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

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Abstract

BIM is not new but it is still not widely applied in Malaysian construction industry. Many have claimed to have adopted BIM but failed to have applied BIM in accordance to BIM ISO standards. The issues of cost overrun and time overrun persisted in the BIM construction projects. BIM proved to have various tools that will definitely mitigate the issues but not many are familiar with BIM ISO 19650 to unleash the full potential of BIM. BIM ISO is a standard to manage the information for a project. This research is aimed to evaluate the barriers of apply BIM to the standards of BIM ISO 19650 during design phase in the construction industry in Johor, Malaysia. Online questionnaire is sent through email to the building designers – architects and engineers. After the primary data is collected, the findings are displayed with relative importance index (RII). This research has discovered the low practice level of BIM in Johor is mainly due to the barrier of lack of detail and guidance of national standard.

Keywords

BIM, Barriers, Initiatives.

Introduction

Construction industry is one of the most essential sectors in Malaysia. With the constant improvements on technologies in the construction industry, construction parties have found various ways to overcome certain limitations and decrease workload immensely as well as empower the national economy. One of them is Building Information Modelling (BIM). BIM has proved its value as it has become more commonly utilised in the construction industry worldwide.

BIM is a tool that produces 3D design of a building project. It gathers and organises the information received from the building design before proceeding to the construction phase (Hameed Memon, Abdul Rahman and Memon, 2014). In addition, BIM is able to build up the entire design method from a scattered traditional method to a well-defined digital method (Othman *et al.*, 2020). In other words, stakeholders such as consultants and clients, are managed to view the building in a solid model instead of a flat piece of drawing. This allows the stakeholders to be much easier to visualise how the building looks like in the actual life.

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Adoption of BIM brings benefits to the construction parties. BIM enables the architectural, engineering and construction (AEC) industries to be more efficient and effective due to less clash detection. According to Ahmad Latiffi *et al.* (2013), clash detection by BIM can help to reduce 10% of contract sum and achieve 3% of accurate cost estimation. With this, the BIM tools can perform tasks that allow the construction parties to obtain a favourable project quality and decrease any unexpected disruption during construction such as delay, extra cost, poor construction management and misperception between the construction parties.

However, it takes full application of BIM ISO standards to unleash the potential of BIM and the adoption of BIM according to the standards is low due to certain barriers. The first BIM international standard was published in December 2018, namely ISO 19650 **"**Organization and digitisation of information about buildings and civil engineering works, including BIM" (International Organization for Standardization (ISO), 2018b)**.** It has further developed to five parts. Namely ISO 19650-1:2018 Part 1: Concepts and principles, ISO 19650-2:2018 Part 2: Delivery phase of the assets, ISO 19650-3:2020 Part 3: Operational phase of the assets, ISO/CD 19650-4 Part 4: Information exchange and ISO 19650-5:2020 Part 5: Security-minded approach to information management.

Lack of compliance to level of BIM ISO 19650 lead to time and cost overrun. There are some difficulties that impede BIM to be practiced by the construction parties and such difficulties lead to common time and cost overrun although the project have 'applied' BIM (Curda, et al., 2018). These problems persist although BIM appeared to have applied in these projects.

Time and cost overrun happen due to poor project management and lack of BIM ISO. It has been consistently reported that construction projects including BIM projects still face the issues of cost overrrun. Besides, it has been reported that BIM projects could still face time overrun as part of the poor project management (Tahir *et al.,* 2018). These issues are due to lack of applying BIM ISO.

Although BIM is beneficial to the construction industry, Malaysia seems to fall behind other countries in utilising it as well as applying it according to BIM ISO. There are barriers that affects the BIM implementation for the construction industry in Johor. The main objective of this paper is to identify the barriers of implementing BIM in design phase in Johor, Malaysia.

Barriers of Implementing BIM According to BIM ISO in Design Stage

Personnel aspect

Lack of awareness

Stakeholders are unaware of BIM ISO standards. In spite of the BIM benefits for design phase, BIM is still not fully aware its potential usage in the design process by the construction parties (Afsari, 2012). There are designers who are satisfied with the conventional method and unaware of BIM ISO standards of designing project and therefore they failed 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 of BIM ISO and lack of technical skills that are required to perform in BIM (Afsari, 2012; Farhan Roslan *et al.*, 2019; Hoang *et al.*, 2020). Most employees are lacking time for attending workshops to train and enhance their skills due to their work occupying a lot of their time.

Culture issues
Some employees have approached the technological advancement in a negative mindset. They have turned down the opportunity to adopt BIM according to BIM ISO in the designing process (Chan, Olawumi and Ho, 2019; Farhan Roslan *et al.*, 2019). This is due to their attitude, opinion and mindset (Toe and Kong, 2018). This will eventually lead to the 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 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 show encouraging results.

Interoperability
BIM tools suffer interoperability insufficient 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 by the reason of platforms 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 have contributed their efforts to the project. The design ownership commonly and legally should 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 the guideline and detail for BIM ISO. The contractual framework and national standard for BIM ISO are important to establish the information which has the best coordination with the organisation 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 new technology
The cost of BIM software is considerably high (Ahmad Latiffi *et al.*, 2013; Wu *et al.*, 2021). An immense amount of start-up capital is required to invest BIM hardware, software, operation and management cost and employee training workshops (Hameed Memon, Abdul Rahman and Memon, 2014; Mohd-Nor and Grant, 2014; Su-Ling *et al.*, 2018; Toe and Kong, 2018; Chan, Olawumi and Ho, 2019; Tan *et al.*, 2019). 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 to shift from traditional practices
It is a tough and challenging task to convert the designing process from their conventional mode to a digital manner. Some construction organisations sensed that BIM is too much of a complex 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 will influence the receipt of competitive tenders. Integrating BIM will lower the possibility of obtaining potential bidders as well as heighten 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 deeper understanding on BIM software in Malaysian construction industry. Journal articles and official websites are more often to be read and referred to. For the primary data, quantitative method will only be applied to collect the architects' and engineers' opinions for answering the key questions of the research. The questionnaire is distributed to 40 architects and 40 engineers in Johor state via email. Only 28 responses are gained from the total of 80 questionnaires, which represents 35% as the response rate of this research. The statistical tools used for data analysis are frequency distribution, 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 fathomed out by using RII method to rank the barriers.

Table 2. 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 concern the barriers of projects according to BIM ISO during design stage in Johor state as well as the initiatives to promote BIM. This research has discovered the low practice level of BIM according to BIM ISO in Johor is mainly due to the barrier of lack of detail and guidance of national standard and difficulties to shift from traditional practice. By implementing BIM

according to BIM ISO, most projects are expected to be able to run more efficiently, with better end-products and value for money for clients.

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