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AN INSIGHTS OF BUILDING INFORMATION MODELLING (BIM) IN FACILITY MANAGEMENT: CASE STUDY OF KKR2 TOWER

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ABSTRACT

Building Information Modelling (BIM) is defined as three dimensions (3D) technology that can represent an accurate virtual model of a building. BIM can be used for the designing and planning stage, the construction stage and the operation and maintenance stage. However, BIM used in FM remains limited. This has resulted, the stakeholder does not have the confidence to invest in BIM for managing the operation and maintenance stage of a building. Due to that, this research aims to investigate the level of BIM implementation on Facility Management in KKR2 Tower and to determine benefits of BIM implementation on Facility Management in KKR2 Tower. The research used a qualitative approach by conducting online interviews with the respondent. The finding of the research is based on PWD's management toward the BIM model. The data analysis showed that the level of BIM implementation for handing over documents is already at Level 3 - the illustration of the building plan is provided in 2D and 3D, handing over the document is using the Jcloud server and the BIM model can be accessed by professional teams, client and PWD's asset management. Meanwhile, the benefits of using BIM in Facility Management were agreed by the respondent; reduced cost of operation and maintenance, improved time response, improve documentation system, and enhance workers' productivity and efficiency.

Keywords: *building information modelling (BIM), facility management, Malaysia*

INTRODUCTION

Building Information Modelling (BIM) is defined as three dimensions (3D) technology that can represent an accurate virtual model of a building that will improve the life cycle of a building (Azhar, 2011; Volk et al., 2014). BIM can function to generate, store, manage and share data and information about a building during the planning and design stage, construction stage, and operations and maintenance stage (Hossain & Yeoh, 2018). In developed countries, they have conducted various studies regarding the use of BIM for the design and construction stage, while BIM for the operations and maintenance stage is rarely explored (Carbonari et al., 2018; Dixit et al., 2019). Even the building that has been constructed with BIM usually will end at the construction stage. This has resulted, the stakeholder does not have the confidence to invest in BIM for managing the operation and maintenance stage of a building.

According to Nor Diana et al. (2016) research, some of the FM industry in Malaysia still relies on the traditional method when handling the operations and maintenance stage. In addition, Durdyev et al. (2022) also pointed out that the issue of a traditional method carried out by the FM industry is inefficiencies because the data would be entered manually is considered low-quality documentation and storage of information due to the method is required lots of time-consuming.

As referring to Durdyev et al. (2022) study, have found potential use of BIM for FM is to support the operation and maintenance stage using digital data storage, efficient energy use and act as preventive maintenance. Besides that, BIM can be a key element for FM systems because it is a combination of advanced technology and this is capable to improve the operational workflows (Naghshbandi, 2016). Thus, implementing BIM in the operation and maintenance stage, can reduce the chance of error and increase the efficiency of the work.

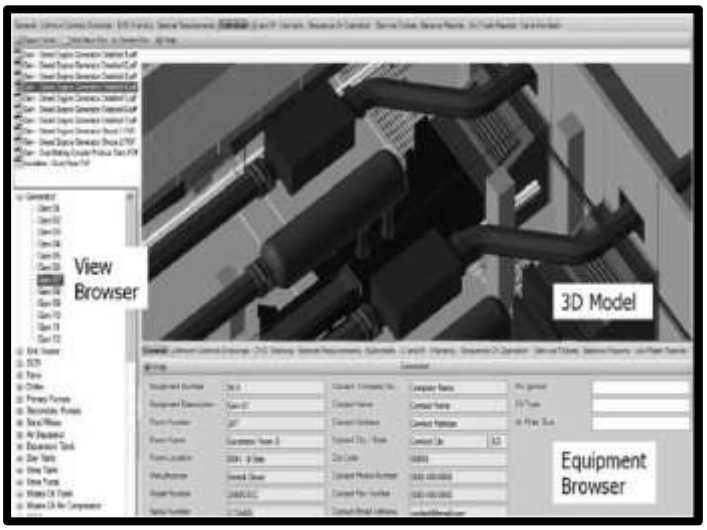
In Malaysia, BIM was introduced in 2007 by the Public Work Department (PWD) and it was implemented in 2009 by the private sector. However, the implementation of BIM in the Malaysia industry mostly focuses on the designing stage and construction stage, meanwhile the awareness of BIM for FM seems limited. Furthermore, the Strategic Plan, 2021-2025 of PWD has targeted the adoption of BIM to achieve around 80% by 2025 (Jabatan Kerja Raya Malaysia, n.d.). Thus, to achieve the target PWD, the FM industry should contribute to the process of implementation of BIM.

