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The Effectiveness of Building Information Building (BIM) for Precast Building Maintenance in Malaysia

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KEYWORDS

Building Information Modelling (BIM)
CMMS
Precast Concrete
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ABSTRACT

In this paper, the investigation of the usage of conventional method (paper-based report, MS Word and MS Excel) affecting the cost at the end of building life cycle and work quality of an engineer performing performance action. Then, to identify the requirement of integrating BIM and Computerized Maintenance Management System (CMMS) for effective precast building maintenance need to be achieve. To achieve this qualitative technique (semi structure interview) need to be applied. From the experimental works result showed that there are two requirements to support BIM and CMMS integration in maintenance management which is a complete and organize data and compilation of a standard requirement that stated by the department (e.g., Fire and Rescue Department of Malaysia, Syarikat Air Selangor and JKR) were understood. From these results, it can be concluded that the construction of critical part of the maintenance management system that employs developing technologies to assist engineers at precast building in enhancing their current maintenance management procedure.

1. INTRODUCTION

Technology is evolving at a breakneck pace in this era of globalization, and this technology is developing in a fraction of the time it took before. New technology's contribution in economic growth, on the other hand, can only be achieved if it is broadly embraced and exploited. However, in the 1960s where then in 1964 the Government took bold step of launching two pilot projects in the IBS idea [1]. As we know IBS in Malaysia consist of precast concrete framing system, prefabricated timber framing system, blockwork system, reusable formwork system, steel frame system and innovative mold (A. Mohsen et. al, 2019)[2] Precast concrete framing system will be the main focus of this research due to precast concrete demand by architect and engineer as mention by CIDB (2017)[3]. Hence, IBS is a method that can be cost effective where IBS helps in quick completion and also increase the quality of the end product.

Whilst IBS is in great use during construction of a precast concrete building in contrast to the maintenance management system for precast building because in maintenance management shows unsatisfactory results (problem in defect diagnose) which make the cost of the post-construction increase. Maintenance management system that are used at every precast building have shown poor performance and this maintenance management system that commonly used by some organization are MS Word, MS Excel and paper-based report (Malek et al., 2016)[4]. Ismail et.al (2016)[5] revealed that the current output of the performance of the usage of CMMS falls well short of the best practice expectation and that the usage of emerging technology such as Building Information Modelling (BIM) is finite. Moreover, BIM is considered as one of the most popular technologies since BIM enables a streamlined workflow across the project's many stages which is design, construction, operation and deconstruction (Barazzetti et al., 2015)[6]. As mentioned by Valdepeñas et al (2020)[7], the benefits of BIM in maintenance management which BIM provided three-dimensional visualization to represent the building infrastructure inspection history and storage, existent of parameterization in the modelling system, ease of locating elements and assets on the infrastructure and lastly connection and information exchange between the BIM and CMMS tools.

Furthermore, Ismail et al (2015)[8] identified from previous study that by utilizing the latest technology (e.g. BIM) it shows potential in the construction industry including the maintenance management which help in sharing information throughout the project between client and architect-contractor. BIM also widely implemented for design coordination and clash detection (NBS, 2019)[9]. BIM shown a promising of upgraded performance of maintenance management so that the workload of the engineer can be done more effectively. Therefore, in order to increase the potential usage of BIM in precast building maintenance, management needs to acknowledge more on the latest technology in maintenance management by trying to plan strategies and implementing BIM to enhance the precast building maintenance system.

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2. EXPERIMENTAL PROCEDURE

Research design assists researchers in arriving at answers to research questions while successfully managing variation by giving reasoning that connects the data to be collected to the initial research questions (Vaisnys et al., 2016)[19]. Figure 1 depicts the flow of the research project, which contains three phases. Figure 1 below represents the workflow of the research.

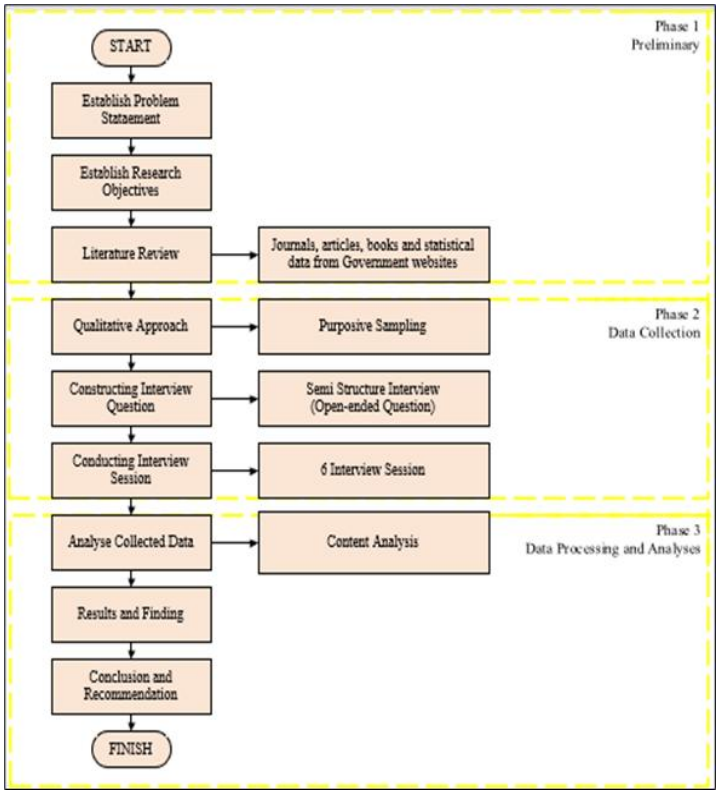

Figure 1. Flowchart of The Research Design.

