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Implementation of Building Information Modeling (BIM) in Malaysia Construction Projects Life-Cycle

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ABSTRACT

BIM has existed for more than 20 years across the globe, yet the awareness and benefits of BIM has only been realized in last few years in construction projects. Nevertheless, in Malaysia the lack of details, ambiguity, fragmentations, and poor knowledge in executing BIM technology have hindered the building performance. Although the potential benefits of BIM are well documented, the implementation process is still unsystematic and requires a standardized plan complete with expert hands-on to execute BIM in construction projects. Hence, the objective of this paper is to explore the implementation of BIM in Malaysian construction project life-cycle. The research engaged semi-structured interviews with four respondents from the public and private organisations. Data from the interviews were analysed by using content analysis techniques. The findings revealed that three (3) critical phases contributing to successful BIM implementation in Malaysia are: pre-construction; construction; and post-construction phase. The results of the research could provide an insight into the Malaysia construction projects and will provide a valuable guideline in managing BIM for construction projects.

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INTRODUCTION

In Malaysia, the deployment of computer-based technology in construction, particularly BIM, is described by many researchers and practitioners as a processes and new IT tool that could serve as a solution to a number of inefficiencies in the construction environment (Muafi, R.H., *et al*., 2012; Takim, R., *et al*., 2013). The reasons are to capture and store information systematically, and to prevent loss of process continuity during project implementations, especially for construction projects (Lutter, S., 2007). Through the agenda of Malaysian Government National Key Economics Areas (NKEAs), the AEC organisations have aggressively embraced new technology in order to remain competitive in the current market (Alshawi, M., *et al*., 2010). Hence, BIM applications have grown tremendously, from a tool to design in three dimensions, used for model analysis, clash detection, product selection, and whole project conceptualization (Weygant, R.S., 2011).

Despite the industries' awareness on the potential of BIM which has existed for over 20 years, Malaysia had only started to focus on the benefits of adopting BIM in construction since 2007 to increase the efficiency of construction projects. However, BIM initiatives in Malaysia are currently uncoordinated (JKR, 2013) that lead to local construction organisations (public and private) are reluctant to deploy the technology in its service delivery. Nevertheless, of late, the initiatives by Public Work Department (PWD), Construction Industry Development Board (CIDB), Sime Darby Property Berhad (through carbon-zero Sime Darby Idea House project which showcases the latest innovation in eco-architecture, high performance design and modular construction) and other agencies are seen to be encouraging in adopting BIM for local construction projects (Latiffi, A.A., *et al*., 2013; Zahrizan, Z., *et al*., 2013).

Problem Statement:

The issues of conflicts, complexities, uncertainties and ambiguities with traditional practices (i.e., business model, process, legal and compensations schemes) in implementing construction projects which attributed to the fact that the industry is made up of separate parties from diverse professions that operate by their own rules.

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However, technology of ICT alone cannot influence the collaboration of separate parties in construction environment. Hence, the integrative use of BIM for the building lifecycle is seen to integrate the disjointed practices, and act as the catalyst for changing business process (Aranda-Mena, G., *et al*., 2009). Nowadays, BIM has been implemented advanced in many developed countries for their construction projects. Those countries are currently at stage 2 (model-based collaboration) while Malaysia is still crawling on pre-BIM stage (Haron, A.T., 2013). Hence, the focus on BIM must be given to increase the quality and productivity in construction industry. This indicated there are still rooms for improvements in the support from the government in introducing BIM in the industry (Zahrizan, Z., *et al*., 2013). Furthermore, due to the lack of knowledge of BIM and the low level uptake by the Malaysian construction industry players, the implementation of BIM in Malaysian construction industry thus lies between level 0 (CAD-based) and level 1 (object-based collaboration) (Zahrizan, Z., *et al*., 2013). This is for the fact that the low adoption from top management of major project clients, whom are regarded as the key drivers on the user of BIM, to understand the benefit brought about by BIM and to plan their organisation to get prepared for adoption the BIM in term of setting up the demand for BIM projects (Jones, S.A., 2009; Azhar, S., *et al*., 2009; Harris, M., *et al*., 2014). Hence, the objective of this paper is: to explore the implementation of BIM in construction project life-cycle.

Methodology:

The methodology used for this research is based on purely qualitative research techniques. The qualitative research paradigm demands an in depth understanding of a phenomenon, an individual or a situation (Merriam, S., 2002). In this paradigm, qualitative research technique is more to know how people do things and what meaning they give to their live rather than on people's surface opinion as in survey research. Hence, samples were randomly selected from the listing provided by BIM committee (the public and private organisations) that had experienced of using BIM for their projects. Semi-structured interviews were conducted among four respondents from the public (3 respondents) and private sectors (1 respondents) for the preliminary data collection. The face-to-face interviews were designed to gather preliminary data on BIM application in construction projects. The interviews were recorded and transcribed verbatim for content analysis.

Table 1 shows the information on the respondents that were involved in interviews. Majority (75%) of them has more than 10 years' working experience in the industry and an average of 6 years in BIM (since 2007). Hence, it is reasonable to infer that respondents have a wide-ranging knowledge in BIM and can provide relevant and reliable information.