LITERATURE REVIEW

The roles of Facility Management (FM) in the life cycle of a building are crucial. This is because good maintenance from the beginning of the operation and the maintenance stage can reduce costs and enhance the condition of the building. The implementation of Information Technology (IT) in the operation and maintenance of buildings will be helpful for the FM to carry out the task efficiently (Carbonari et al., 2018). One of the potential IT that can be implemented in the FM industry is BIM. Where BIM features can become value-adding for FM in managing the operation and maintenance stage because this will improve the ways FM carries out the task (Edirisinghe et al., 2016).

The existence of BIM can be so useful for the FM industry since BIM is an advanced technology that is able to convert raw information to perform various types of analyses but still, the BIM has not been fully utilized for the FM industry. (Naghshbandi, 2016). Moreover, according to Construction Industry Development Board (2016), BIM is an efficient way for FM to carry out tasks because the BIM has features such as; creating and maintaining facilities efficiently by reducing carbon emissions; using a single source that could provide accurate and up-to-date information; and improve documentation of lifecycle data for facility management.

Besides that, since the BIM is as-built documentation, this could be used as a decision-making tool to prepare maintenance plans and to conduct the deconstruction process (Bortolini et al., 2016; Carbonari et al., 2018). Referring to Figure 1, the FM team is able to check and monitor all the building's equipment from BIM software, so this will be easier for the FM to prepare a maintenance plan based on the equipment performance shown on Facility Management Model (Azhar, 2011). The BIM can guide the deconstruction process in terms of scheduling and sequencing, cost estimation and monitoring the deconstruction progress, which will help to reduce errors and financial risk (Volk et al., 2014). Figure 2 is shown the scope of FM that can be covered by using BIM software.



(Sources: Azhar, 2011)

Figure 1: Facility Management Model

(Source: Revit Verse, 2023)

Figure 2: Function of BIM in FM

Last but not least, according to Nor Diana et al. (2016) research, the adoption of BIM in FM has enhanced the quality of life (QOL) among FM employees. The QOL of the employee is important; good QOL will bring good performance of employees while carrying out the task. One of the QOL that BIM provides is working flexibility, where the employee can use the BIM as a platform for collaboration and communication. Thus, the FM should consider implementing BIM in managing the operation and maintenance of the buildings instead of relying on traditional methods (Carbonari et al., 2017; Durdyev et al., 2022).

Level of Building Information Modelling Implementation

Based on the Construction Industry Development Board (2016), as shown in Table 2.1 there are 4 levels of BIM implementation.

Table 1: Level of BIM implementation

LEVEL	DESCRIPTION
0 - Conventional	2D Manual and CAD-based
1 - Modelling	Single disciplinary use of object-based 3D modelling software within one discipline
2 - Collaboration	Sharing object-based model and data between two or more disciplines
3 - Integration	Integration of several multi-disciplinary models and data using model server or other network-based technologies

(Sources: Construction Industry Development Board Malaysia, 2019)

Level 0

Level 0 BIM means there is no collaboration among professionals in each stage (Design stage, construction stage, and operation and maintenance stage). This is when the project is managed manually using tools such as CAD drawings and spreadsheets. In this level of BIM implementation, communication of design information is considered at a poor stage. For example, design using some symbols that only a professional can understand so can lead to misunderstanding for other professional teams (Construction Industry Development Board, 2016).

Level 1

Level 1 BIM is digital information based on a 3D Model. Besides that, BIM application used to standardize the design or construction activities is limited to internal use. However, during this level, object-based 3D modelling is used by a single discipline. Where the implementation of BIM only occurs among the organisation in the isolated situation (Construction Industry Development Board, 2016).

Level 2

Level 2 BIM is when collaboration between two or more disciplines is based on a 3D Model with digital information. Next, the information on construction is managed in a 3D structured manner and the information can be shared using a specific platform. By using the multidiscipline model this is a function to promote collaboration among professional teams. During this level, the common standard may be used for collaboration between different disciplines (Construction Industry Development Board, 2016).

