

## Barriers of Applying Building Information Modelling (BIM) According to BIM ISO

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### Abstract

Building Information Modelling (BIM) is not a new concept, yet its application in the Malaysian construction industry remains limited. While many practitioners claim to have adopted BIM, they often fail to implement it in accordance with the BIM ISO 19650 standards. Consequently, issues such as cost overruns and schedule delays persist, even in projects that reportedly utilize BIM. Although BIM offers a suite of tools capable of mitigating these issues, limited familiarity with ISO 19650 constrains its effectiveness. ISO 19650 provides a standardized approach to managing information throughout a project's lifecycle. This study aims to evaluate the barriers to applying BIM in accordance with ISO 19650 during the design phase within the construction industry in Johor, Malaysia. An online questionnaire was distributed via email to building designers namely, architects and engineers. The collected primary data were analyzed using the Relative Importance Index (RII). Findings indicate that the low level of BIM practice in Johor is primarily attributed to the lack of detailed guidance and national standards.

### Keywords:

BIM, Barriers, Initiatives.

### Introduction

The construction industry is a vital sector in Malaysia, significantly contributing to national economic growth. With the continuous advancement of technology, industry stakeholders have identified innovative methods to overcome traditional limitations, reduce workload, and enhance productivity. One such innovation is Building Information Modelling (BIM), which has increasingly demonstrated its value in global construction practices.

BIM is a digital tool that generates a three-dimensional (3D) representation of a building project. It consolidates and organizes information from the design stage to support decision-making before construction begins (Hameed Memon, Abdul Rahman, & Memon, 2014). According to Othman et al. (2020), BIM facilitates a transition from fragmented traditional design methods to integrated digital workflows. This shift enables stakeholders—including consultants and clients—to visualize the building as a tangible model rather than relying on two-dimensional drawings, thereby improving comprehension and planning.

**Submission:** 30 July 2021; **Acceptance:** 13 September 2021



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The adoption of BIM provides numerous benefits to stakeholders in the architectural, engineering, and construction (AEC) industries, particularly by enhancing project efficiency and reducing design clashes. Ahmad Latiffi et al. (2013) reported that BIM-based clash detection can reduce contract sums by up to 10% and improve cost estimation accuracy by 3%. Accordingly, BIM tools contribute to higher-quality project outcomes and minimize disruptions such as delays, cost overruns, poor project coordination, and miscommunication among stakeholders.

However, realizing the full benefits of BIM requires strict adherence to ISO 19650 standards, which are often neglected. The international standard ISO 19650, first published in December 2018 by the International Organization for Standardization (ISO), addresses the organization and digitalization of information about buildings and civil engineering works, including BIM (ISO, 2018b). This standard comprises five parts: ISO 19650-1:2018 (Concepts and Principles), ISO 19650-2:2018 (Delivery Phase of the Assets), ISO 19650-3:2020 (Operational Phase of the Assets), ISO/CD 19650-4 (Information Exchange), and ISO 19650-5:2020 (Security-Minded Approach to Information Management).

Non-compliance with ISO 19650 often results in time and cost overruns. Despite claims of BIM implementation, many projects continue to suffer from the same inefficiencies they are meant to avoid (Curda et al., 2018). These challenges are frequently attributed to inadequate understanding or partial application of the ISO standards.

Furthermore, Tahir et al. (2018) emphasize that project delays and cost overruns remain prevalent in Malaysia, even in projects incorporating BIM, due to weak project management and the absence of ISO-compliant practices. Although BIM has the potential to transform the construction industry, Malaysia lags behind other nations in both adoption and standard-compliant implementation.

This paper seeks to identify the barriers to implementing BIM in accordance with ISO 19650 during the design phase, with a focus on the construction industry in Johor, Malaysia.

## **Barriers to Implementing BIM According to BIM ISO in the Design Stage**

### **Personnel aspect**

#### ***Lack of awareness***

Stakeholders are unaware of BIM ISO standards. Despite the BIM benefits for the design phase, BIM's potential usage in the design process remains underappreciated by construction parties. Some designers are satisfied with the conventional method and are unaware of the BIM ISO standards for designing projects, and therefore, they fail to apply BIM to the standards (Haron, Raja Soh and Harun, 2017; Toe and Kong, 2018; Farhan Roslan *et al.*, 2019).

#### ***Lack of competent personnel***

The current workers are less knowledgeable about BIM ISO and lack the technical skills required to perform in BIM (Afsari, 2012; Farhan Roslan *et al.*, 2019; Hoang *et al.*, 2020). Most employees lack time to attend workshops that would help them train and enhance their skills, as their work often occupies a significant portion of their time.