Table 1: Profile of respondents and their experience

Res	*Organisations*		*Designations*	*Experience(years)*	
	Type	*Name*		*Industry*	*BIM*
R1	Public	Construction Industry Development Board	Senior Manager	20	6
R2	Public	Jabatan Kerja Raya (PWD)	Prin. Ass. Director	27	7
R3	Public	Perumahan Rakyat 1 Malaysia (PRIMA)	Ass. Vice President	8	6
R4	Private	Sime Darby Property	Head of Development	18	5

Data Collection and Findings:

Table 2 presents the results on the BIM implementation in construction project life-cycle. The use of BIM in integrated environments leads to the new ways of working that result in more accurate, predictable and effective building outcome. From the interviews, most of the respondents agreed that for successful BIM implementation occur in all phases during the construction project life-cycle. As stated by R2 *"BIM occurs in every phase of construction project lifecycle, especially from the beginning of project phase until completion, the benefits of it also could be seen in the long run for business potentials and agility."*

Table 2: Result of BIM implementation in Malaysian construction project life-cycle

Res.	*Phase*		
	Pre-construction	*Construction*	*Post-construction*
R1	√√		√
R2	√√	√	√
R3	√√	√	√
R4	√√	√	√

*Note: √√ highlighting the importance is more in particular phase

Based on the result, R1 and R2 agree that the pre-construction phase using BIM technology tools to assist in conceptual and design development process. However, there is a risk of adopting the tools in the project, depending on the experience from the team members (Azhar, S., *et al*., 2009; Harris, M., *et al*.,

2014). It is supported by the statement of R3 that emphasised on the *"differences of project variables such as project teams, project types, locations and so on lead to the difficulty of plan for BIM at the early, thus an ample BIM software in the market such as Revit, Bentley, Graphisoft ArchiCAD, Tekla Structure, Naviswork and etc needs a comprehensively hands-training classes until they are conversant with the tool in order to make it effectively".* This is due to the facts that there are so many BIM technologies that had grown and change the construction industry for the better. This is in line with the (Latiffi, A.A., *et al*., 2013) that emphasized that the BIM application during in pre-construction stage is more important because it involves activities such as design, scheduling, and estimating that requires BIM software's applications. Despite each player seeing its own opportunities, most of them recognize that value can be gained by improving the ability of team members to share data and integrated collaborative processes (Jones, S.A., 2009). The above statement is supported by the R4 who indicated that "*it is important to identify the responsible parties in the early stage of the projects besides the BIM tools. Each party will perform the task based on the requirements from the BEP guideline. Parties in the project could be architect, M&E and C&S consultants, quantity surveying, planner and others. Therefore, each discipline is to be involved*". The statement also inclined with R2 that *"the first thing that needs to achieve is the collaboration and understanding the concept of BIM itself. In Malaysia, BIM is considered as new and not all people can adopt the concept in the right manner. Hence, to make it realize, we must develop a dedicated team to support and help each other's, this how collaboration comes in. The information exchange among teams could happen when they realize how important to deliver a successful project outcomes (i.e., cost, time and quality)".* This resulted for improvement in decision-making and building quality.

Second, the construction phase that associated tasks including scheduling, constructability, and trade coordination represents on 'typical' construction projects. R2 highlighted that "*the tasks can be accomplished in concert with the architectural and engineering project teams to enable better coordination in construction projects*". It has been verified by (Azhar, S., *et al*., 2009) that activities in construction phase includes progress monitoring, coordination meeting and integrating RFIs in the BIM models through the continuously update the model. As pointed out by the R4 "*our organisations's objective regarding BIM is to deliver the project in an effective manner, within the cost, time and quality through regular site inspections and review of progress. Thus, adopting BIM now for our new projects is inevitable so that technical project data are captured and stored throughout project phases systematically"*. This statement corroborates with the idea of (Aranda-Mena, G., *et al*., 2009) that to see the comprehensive benefits of BIM, it should start from the early stage of construction commencement by exploring digital model before the actual product is constructed. Whilst, R3 ascertained that "*in construction phase when all the structural elements are in, a lot of people don't realize that all of things will bring the effect on the aesthetic value. So, if you are looking BIM at the early stage as 3D visualization, you can see the entire actual model for the project*". This is in line with (Hardin, B., 2009) that, the most important benefits in construction phase is the improvement of construction management.

Although the findings from the above interviews are very useful in pre-construction and construction phase, the findings are still not comprehensive. The use of BIM is still new in our industry and the respondents interviewed in the study can be considered first users involved in BIM project currently in Malaysia. There is not much evidence in the post-construction phase since there is no clear understanding how BIM can help in post-construction phase to the owners. It has been added by (Smith, D.K. and M. Tardif, 2009) that besides the owners, the facility manager are unable to indicate clearly the information they need and tools that can be used effectively. Furthermore, R1, R2, R3 and R4 indicated that another phase worth to consider is post-construction phase but they still did know how BIM could be used in post-construction phase. It is highlighted by R3 that *"Malaysian industry is still at infant stage in BIM implementation, and our industry is not yet ready to have an advanced BIM implementation up to the end of construction life cycle phase (post-construction) because we not yet produce any successful BIM implementation project with full use of BIM concept".*

Hence, the findings revealed that all respondents unanimously asserted that in order to become competitive and to be in line with the international construction players, adopting BIM technology in construction is inevitable for the Malaysian construction industry. Moreover, three (3) utmost critical phases which are pre-construction; construction; and post-construction have been addressed by the respondents to influence the implementation of BIM in construction projects.

Conclusion:

This paper has presented the findings on the the implementation of BIM in construction project life-cycle. The phases of construction project life-cycle have been addressed as the utmost critical components. It has been proven through detailed interview results. Hence, the respondents tend to suggest that the most important implementation

process occurs across project phases and pre-construction phase is the main target of succesful BIM projects. The result of the study could offer as valuable guideline for BIM implementation in Malaysian construction industry through incorporating those phases earlier. The details of the construction project life-cycle phases in the form of a case study analysis approach will be reported in the next research.

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