smoothly during the construction stage. They also stated that effects from the installation reduced variation order (VO) in the projects. Therefore, BIM has the potential solution to reduce project delay and cost overrun.

The PC and BC also mentioned that BIM was also used to verify and monitor work programs and progress by using four-dimensional (4D) modeling. The work progress was easily monitored and understood by the construction players thanks to the use of BIM tool Naviswork. This was because construction players could see actual progress

by referring to the model without going to the construction site. BIM also populated or captured information as much as possible for facility management (FM) purposes.

Moreover, the PC and BC agreed that the implementation of BIM in the project had improved communication and collaboration among the construction players. Even though both projects only used BIM in early stages of the construction, the clients of the projects were interested to use BIM for the purpose of FM.

3.3 Potential Improvement for Implementing BIM

According to the PC, the implementation of BIM in the Malaysian construction industry will increase. However, to increase BIM implementation in the industry, the BIM unit of Complex Management Division (PROKOM) has to start using BIM first. As the PC is head of the BIM unit in PROKOM Malaysia, the PC has to completely master the knowledge of BIM. Moreover, the BC agreed with the PC that in order to implement BIM, construction players must have knowledge of BIM. The PC also stated that the Malaysian Government wanted to increase BIM implementation in the construction industry by developing BIM Standard Manual and Guidelines and BIM Roadmap, in order to encourage and assist construction players in implementing BIM. The PC and BC also participated in other government bodies, and were involved in academic activities to share their knowledge in BIM.

4 CONCLUSIONS

The implementation of BIM in the Malaysian construction industry is still new. BIM implementation in both projects showed positive effects. BIM in the projects improved communication and collaboration among construction players, minimized design changes, reduce request for information (RFI) during construction stage, and avoid project delay. The Malaysian Government also observes BIM as a new technology to increase quality of projects by reducing construction problems. The Government has also made BIM Standard Manual and Guidelines and BIM Roadmap to encourage construction players to engage with BIM implementation in construction projects and as a guideline for them to implement BIM. The efforts made by the Government show that the Malaysian Government is serious about implementing BIM in the industry.

Further work will be carried out to gain more information on the roles of BIM in other projects that use BIM. The data obtained will then be used to give suggestion to construction players to implement BIM in their construction projects.

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