PRIORITIZING BUILDING INFORMATION MODELING (BIM) INITIATIVES FOR MALAYSIA CONSTRUCTION INDUSTRY

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ABSTRACT

Building Information Modeling (BIM) is identified as a key technology and process to improve productivity and increase integration across various disciplines throughout the construction value chain. BIM necessitates a different way of thinking and behaviour compared to traditional project handling. Successful BIM usage depends on collective adoption of BIM across the different disciplines and support by the client. Thus, for a successful implementation, there must be targeted BIM initiatives at national level to ensure wider adoption of BIM. This paper describes ideas and issues around the development and prioritizing the BIM initiatives to be undertaken in Malaysia construction industry. The research used a *four step process* to identify the priority initiatives for BIM implementation. The contribution from this research is to propose a priority BIM initiative that will be used at a national level in implementing BIM. Eight (8) high impact and implementable priority initiatives had been identified which are proposed to be implemented in Malaysia for the next 5 years.

Keywords: Building Information Modelling, BIM, Strategic Planning, Initiatives, Implementation

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INTRODUCTION

Most industries are dynamic in nature and the construction industry is no exception. Its environment has become more dynamic due to the increasing uncertainties in technology, budgets, and development processes (Ahmed, et.al., 2010). Since independence in 1957, the Malaysian construction industry has developed from a low-tech, labour intensive, craft-based industry to one that has a capacity to deliver advanced buildings and infrastructure, using innovation of mechanized production techniques (ibid). As Malaysia progressively moves towards industrialization, the role of the construction industry is greatly enhanced, with the idea of transforming the aspirations and needs of people into reality (Sahoo et.al., 1993).

The latest incursion of technology into the nation is Building Information Modeling (BIM). BIM methodology seeks to streamline the construction processes, present construction information in an accessible and common way, minimize the possibility of clashing or

redundancies of object that being represented at different scale and to ensure optimised project coordination (Eastman, 2008; Hooper and Ekholm, 2010). To achieve that, BIM should integrate the information from the initial stage before the project commenced. As such, BIM is an integrated various construction process of generating and managing a building by exploring a digital model before the actual project is constructed, during its construction and later facility operation and maintenance (Luthra, 2010). In line with Ariyaci et al. (2012), BIM is defined as the use of ICT technologies to streamline the building lifecycle processes to provide a safer and more productive environment for its occupants, to assert a list of possible environmental impact from its existence, and to be more operationally efficient for its owner throughout the building lifecycle.

BACKGROUND

BIM implementation serves as a useful alternative to addressing key construction sector issues, and offers solutions to these in order to increase productivity, efficiency, quality, reduce costs, lead times and duplications, via effective communication with stakeholders in remote construction projects (Hanif et.al., 2010). BIM applications has grown tremendously, from a tool to design in three dimensions and use of components, to a tool that is used for model analysis, clash detection, product selection, and the whole project conceptualization (Weygant, 2011). The introduction of BIM should avoid many of the conflicts which arise as a result of poor perceptions of project information (Naik and Gupta, 1996). Hence, BIM can be thought of as a database of the building project. The information in this database spans the full range of data as an integrated data set. As such, BIM integrate the information created by many industry domains (JBIM, 2007).

Today, many public and private organisations are experiencing conflicts, complexities, uncertainties and ambiguities with traditional practices in implementing construction projects (Khosrowashahi and Ariyaci, 2012). The involvement of a multitude of participants in design environments contribute to the poor design information, inaccurate information transfer and wrong deliveries, made the construction industry a highly fragmented business (Ibrahim, 2006; Motsa et al. 2008; Othman, 2011).

These issues are attributed to the fact that the industry is made up of separate parties from diverse professions that operate by their own rules. However, technology of ICT alone cannot influence the collaboration of separate parties in construction environment. The integrative use of Building Information Modelling (BIM) for the building lifecycle is seen able to integrate the disjointed practices, and act as the catalyst for changing business process (Aranda-Mena et al. 2009). Nowadays, BIM has been implemented in many countries such as United Kingdom, Singapore, Finland, Sweden, France, Germany and Australia. Nevertheless, Malaysia has now begins to adopt BIM technology since the official introduction by Director of Public Works (PWD) during the opening of Infrastructure & Construction Asia's Building Information Modeling and Sustainable Architecture Conference in 2009. The idea of BIM was introduced to maximize the value of investment throughout the development plans and employed various ICT solutions in its strategies.

According to Haron (2013), fragmentation, low productivity and time and cost overrun which is rooted at the change order, inadequate drawings and specifications, late issuance of construction drawings by consultants and the interrelated problem of coordination between consultants are among the issues that require BIM to be implemented effectively. Therefore,

BIM is believed to be a solution to many significant problems that occur in the construction industry. The phenomena of BIM has emerged in the construction industries across the world.

Meanwhile, the participation of government towards BIM in Malaysia is through the first government's project; the National Cancer Institute in Sepang, Selangor which was officially announced in 2010. The NCI project was completed three weeks earlier from the actual date of expected completion. This pilot project had proven the benefits of using BIM that could shortened the construction period besides facilitating problems solving at the early stage of a project lifecycle.

