

Assessing the Readiness and Challenges of Implementing Building Information Modelling (BIM) Among Contractors in Kelantan

Mohd Hasbi bin Mat Zain¹, Nik Ahmad Nazuli bin Nik Yahya², Mohd Izuddin bin Mahmood³

^{1,2,3} *Jabatan Kejuruteraan Awam, Politeknik Kota Bharu, KM 24, Kok Lanas, 16450 Ketereh, Kelantan*

Corresponding author: hasbi@pkb.edu.my

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Abstract

Building Information Modelling (BIM) is a digital approach that is growing in the global construction industry, including in Malaysia. This study aims to explore the level of awareness, understanding, and challenges of implementing BIM among G6 and G7 grade contractors in Kelantan. A qualitative method was used through semi-structured interviews involving eight (8) experienced respondents in the local construction industry. Thematic analysis was used after data were obtained from the interviews conducted to identify themes that emerged from the research questions. The study found that the level of awareness of BIM in construction projects is high. However, the understanding of the importance and benefits of BIM in Kelantan is at a low level. The study also found that among the challenges faced by the construction industry in Kelantan in implementing BIM include high implementation costs, lack of local expertise, negative perceptions of new technologies, and market demand constraints. Additionally, the lack of comprehensive infrastructure and policies was also identified as a major challenge.

INTRODUCTION

The era of digital transformation has begun to hit the construction industry, driven by various applications of technology throughout the life of a building (Naji et al., 2024). The explosion of the digital era has begun to yield significant results when it increases output, efficiency, and reduces risk (Musarat et al., 2021). Among the main technologies used in the construction industry today are the Internet of Things (IoT), drones, digital twins, and Building Information Modelling (BIM) (Yadav et al., 2023).

BIM is an innovative technology in the construction industry that reduces errors, increases productivity, and encourages collaborative participation among stakeholders when used in construction projects. Furthermore, BIM integrates various information, such as time, cost, and materials, that can be accessed throughout the life cycle of a project (Nguyen, 2025). Many countries have begun using BIM in construction projects to increase productivity, save costs, and reduce risk. Therefore, as the Malaysian construction industry will triple its contribution to the nation's Gross Domestic Product (GDP) by 2050, BIM was included as a national agenda to improve efficiency in construction projects (Alaloul et al., 2021)

The Public Works Department (PWD) began introducing BIM to be implemented in Malaysia in 2007. This effort was later continued by the private sector when they actively promoted the use of BIM in their projects. The first public project that used BIM was the National Cancer Institute (NCI) building, which was completed in 2010. The pioneer project was considered successful when it was completed earlier than the contract completion date. As of 2025, Malaysia has recorded over 400 projects using BIM since it was first introduced in 2007 (Malaysiagazette, 2025). However, most projects that involve BIM are concentrated in the Central Region compared to the East Coast Region (BIM report, 2020).

Contractors are one of the driving forces of the construction industry. In Malaysia, G6 grade contractors are limited to bidding for projects worth 10 million, and G7 grade contractors have no limit on the project value they can bid (CIDB, 2025). G6 and G7 grade contractors are also companies that are often involved in complex and medium projects and are more advanced in the use of technology, such as BIM. However, problems often arise among industry players when applying BIM in construction projects, such as a lack of education and training, limited knowledge about BIM, and a reluctance to adopt new methods (SY Wong and Gray, 2019). Studies on the use of BIM in Kelantan are limited compared to more developed states such as Kuala Lumpur, Penang, and Johor. Therefore, it leaves a knowledge gap to understand the readiness of BIM implementation for states that are still lagging in the modernization trend.

Consequently, to fill this gap, this study aims to identify the readiness and challenges associated with BIM implementation among contractors in the G6 and G7 grade in Kelantan. This study is expected to assist local, state, and subsequently federal authorities in developing the best formula to help Kelantan not be left behind in the digital era.

LITERATURE REVIEW

Definition of BIM

Generally, there are many definitions that can be found in literature and vary among researchers. According to the definition by Construction Industry Development Board (CIDB) Malaysia in 2025, "BIM is the process of preparing, using, and sharing 3D models through digital technology that contain various information where it can be used by all parties involved in the project to achieve objectives throughout the implementation phase of a project". Additionally, according to Dan (2015), "BIM is the use of three-dimensional (3D) data in the process of creating and managing building data throughout its life using appropriate building information software to improve the efficiency of building design and construction". Moreover, according to Autodesk (2025) defined BIM as "the holistic process of creating and managing information for a built asset. Based on an intelligent model and enabled by a cloud platform, BIM integrates structured, multi-disciplinary data to produce a digital representation of an asset across its lifecycle, from planning and design to construction and operations".