Level 3

Level 3 BIM is the highest level of BIM implementation, this level is an integration of 3D Model and digital information using a based application network or cloud. The use of the cloud-based model function to improve collaboration and coordination throughout the construction process. At this level, only a single source of information on the cloud is used (Construction Industry Development Board, 2016).

Benefits of Using Building Information Modelling in Facility Management

Even though the use of BIM in FM is limited, some researchers have found various potential benefits can be enjoyed by FM. Table 2 shows the most benefit that has been mentioned by researchers.

Table 2: Benefits of Using BIM in FM

No.	Benefits	Authot & Year
1	Reduce Cost of Operation and Maintenance	Hoang et al. (2020) Lalith (2016) Nor Diana et al. (2016)
2	Improve Response Time	Eastman et al. (n.d.) Hoang et al. (2020)
3	Improve Documentation System	Nor Diana et al. (2016)
4	Enhance Workers' Productivity and Efficiency	Al-Ashmori et al. (2020) Hoang et al. (2020) (Othman et al., 2021)
5	Promote Collaboration among Professional Team	Al-Ashmori et al. (2020) Hoang et al. (2020) Nor Diana et al. (2016)

(Source: Researcher, 2023)

Reduce Cost of Operation and Maintenance

BIM has the potential for cost saving, where based on research conducted by Lalith (2016), found that one case study is able to cost saving around 5 to 10%. Besides that, according to Patacas et al. (2020), BIM can provide information that will become a source for FM to prepare or estimate the accurate financial cost to carry out operation and maintenance work (Nor Diana et al., 2016). Thus, any unnecessary cost may be cut.

Improve Response Time

BIM has a feature of decision-making tools that will help the FM to detect and visualize any failure that occurs (Construction Industry Development Board, 2016). This intelligence feature also could provide suitable decisions or solutions that should be taken by the FM. Thus, the FM could take immediate action whenever a failure occurs and prevent any worst situation from happening.

Improve Documentation System

The study made by Liu & Issa, (2016), found that data that has been collected using BIM can be used for the whole life cycle of a building. This is because by using BIM, the data is digitally stored in the BIM cloud and managed in a single file concept, so the data can easily be found and exchanged within the team collaboration; i.e., architect, building engineer, construction manager and facility manager.

Enhance Workers' Productivity and Efficiency

One of the main benefits is enhancing workers' productivity and efficiency (Al-Ashmori et al., 2020). Since the feature of BIM is a single file concept, this will be easier for the workers to find any information related to the building with one single click. Besides that, the document in the BIM will automatically be generated and updated to make the data up to date (Construction Industry Development Board, 2016).

Promote Collaboration among Professional Teams

The collaboration among the professional teams may be improved internally and externally (Edirisinghe et al., 2016). According to Lee et al. (2016), BIM can virtually present the building model in 3D, which can increase the FM level of understanding regarding the information provided in BIM. The 3D model is better than 2D graphic because 2D graphic sometimes consists of several symbols that usually would only be understood by professionals such as architects and engineers, this could be difficult for the FM to understand the graphic.

METHODOLOGY

The method used in the research is qualitative research method. As referred to research by Durdyev et al. (2022), a structured interview may be carried out in order to clarify something regarding BIM from qualified experts. The structured interview questions that have been prepared as a guide during the interview session and the interview session took around 30 minutes. Based on the interview question, this allowed the respondent to share his opinion regarding the topic in depth. The respondent is the PWD's BIM Executive; only one respondent in the research due to the limitation of BIM implementation in Facility Management in the government sector. The data is analysed using transcribe technique; turning spoken words into a written statement.

ANALYSIS AND FINDINGS

Only one respondent is managed to obtain for the research due to the limitation of BIM implementation in Facility Management in Malaysia. However, the respondent of this research is an expert person regarding the BIM Model. As mentioned by the respondent, PWD is at the early stage to implement BIM in FM for the operation and maintenance stage.

The respondent is a government worker who has working experience more than 20 years. One of his job scopes is handling the BIM model for the project under the Public Work Department (PWD). Table 1 is showed the respondent's profile in terms of gender, age, work position and working experience.

