Establishing the Level of BIM implementation – A Case Study in Melaka, Malaysia

Yasser Yahya Al-Ashmori1*, Idris Bin Othman1, Hisham Bin Mohamad1, Yani Rahmawati1 and Madzlan Napiah1

1* Department of Civil & Environmental Engineering, Universiti Teknologi Petronas, Seri Iskandar, 32610 Bota, Perak
Corresponding author: Yasser.alashmori@gmail.com

Abstract. The implementation of Building Information Modelling (BIM) in Malaysian construction industry is considered very challenging. Although there is significant support from the government to enhance BIM adoption, the implementation of BIM is still in a very low level. Therefore, this paper is evaluating the level of BIM use among Malaysian construction companies. The research is based on a survey and observation conducted in the state of Melaka in which 90 Malaysian companies were surveyed. Based on the evaluation of 90 construction companies, 63 questionnaires were returned and only 46 were valid for further analysis which covered the main objectives of this research. Result revealed that there is a significant drawback of BIM implementation among construction companies due to the lack of awareness of application process and technology concept. The main factor responsible for the lack of awareness was found to be the delay of organizations to use BIM on their project practices. Hence, it is recommended that organizations should be practicing the BIM process within their company. Also, organizations should have the initiative to develop their roadmap for implementation and development of individual transformation plan that gradually overcomes challenges.

1. Introduction

Building Information Modelling (BIM) is described as new technology to model building and infrastructure projects and associated data in a digital manner to produce, communicate, analyse, integrate, and collaborate project processes throughout the construction project life cycle [1–3]. BIM is also called n-D Modelling or Virtual Prototyping Technology [4]. It enhances inter-organizational communication, collaboration, and enables interoperability [5–8]. Moreover, BIM implementation enhances productivity and efficiency during design stage, scheduling, quantity estimating, procurement, construction execution, and project commissioning operation [4,9–12]. In other words, BIM represents the building in 3D geometric objects which is integrated with non-geometric attributes (cost and time) that can be used and maintained throughout the building lifecycle.

The new technology of BIM was introduced to the Malaysian construction industry in 2006 during the launching of the Construction Industry Master Plan (CIMP). The idea of BIM implementation was first introduced by the Public Works Department (PWD) in 2007 [13,14], in order to overcome the weaknesses of the current construction industry [12]. Furthermore, in the launching of the Construction Industry Transformation Program (CITP) in 2015, construction industry tended to eliminate the limited adoption of information technology [15]. As a result, the government represented
by CIDB had made a step forward to adopt and promote BIM to the construction industry. The latest development on enhancing the concept of BIM was conducted in 2018. Figure 1 illustrates the milestones of BIM initiation taken by CIDB to promote BIM implementation in Malaysia from 2014 to Sept. 2018.

![Milestones of BIM initiation by CIDB](image)

**Figure 1.** The milestones of BIM initiation by CIDB to promote BIM implementation.

Project development in the Malaysian construction industry is still organized by traditional processes that caused lack of development and global competitiveness [16]. The outcome of the adopted traditional processes results in delay, cost overrun, poor quality, low performance and low productivity. According to Memon et al. [17], BIM implementation is meeting the requirements during the design phase compared to poor implementation during the construction phase. The usage of BIM in the design organisations is more than that implemented in the construction companies [17]. This differences in the implementation causes fragmental application of BIM and keeps the industry in low level of BIM implementation. There are many reasons for this fragmented process such as the lack of understanding the process of BIM implementation, lack of skill in preparation of plans in BIM and the ability to effectively utilise it with stakeholders, resistance to changing current ways of working, lack of collaboration and coordination among various disciplines, limited availability of usage guidelines, etc. [15].

To the best of the author’s knowledge, no efforts have been undertaken to explore the shortcomings of BIM implementation in building and infrastructure projects. In addition, there is a lack in the establishment of the current level of BIM application in Malaysia. Therefore, an analysis of the awareness level of professionals in construction industry, usage of technology in the Malaysian organization, and interference of employer with BIM technology is the focus of this study. This research also investigates the level of BIM implementation and the impact of BIM usage within the organizations and compares the level of awareness. Descriptive analysis and correlation were performed to achieve the objectives of this research. The research outcome promotes BIM utilization among construction companies in Malaysia.

2. Methodology

The questionnaire was developed based on the findings from the variable elements identified in the literature review [18–22], and designed to explore the participant background, awareness of BIM technology implementation process, usage of BIM, and to extract the organization challenges and success factors for BIM implementation. The questionnaire survey adopted in this research was distributed to the audience in JELAJAH BIM, MyCREAST, & QLASSIC 2018, Melaka. In this research, participants were from different backgrounds and different organizations including client/developers, contractors, consultants, participants from CIDB and MYBIM centre. Additional
information was recorded during the Q&A session to extract the most frequent questions asked by participants regarding BIM technology and implementation. This helped to develop an empirical knowledge to the level of BIM implementation and factors influencing companies to consider BIM in their projects.

The questionnaires were distributed to 90 participants from different construction classification and agency interested in BIM technology. Only 63 questionnaires were returned and after conducting the first screening, 46 returned questionnaires were valid for further analysis and discussion as they fulfil the requirements of this research. Meanwhile, the first part of the questionnaire was established to classify respondents according to their qualification, years of experience, and position as shown in Figure 2. The qualification of respondent measured to be 50%, 26%, and 22% for bachelor degree, master degree, and diploma, respectively. The figure also shows that 33% of the respondents have working experience of less than 5 years, which is the highest percentage. 30% of the respondents have working experience of approximately 5 to 10 years, while 11% of the respondents have 10-15 years working experience, which is the lowest. Furthermore, it can be observed from the collected data that 17% of the respondents are executive management, 17% are junior management, 22% are the senior management and 44% are others. The others included engineers, lecturers, and administration staff, which is the highest percentage among the respondents.