Implementation of BIM in Malaysia

According to Ahlam and Rahim (2021), the implementation of BIM in Malaysia has not yet reached a maturity level. However, its advantages will take the sector to a whole new level when it is fully utilized (Feng, 2021). As a government measure to increase the use of BIM, construction players are required to maintain a BIM Stage 2 development implementation rate of at least 40% for public projects worth RM 100 million or more (BIM Report 2016). In addition, from 2019, public projects worth more than RM100 million must use BIM (PWD and CIDB, 2018). The Construction 4.0 Strategic Plan (2021-2025) which focuses on Industry 4.0 also emphasizes the importance of using BIM in construction projects (Construction 4.0 Strategic Plan (2021-2025) besides the PWD Strategic Plan 2021-2025 which targets to implement BIM into 90% of projects worth more than RM10 million to digitize and automate construction (The Edge, 2024).

BIM Awareness in Malaysia

The 2020 BIM Report released by CIDB shows an increase in BIM awareness and implementation in Malaysia compared to the 2016 BIM Report. The high level of knowledge about BIM indicates that most industry players are already aware of the use of BIM in the construction sector. This positive development further supports Malaysia's progress towards wider use of BIM.

Furthermore, there are positive results from a survey conducted by CIDB from November 2019 to February 2020 using various methods, such as online surveys, seminars, interviews, conferences, and meetings. The survey was to assess the level of BIM implementation in the Malaysian construction industry, three years after the first National BIM Report was published in 2016. According to the findings of the survey released by BIM Report (2020), there is an increasing trend in BIM awareness, which is 74% in 2020 compared to only 45% in 2016. The results of the survey in 2021 found that awareness of BIM continued to increase to 78% as professionals took the opportunity to upskill and reskill in BIM due to the movement restrictions in the country (BIM Report, 2021).

Government agencies such as PWD and CIDB, with the assistance of the private sector, have organized various programs such as BIM day, BIM road tours, courses, and training to increase awareness and further strengthen the use of BIM in Malaysia. According to the BIM Report 2021, there was an increase in respondent participation from 55% in 2016 to 66% in 2019. Although there was a decrease in BIM program participation in 2021 to 62%, it is still high when compared to 2016 (55%). The decrease may be due to the COVID pandemic, which caused people to be more cautious in joining BIM programs. Therefore, this increasing trend shows that respondents are aware and interested in participating in the BIM program.

Challenges of BIM Implementation in Malaysia

According to Othman (2020), the use of BIM in the construction industry in Malaysia is only around 13%. This low use further slows down the implementation of BIM in Malaysia. Apart from that, industry players apply BIM separately, such as only for the purpose of producing models, resulting in collaborative involvement not occurring. According to the study, among the biggest obstacles faced are the lack of guidelines, high costs, and lack of awareness about BIM.

Another study was conducted by Khairol et al. (2019) to find out the challenges of using BIM among architects in Malaysia. According to the findings of the study, the still slow rate of use among architects are due to several factors, such as many things that need to be mastered in a short time, a lack of skilled experts, and the high cost of purchasing and subsequently operating the software.

The lack of BIM implementation is influenced by the lack of customer demand for using BIM (Miza, 2023). Apart from that, companies also face complex software problems, a lack of skilled workers, and the need for companies to purchase BIM equipment. Furthermore, companies also experience technical difficulties, such as drawings, software limitations, in addition to challenges during the BIM project.

METHODOLOGY

Research Approach

This study used a qualitative method to answer questions about experiences, meanings and perspectives, often from the participants' perspectives (Hammarberg et al., 2016). In addition, the qualitative method was chosen because it coincides with the situation and characteristics of the study conducted, because BIM-related issues need to be discussed with a specific group who have in-depth knowledge about them. In this study, semi-structured interviews were used to generate the same questions for each respondent. Semi-structured interviews typically refer to situations where the interviewer asks the same set of questions but may change the order of the questions (Bryman, 2016). This type of interview is conducted once with an individual or group, and it typically lasts from 30 minutes to more than an hour (DiCicco et al., 2006).