Table 3: Respondent's Profile

Respondent	Gender	Age	Position	Working Experience
Respondent 1	Male	41 – 50 years old	BIM Manager	20 years and above

(Source: Researcher, 2023)

Level of Building Information Modelling (BIM) Implementation in Facility Management

Based on the Construction Industry Development Board Malaysia (2019), there 4 levels of BIM. Start with Level 0 – Conventional, Level 1 – Modelling, Level 2 – Collaboration and Level 3 Integration. The research has conducted an investigation on the level of BIM implementation on Facility Management in KKR2 tower, the respondent has answered the research question as follows:

"The existence of BIM has changed the process handing over of as-built drawing of building from using paper into model…the client will receive the file in native, this means the client able to edit the document…At the end of the project, the contractor is required to upload a file of the BIM model into the cloud server developed by PWD which is known as Jcloud." (Respondent 1)

"…the illustration in 3D and 2D. Both of view is able in the model file. 2D view is showed the layout plan, elevation, section, front view, rear view and other." (Respondent 1)

"…the document received can be accessed by the client. Even PWD's Asset Management also has access to the document. Other than that, the designer and contractor still have access to the document since they just upload the document using Jcloud." (Repondent 1)

"The system that can access the BIM model features is using Archibus software. However, Archibus is expensive software. Mostly government building is managed by concession using a regular system such as CWorks but this system is unable to read the BIM model." (Repondent 1)

Based on the respondent's answer is shows that currently the level of BIM implementation is starting been improved into level 3, in 2016 the implementation in Malaysia was between level 0 and level 1 (Harun et al., 2016). Due to the illustration of the building plan is provided in 2D and 3D. Besides that, the illustration of the BIM model is uploaded to Jcloud by the designer and contractor, so the client and PWD's asset management will be able to access the BIM model. Where the existence of the BIM model has replaced the as-built drawing on paper.

Benefits of Building Information Modelling (BIM) in Facility Management

According to Azhar (2011), BIM in FM can be used for renovation, space planning and maintenance operations. Since BIM is intelligent technology, this is an opportunity that should be grab by the FM industry to improve current FM practices (Bortolini et al., 2016). There are several literature reviews have highlighted the benefits of BIM for Facility Management, so the research wants to determine the true

benefits that have been mentioned before. The response of the respondent regarding the benefits of using BIM on Facility Management in KKR2 Tower is as follows:

"BIM in Facility Management can reduce the time searching for documents because all information can be obtained from the BIM model. Before this, everything is on paper and file, this becomes difficult to check the warranty, supplier, and brand of the equipment. BIM definitely can reduce time work, when time is reduced, automatic will reduce the cost." (Respondent 1)

"Time response will be faster due to FM already aware of the location." (Respondent 1)

"The ultimate benefit when implementing BIM; BIM provides information. Before the existence of BIM, the information is disorganized, as because information on building components is given in different papers and files. But when using BIM, all component information that is required in the phase of FM is provided in one place." (Respondent 1)

"…time searching for information can be reduced, so this will increase the productivity of the worker. This is because before this a worker takes around 2 to 3 hours to find the information; looking at the cabinet, open file one by one. But with BIM, the worker can get the information within a few minutes." (Respondent 1)

"Even by having a contact number of professional teams but if the person refuses to answer, this will become a problem for the collaboration." (Respondent 1)

The respondent agrees with 4 over 5 benefits that have been mentioned in this research. Where he agrees about the BIM model reduces the cost of operation and maintenance, improves time response, improves the documentation system, and enhances workers' productivity and efficiency. However, the respondent has expressed he feels hesitant about BIM's benefit in terms promote collaboration among professionals.

CONCLUSION

In conclusion, the findings show that the BIM implementation for handing over has reached level 3 because have elements of a 3D illustration of the building plan, the model can be accessed using the Jclould server by the internal team such as contractors, designers, clients and PWD's asset management. Meanwhile the benefits of using BIM in Facility management, the respondent only agrees with reducing the cost of operation and maintenance, improving time response, improving the documentation system, and enhancing workers' productivity and efficiency. The future researcher is advised to conduct the research by getting the facility management that manages private buildings instead of focusing on government buildings or may re-conduct this research when the BIM used in FM in Malaysia has been fully stable.

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