3. RESULTS AND DISCUSSION

The six interviews that was done in this study is to help identify the requirement of CMMS and BIM integration for precast building maintenance. To identify that, first thing that needed to be acknowledge are technology use for precast building maintenance, shortcoming of using the technology, improvement needed from using the technology, and factor preventing from implementing developing technology. The findings from the respondents are summarized and presented in Table 2 below.

Table 1 Summary of Findings from the Respondent

Respondent	**Technology Use**
A	- Paper-based report and mobile application for maintenance
B	- Paper-based report
C	- Paper-based report and SCADA
D	- Paper-based report
E	- Paper-based report
F	- Paper-based report and emailing system
Respondent	**Shortcoming of Technology**
A	- Data is incomplete and disorganization of the data - Transferring of information
B	- Data is incomplete and disorganization of the data - Transferring of information - Human error
C	- Data is incomplete and disorganization of the data - Human error
D	- Data is incomplete and disorganization of the data - Transferring of information
E	- Data is incomplete and disorganization of the data - Security issues - Lack of storage
F	- Transferring of information
Respondent	**Improvement of Technology**
A	- Organized data properly in the report - Use developing technology
B	- Construct more reliable report for defect - Use developing technology
C	- Organizes data properly in the report - Use developing technology
D	- Organize data properly in the report - Use developing technology
E	- Organize data properly in the report
F	- Use developing technology
Respondent	**Factor Preventing from Implementing Developing Technology**
A	- Lack of knowledge of functionality of BIM itself
B	- Cost of implementing the technology - Lack of knowledge of functionality of BIM itself
C	- Cost of implementing the technology - The ability of a company in growing its skill more on maintenance but due to assumption of that maintenance have a minimum amount of work on maintenance the company not investing more on maintenance. -
D	- Cost of implementing the technology - Lack if knowledge of functionality of BIM itself
E	- Cost of implementing the technology - Competency of staff using BIM - The ability of a company in growing its skill more on maintenance but due to assumption of that maintenance have a minimum amount of work on maintenance the company not investing more on maintenance.

Based on the summary above, it appears that almost all of the respondents have the same thoughts about their maintenance management system. Whereas mostly all six respondents used the conventional method, which is a paper-based report, respondents A and C use a mobile application and SCADA. The technology used by respondent A helps in data storage in an organized way but does not provide any defect diagnosis or decision-making process. For respondent C technology help in gathering data in real time from a remote location in order to regulate equipment and conditions.

Even though the respondents all agreed on the utilization of developing technology which help improve maintenance management system but still respondents are unable to utilize the technology. As mentioned from summary above, some of the factors that discourage the implementation of developing technology are lack of knowledge of the BIM functionality itself, cost of implementing the technology and ability of a company in growing its skills more on maintenance.

Furthermore, out of the three respondents, only one have the knowledge of BIM having a functionality that can be use in maintenance and respondent C mention that BIM is a great tool to be use in maintenance. The reason of respondent C having the knowledge of BIM in maintenance is owed to the respondent's company sending staff to BIM workshop at Construction Industry Development Board (CIDB). Due to the knowledge of respondent C about BIM functionality in maintenance, respondent C can provide answer about requirement of information needed to support CMMS and BIM integration for effective precast building maintenance. Respondent C stated that provide a checklist of

requirement standard of a component example from Fire and Rescue Department of Malaysia, Syarikat Air Selangor, or Jabatan Kerja Raya (JKR) this department have their own standard requirement that one building need to comply. From there all the standard requirement are compile and to be included in the BIM software.

4. CONCLUSION

There is a total number of six respondent that was interviewed and the information that were gather were used to identify the requirement of CMMS and BIM integration for an effective precast building maintenance. The requirement that needed to support CMMS and BIM integration in maintenance are as follow:

- A complete and organize data of the defect area for example history of component, date, location of defect type of defect, reason of defect, picture, the person that inspect the defect, and many more. By key in the data in the CMMS which construct a more accurate and detail report of a defect from there when integrate with BIM then a diagnosis will be conduct to identify whether the defect is major or minor and on how to repair the defect.
- A compilation of a standard requirement that stated by the department (e.g., Fire and Rescue Department of Malaysia, Syarikat Air Selangor and JKR). This checklist of department then can be input into the system into enhance the maintenance department in repairing the defect which the defect will be in the compliance of the department standard stated above.

Overall, usage of technology to assist maintenance procedures and activities can have a positive influence on service delivery. Various approaches have been developed to aid decision making in IBS building maintenance diagnostics. Yet, efficient practice necessitates the use of a system capable of providing good decision-making help in diagnosis. It can be concluded that integrating CMMS and BIM technology will improve precast building maintenance.

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