Interview Preparation

Semi-structured interviews were used to collect primary data. The interview sessions were conducted face-to-face. Before the interview began, participants were given a brief explanation of the study and informed that all data and information from the interview results were classified as confidential. All interviews in this study were recorded and transcribed to ensure that all participants were in focus during the interview session and to avoid losing important information.

Respondents Selection

This study outlined several criteria for selecting respondents to obtain more in-depth study results, namely: -

1. **Contractor:** G6 and G7 contractors in Kelantan. The purpose of selecting G6 and G7 contractors was to find out whether contractors who can bid for high-value projects in Kelantan implement BIM and how BIM is applied.

2. **Years of Experience:** At least 15 years of experience working in the construction industry. The value and validity of this research will be better if the respondents have extensive experience.

Interview Structure

A set of interview questions was developed to obtain information on the implementation of BIM in construction projects in Kelantan. The interview questions were divided into three parts. The demographic background of the respondents was collected in the first part. The second part focused on determining the level of understanding and awareness of BIM in the construction industry. The third part looked at the challenges of the Kelantan construction industry in implementing BIM.

Data Analysis Method

Non-numerical information, such as transcripts, notes, videos, audio recordings, images, and text documents, is classified as qualitative data. According to Dudovskiy (2022), qualitative data falls into five categories. One of them is thematic analysis, which is a technique to analyze qualitative data (Caulfield, 2019). This analysis usually involves sets of text, such as interview transcripts. This methodology involves examining the data thoroughly to find recurring themes. After the data is collected, thematic analysis is used. Thematic analysis begins with the collection and entry of data, and it continues after the coding and interpretation of the data (Evans et al., 2017). Thematic analysis was carried out in six steps as shown in Table 1 (Caulfield, 2019): -

TABLE 1: Thematic analysis process

Thematic Analysis Process	
1.	Familiarizing with the collected data
2.	Generating initial codes
3.	Looking for themes
4.	Reviewing for themes
5.	Defining and naming themes
6.	Producing the report

RESULTS

The results of semi-structured interviews with eight respondents are presented as follows:

TABLE 2: Demographics of the respondents

Respondent	Position	Contractor Registration Grade	Experience (Years)	Highest Level of Academic
Respondent 1	Manager	G6	17	Master’s Degree
Respondent 2	Manager	G7	25	Degree
Respondent 3	Manager	G6	20	Degree
Respondent 4	Assistant manager	G7	17	Degree
Respondent 5	Contract executive	G6	19	Degree
Respondent 6	Project executive	G7	20	Degree
Respondent 7	Managing director	G7	20	Degree
Respondent 8	Project manager	G6	18	Degree

Table 2 shows the demographics of the eight respondents who were selected to participate in this semi-structured interview. They held key positions in the company, such as manager (3), assistant manager (1), contract executive (1), project executive (1), managing director (1), and project manager (1), which shows the involvement of various layers of management in the construction industry. There are four companies that are contractors in grade 6, and another four companies are in grade G7. All of them have more than 15 years of experience, which shows that they are quite experienced and have expertise in their respective fields. As for the highest academic qualification, seven respondents have a degree, and another one has a master's degree, which shows that each of them possesses a great academic background. The study respondents consisted of individuals with extensive experience and high qualifications representing various positions in contractor companies, making their views relevant and authoritative in assessing the readiness and challenges of BIM implementation in Kelantan.

Based on the data analysis method using thematic analysis, several themes were generated to answer the research questions. The data was obtained from semi-structured interviews with 8 respondents, consisting of G6 and G7 grade contractors in Kelantan. Table 3, Understanding and Awareness Level of BIM in the Construction Industry, below shows data from the perspective of respondents from the interviews conducted, which produced three main themes, namely Understanding of BIM, Benefits of using BIM, and Level of BIM Implementation in Kelantan. There is a main theme in Table 4, which is BIM Implementation Challenges under the Challenges affecting BIM implementation in Kelantan.