![Figure 2. The classification of respondents.](image)

Figure 3 shows that the respondents’ sector was classified as public and private. It is clearly shown that 52% of the companies practicing BIM are from the private sector, which was a slightly higher rate than the participants from the public sector (48%).

![Figure 3. Classification of respondents’ sector.](image)
The variation of respondents according to their nature of business was satisfactory except for MEP engineering where it shows zero participants in this research. Figure 4 represents the number of respondents for business practices from each organization in relation to the respondents’ classification. It is clearly seen that the results were similar for client/developer from both public and private sectors. The number of contractors was the highest compared to other business classes. When comparing the public and private sectors, the number of contractors from private sector was significantly higher. Furthermore, the majority of civil and structural engineer respondents in this research were from public sector, which is similar to those from other nature of business such as management and education. All respondents from Architecture were from private sector. Overall, variety of participants in such activity provided a significant sign of readiness of these organizations to transfer into BIM. The higher number of contractors participated in this seminar showed their willingness to understand BIM and its benefits that could enhance BIM implementation among Malaysian construction companies.

![Nature of Business](image)

**Figure 4.** Respondent nature of business.

Professionals representing the participating organization work in different projects as illustrated in Figure 5. 26% and 23% work in Housing and commercial projects, respectively, while organizations working in infrastructure and high-rise projects accounted for 17% and 14%, respectively. The availability of different organizations with different project types interested in BIM technology shows that the construction industry is motivated to make changes and adopt the new technology. Similarly, according to Bui, Merschbrock, & Munkvold [23], BIM is seen as a catalyst for innovation and productivity in the construction industry. Thus, while organizations acknowledge its benefit, the application of BIM incorporates a range of risks [4–6], and required change in management as it reshapes the Architecture-Engineering-Construction (AEC) industry [4,24]. Therefore, organizations are reluctant to adopt the technology unless they know how, where and when to use it.
3. Result and Discussion

This questionnaire analyses BIM diffusion among organizations in Malaysian construction industry with respect to BIM implementation and usage of BIM within their projects. The results of the descriptive analysis are illustrated and discussed in this section.

3.1. BIM Implementation in Malaysian Construction Industry

BIM implementation in Malaysia is still very low and construction players are still facing major challenges in implementing BIM [17,25–27]. The analysis of the conducted survey revealed very low rate of BIM implementation. It can be seen in Figure 6 that only 9 organizations implemented BIM within their projects. Most of the investigated companies reported that they are not using BIM due to various reasons such as poor knowledge about BIM. It is clearly seen that some respondents from four companies did not have a clear idea as to whether their companies are using BIM or not. Figure 6 illustrates the number of participants representing organizations using BIM in Malaysia.

Furthermore, the survey examines the period of BIM use among those organizations. It is clearly shown that only three organizations have been using BIM for 3 to 4 years. This represents only 30% of the total organizations using BIM. Also, it is obviously seen from the Figure 7 that six organizations have been using BIM for 1 to 2 years. Figure 7 depicts the period of BIM implementation among organizations.
Figure 7. Period of BIM implementation among organizations.

Construction organizations that implement BIM do not always use BIM for all projects [27]. Therefore, Figure 8 represents the frequency of time that Professionals in the organization interfere with the BIM during the development of the building and infrastructure project. The frequent of interference is termed as never, rarely, sometimes, often, and always. The results indicated a very clear difference between those who never use BIM and vice versa. Approximately 72% of those who responded said that they never use BIM. Around 13% of the professionals representing the organizations used BIM in some of the projects, while 11% rarely use BIM in their projects. Low rate of continuous BIM usage among the construction projects was indicated as 4%. This rate gives a drawback indicator of the BIM implementation in Malaysian construction industry.

Figure 8. Frequency of time professionals interfere with the BIM.

It can be concluded from the above result and discussion of the respondents that the practice of BIM technology within the organization has a significant impact on improving awareness. Therefore, it is recommended that the organizations should start practicing BIM processes within their projects. Organizations also should take the initiative to develop their roadmap to adopt BIM and develop individual transformation plan and gradually overcome challenges.

3.2. Awareness of BIM Implementation

The awareness of BIM processes implementation was investigated in this section. It can be seen in Figure 9 that the awareness of BIM implementation is still very low [27]. Organizations acknowledge the benefits of BIM technology as a reflection of their interest to attend the promotion programs.
organized by CIDB, Malaysia. Result shows that 46% of the respondents are not aware of the BIM process implementation, whereas 39% are somewhat aware. However, there is still a significant unawareness of the usage of BIM technology. This was observed through the discussion that was opened for the audience, where all the questions raised were on BIM implementation and how the information is transformed through different organization or parties in the same project.

4. Conclusion
This paper investigates BIM implementation level and explores the usage of BIM in Malaysia. The investigation was carried out using a questionnaire survey and personal observation. Results revealed that BIM implementation in Malaysia is still in the low level and organizations still lack awareness on BIM processes throughout the project phases. While significant interest has been expressed by the participants to learn the technology, the companies are still not using or promoting the usage of BIM in its projects, with the result that professionals are facing difficulties to practice the technology. This research recommended organizations to initiate the adoption of BIM and encourage professionals to develop their skills on the BIM implementation. Attending training or seminars will enhance the theoretical knowledge of participant, while practicing the technology will increase skills and knowledge. In addition, organizations should adopt best practices from experts and develop individual transformation plan to gradually overcome challenges.

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