### ***Culture issues***

Some employees have approached technological advancement in a negative mindset. They have declined the opportunity to adopt BIM in the design process, as per the *BIM ISO*. This is due to their attitude, opinion, and mindset (Toe and Kong, 2018). This will eventually lead to conflicts of cultural borders when the organisation is trying to implement a new technology, in this case, BIM (Hameed Memon, Abdul Rahman and Memon, 2014).

### **Technical aspect**

#### ***Short of an actual case study***

There is a lack of real-life case studies or big data on ‘projects according to BIM ISO’, which provides evidence that the implementation of BIM could benefit the organization financially (Haron, Raja Soh and Harun, 2017; Yang *et al.*, 2021). Construction parties are able to promote BIM to clients easily if the evidence shows encouraging results.

#### ***Interoperability***

BIM tools suffer from an interoperability problem to fulfill the requirements of BIM ISO (Chan, Olawumi and Ho, 2019; Yang *et al.*, 2021). The information of the BIM models is unable to combine with other software due to platform divergences. This will lead to the problem of losing BIM data and information (Chan, Olawumi and Ho, 2019).

#### ***Ownership***

It is impossible to decide the model ownership according to the BIM ISO as every team member has contributed their efforts to the project. The design ownership should commonly and legally be held by clients (Hameed Memon, Abdul Rahman and Memon, 2014). Nevertheless, the parties involved, such as architects and engineers for the particular project, must share the model via a common file to amend the design (Su-Ling *et al.*, 2018).

#### ***Lack of contract forms and national standard***

The construction industry in Malaysia is lacking guidelines and details for BIM ISO. The contractual framework and national standard for BIM ISO are important to establish the information that has the best coordination with the organisation’s blueprints to give direction on BIM application in the construction industry. Conventional standards have to be revised for BIM deliverables.

### **Cost aspect**

#### ***Cost of investing in new technology***

The cost of BIM software is considerably high (Ahmad Latiffi *et al.*, 2013; Wu *et al.*, 2021). A substantial amount of start-up capital is required to invest in BIM hardware, software, operational costs, management expenses, and employee training workshops. Introducing an unfamiliar software to the organisation can also be very expensive due to the transformation of the work process (Hameed Memon, Abdul Rahman and Memon, 2014).

## Process aspect

### *Difficulties in shifting from traditional practices*

It is a tough and challenging task to convert the design process from its conventional mode to a digital manner. Some construction organisations sensed that BIM is too complex a software to implement (Farhan Roslan *et al.*, 2019; Tan *et al.*, 2019).

### *Demand from clients*

Clients will refuse to implement BIM in their projects, as they assumed integrating BIM models would influence the receipt of competitive tenders. Integrating BIM will lower the possibility of obtaining potential bidders as well as increase the project price (Baba, 2010, as cited in Hameed Memon, Abdul Rahman and Memon, 2014).

## Research Methodology

Secondary data is widely used for the literature review to have a deeper understanding of BIM software in the Malaysian construction industry. Journal articles and official websites are more often read and referred to. For the primary data, the quantitative method will only be applied to collect the architects' and engineers' opinions to answer the key questions of the research. The questionnaire is distributed to 40 architects and 40 engineers in Johor state via email. Only 28 responses were gained from the total of 80 questionnaires, which represents 35% as the response rate of this research. The statistical tools used for data analysis include frequency distribution and the relative importance index (RII).

## Data Analysis

All relevant barriers are gained and summarised from sources of secondary data such as online webpages and journal articles. The research questions are formulated by using the RII method to rank the barriers (Table 1).

Table 1. RII and Rank based on Overall Data

Aspects	Barriers	Frequency						Mean	RII	Rank
		1	2	3	4	5	Total			
Technical	Lack of national standard	0	2	4	11	11	28	4.11	0.821	1
Process	Difficulties to shift from traditional practices	0	1	6	10	11	28	4.11	0.821	1
Cost	Cost of investing new technology	0	0	8	10	10	28	4.07	0.814	3
Personnel	Lack of competent personnel	0	1	6	13	8	28	4.00	0.800	4
Process	Demand from clients	0	1	7	12	8	28	3.96	0.793	5
Personnel	Lack of awareness	0	1	6	16	5	28	3.89	0.779	6

Technical	Short of actual case study	0	1	9	12	6	28	3.82	0.764	7
Personnel	Culture issues	0	3	7	13	5	28	3.71	0.743	8
Technical	Interoperability	0	0	11	14	3	28	3.71	0.743	8
Technical	Ownership	0	2	11	11	4	28	3.61	0.721	10

### Conclusion

This research concerns the barriers of projects according to BIM ISO during the design stage in Johor state, as well as the initiatives to promote BIM. This research has discovered that the low practice level of BIM according to BIM ISO in Johor is mainly due to the barrier of a lack of detail and guidance of the national standard, and difficulties in shifting from traditional practice. By implementing BIM according to BIM ISO, most projects are expected to run more efficiently, with better end products and value for money for clients.

### Acknowledgements

Not applicable.

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