TABLE 3: Understanding and Awareness Level of BIM in the Construction Industry

Main Theme	Sub-theme	Respondent	Direct Quote
Understanding of BIM	Process and workflow	Respondent 1,2,4,6	“The work process in construction using models from the design stage to construction”
	Digital tools or software	Respondent 3,5,	“New techniques using software”
	Collaboration and data management	Respondent 3,8	“Digital representation and collaboration for the construction industry”
Benefits of using BIM	Efficiency and accuracy	Respondent 1,3,5	“Reduces design errors and makes it easier for contractors”
	Time and cost savings	Respondent 3, 6	“Saves costs, speeds up project implementation”
	Better visualization and planning	Respondent 2, 8	“Makes it easier to see the arrangement of the building in 3D”
	More effective collaboration	Respondent 3, 8	“All parties can work on the same BIM model, share information”
Level of BIM Implementation in Kelantan	Low implementation	Respondent 1, 3, 7	"It's still new, there's no comprehensive disclosure yet."
	Awareness depends on the project scale	Respondent 2, 6, 3	"BIM will be used if it is included in the contract documents."
	Examples of BIM Projects in Kelantan	Respondent 4, 8, 7	"The ongoing construction project in Kelantan is the construction of the Federal Government Building in Tunjong..."

TABLE 4: Challenges affecting BIM implementation in Kelantan.

Main Theme	Sub-theme	Respondent	Direct Quote
BIM Implementation Challenges	Implementation Costs & Infrastructure	Respondent 2, 5, 7	"The cost of installing BIM software and equipment is quite high."
	Lack of Local Expertise	Respondent 3, 6, 4	"Lack of BIM expertise and knowledge in the local workforce..."
	Government Role and Policies	Respondent 1, 4, 8	"The government needs to provide sufficient time and exposure, such as courses..."
	Perceptions Towards BIM	Respondent 2, 7, 5	"It's difficult. If you don't understand, it's indeed difficult. It should be made easier if you accept the technology."
	Market Demand Constraints	Respondent 1, 5, 3	"Customers still choose conventional methods; lack of reference projects."

DISCUSSION

The results of the study show that the Kelantan construction industry has a high level of awareness of BIM. This finding is in line with the BIM 2021 report, which shows an increase in BIM awareness among construction industry players compared to the BIM 2016 and 2019 reports. Starting from 2007, various government initiatives to promote BIM, such as improving BIM skills, disseminating BIM information, and equipping graduates with BIM knowledge, have shown good results in increasing BIM awareness and understanding among Malaysians (Sinoh et al., 2020). In addition, the high level of awareness is because the government has mandated the use of BIM for public projects worth RM100 million or more since 2018.

However, despite the many benefits offered by BIM, fifty percent (50%) of the respondents interviewed stated that industry players in Kelantan are still unaware of its benefits. According to Edmund (2020), there are several factors that contribute to the lack of understanding of the benefits of BIM. These include lack of guidelines, lack of skilled practitioners, unsupportive stakeholders, resistance to changes in current working methods, lack of collaboration and coordination between various disciplines in addition to lack of understanding of the BIM technology implementation process. According to Syed (2022), this statement can be believed to be due to low awareness levels, high adoption costs, lack of experienced workforce, and reluctance to change work processes to BIM.

Data analysis found that 50% of the respondents stated that the level of construction project implementation in Kelantan is still low. The implementation rate for the East Coast Region (Kelantan, Terengganu, Pahang) is 20%, according to the BIM Malaysia Report 2019 behind the Central Region (Federal Territory of Kuala Lumpur, Federal Territory of Putrajaya, Selangor, Melaka, and Negeri Sembilan) which recorded a 71% BIM project implementation rate. The East Coast Region is the second highest BIM implementation project in Malaysia, and most BIM projects are concentrated in Terengganu and Pahang.

The primary challenge of BIM implementation in construction projects in Kelantan is the substantial initial cost. This includes the expenses required to comply with technical requirements, training, software,

and hardware. A study was conducted by Ismail et al. (2021) to find out the problems faced by Small and Medium Enterprise (SME) contractors in the Malaysian construction sector when using BIM. The study found that the high cost of investment in BIM software and hardware is the biggest issue they face.

A factor hindering BIM projects in Kelantan is a lack of experts in BIM technology. The lack of sufficient and knowledgeable human resources on BIM leads to dependence on external experts, which results in higher costs and slower implementation. Experts skilled in BIM technology are required for the implementation of BIM projects. It is usually divided into three levels, namely BIM managers, BIM coordinators, and BIM modelers, where the manager is the highest paid and the model provider is the cheapest (Shin et al., 2018). According to Mohd Fateh et al. (2022), some of the issues that hinder the implementation of BIM in Malaysia include the high cost of consulting fees and the high wages of BIM experts.

The next challenge in implementing BIM in construction projects in Kelantan is policy and the role of the government are not comprehensive. According to Jyh and Hung (2018), there are two main approaches used by the country to promote BIM applications, namely the industry-driven approach and the government-driven approach. The government has implemented various laws, such as mandating the use of BIM, to help the construction industry use BIM. On the other hand, using an industry-driven approach shows that although the government has not done much to promote BIM applications, the industry is actively involved in BIM-related activities, and BIM usage is high. Existing policies have not been fully implemented in the construction industry in Malaysia. Although BIM was used before government initiatives such as the PWD project, there is still a lack of assistance, such as subsidies, education, and laws applied. Industry players may be more involved if government policies are implemented comprehensively.

Implementing BIM in construction projects becomes more challenging when many people think that BIM is complicated and difficult to master. Apart from that, they also think that BIM is not important because they tend to follow the scale of the projects, and it takes time to learn the technology. Construction stakeholders are notoriously reluctant to change. They find it difficult to adopt innovative technologies because they are used to paper-based procedures. It is not easy to motivate sceptical individuals to implement BIM (Tan et al., 2019). By adopting BIM, contractors need to leave their comfort zone as they need to train staff and change their way of working. Organizations will face challenges when creating a new environment, as they will face social resistance among communities with the same culture. This is also due to contractors' views on BIM technology, which is considered difficult to master. They believe that experiencing the benefits of BIM is impossible. Changing people's perceptions towards the use of BIM will require a significant cultural shift (Sriyolja et al., 2021).

The final challenge identified in this study is the market demand constraint. This is evident when seven of the respondents have never been involved in a construction project using BIM. Meanwhile, only one respondent uses BIM in the design and planning phase to review and adjust the developed 3D model, coordinate work during the construction phase, and communicate project information more clearly and transparently to subcontractors and suppliers. Uncertainty about the immediate benefits of BIM, especially in the planning stage, and the reduction in time required to draft drawings compared to current drawing methods has led to low demand for BIM (Sriyolja et al., 2021). Clients will only use BIM if it is beneficial, such as providing a high return on investment after its use. As a result, there is a lack of demand for BIM. Moreover, clients also believe that their ability to receive competitive bids will be affected if the contract terms are changed to include 3D models or BIM. The final cost of the project will increase as the number of possible bidders is reduced.

CONCLUSION

The results of the qualitative analysis conducted on eight respondents, consisting of grade G6 and G7 contractors in Kelantan, found that the awareness of BIM in the construction industry is high. However, the awareness of the importance and benefits of BIM to the construction industry in Kelantan is still low. Most of them demonstrated a basic understanding of BIM, which is software that produces 3D objects and is related to new technology, involving the use of computers. Interestingly, some respondents can provide a more comprehensive explanation of BIM, namely that it involves a preparation process that starts from the initial stage before construction begins, to the design stage.

The findings of this study also show that stakeholders in the construction industry are still unclear about the advantages and benefits of using BIM in construction projects. The lack of use of BIM and reference projects that use BIM in Kelantan may be one of the reasons why they have not yet realized the potential of BIM to drive the construction industry towards greater competitiveness. This indicates a knowledge gap in the basic understanding of BIM and the real significance and benefits of BIM when applied to actual construction projects.

This study also found that there are various challenges that hinder the use of BIM in the construction industry in Kelantan. Among the issues faced at the state level are the high cost of BIM infrastructure and installation, lack of local experts skilled in the use of BIM, negative perceptions of the use of BIM, and lack of demand for projects that use BIM. Apart from that, the policies and roles of the government that are not comprehensive have also resulted in the use of BIM in Kelantan being quite limited and not developing. Overall, although awareness of the use of BIM in the construction industry in Kelantan is increasing, all parties such as the federal government, state government, and industry, should work together to increase the use of BIM and address the challenges that arise at the state level. This holistic and collaborative approach is important to create a sustainable BIM ecosystem in Kelantan.

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