METHODOLOGY

The research is being carried out through 4-step processes; starting with a literature search and review including global benchmarking, which reviews the strategic planning of BIM initiatives from 4 different countries i.e: United Kingdom, Australia, Singapore and Hong Kong. Then continue with engagement with local stakeholders and BIM experts through series of workshops and structured interview beginning November 2013. The wide spectrum of potential BIM initiatives obtained from these processes is then prioritized using the prioritizing tools that utilized Impact (Imp) and Ease of Implementation (EOI) as the predetermining factors. Finally, the high score of Imp and EOI is presented to a Focus Group for validation and final selection.

SELECTION OF THE PRIORITY BIM INITIATIVES

In the light of many countries advancing in BIM technology, Malaysia had realized the importance of planning a strategy towards its implementation. In order to be competitive at the international level, Malaysia is now beginning the BIM methodology in the local construction industry. It is believed that BIM can be adapted and localized to the Malaysia's construction players, hence, induced the need for stable implementation strategies with a well-documented execution plan. The 4-Step processes to identify the priority initiatives had been executed to discuss potential strategies and execution plan pertaining to its implementation.

CIDB also took proactive action by providing awareness programs, seminars and workshops within the industry players towards BIM adoption. The first initiatives undertaken by CIDB is the establishment of a National Steering Committee of Building Information Modelling (BIM) in July 2013 which consists of relevant Government agencies, professional bodies, private sectors and academia was seen as a serious endeavor towards wider and wiser the implementation of BIM in Malaysia construction projects (CIDB, 2012). Among the Terms of Reference (TOR) of the National Steering Committee of Building Information Modelling (BIM) is to advise, monitor and promote BIM activities in Malaysia. A collective decision reached by members of the committee lays out how BIM will be implemented through initiatives arises from the 4-Step processes as follows:

Step-1 Process: Global Benchmarking Through Literatures

The first process of this research deals with the extensive literature on the global initiatives of BIM. This global benchmarking are focusing on the three (3) neighboring countries i.e Hong

Kong, Singapore and Australia; and one (1) western country, which is the United Kingdom. Table 1 listed the related initiatives and the countries that implementing those initiatives.

A total of 26 initiatives had been identified during the first step of the research through the literature search. Establishment of the BIM Roadmap, BIM committee and registration with International bodies are the highest implemented initiatives where all four (4) countries had undertaken it. The second highest is the development of BIM Guideline and the legal and insurance issues where three (3) out of four (4) country believe it is important to be addressed accordingly.

Table 1: Spectrum of Potential BIM Initiatives

ITEM	INITIATIVES	Hong Kong	Singapore	Australia	United Kingdom	Malaysia
1	Establishment of National BIM Roadmap	√	√	√	√	√
2	Incentivize BIM implementation	√	√			√
3	Vendor Support & capacity development of industry players	√				
4	Digital Infrastructures Capability	√			√	√
5	Risk Assessment & Proven benefits	√				√
6	Standard and common practice	√			√	√
7	Legal and insurance	√		√	√	
8	Awareness, training and education	√			√	√
9	Promoting success stories	√	√			
10	Removing impediments		√			
11	Building capability & capacity of people		√			√
12	Product Information & BIM libraries		√	√		√
13	BIM Guidelines	√	√	√		√
14	Information Exchange			√		
15	Compliance & Certification		√	√		√
16	Changing Procurements process			√		√
17	Business process Change			√		
18	Multi-disciplinary BIM education			√		
19	Special interest groups		√			√
20	Research & Development		√			√
21	Forming BIM committee	√	√	√	√	√
22	Registration with international bodies (BuildingSMART International)	√	√	√	√	√
24	Increased exports of AEC/FM professionals through BIM		√	√	√	
25	Mandate BIM for public sector		√		√	√
26	Annual BIM award to recognise advance use of BIM		√			√
27	Collaboration of BIM activities among Government agencies and professional bodies					√
28	Use Government procurements to drive the adoption					√
29	BIM reference center					√

All the initiatives obtained from the benchmarking exercise is being recorded and marked for comparison with local stakeholders and expert's opinion in the next process shown in Table 1.

Step-2 Process: Engagement with Local Experts

Step 2 of the process consists of engagement with the government bodies, stakeholders and local experts through series of workshops and structured interviews. A total of four (4) workshops were held on 20th November 2013, 16th December 2013, 26th February 2014 and 8th April 2014 comprises of industry players and stakeholders. This is followed by a structured interview with the Public Work Department (PWD), CIDB, Universiti Malaysia Pahang and the Master Builders. The representatives from each organisation has more than 10 years' working experience in the industry and an average of 5 years in BIM. This indicates that it is reasonable to infer that respondents have a wide-ranging knowledge in BIM and the data is relevant and reliable.

The potential BIM initiatives for the local construction industry are also marked in Table 1 includes three (3) localized initiatives proposed during this process.

All the initiatives obtained from Step-1 and Step-2 are being aligned and grouped based on the similarity. Table 2 indicates the summarized initiatives which accounted to 24 numbers with the relevant coding for the prioritizing analysis in Step 3.

Table 2: Summarized BIM Initiatives

CODING	INITIATIVES
I.01	Establishment of National BIM Roadmap
I.02	Incentives for software and training
I.03	Collaboration of BIM activities among agencies
I.04	BIM Standard and common practice
I.05	Legal and insurance related to BIM implementation
I.06	Awareness, training and education
I.07	Building capability & capacity of people
I.08	Mandating BIM for public sector
I.09	In-house proprietary BIM solution
I.10	Product Information & BIM libraries
I.11	BIM Guidelines
I.12	Digital Infrastructures Capability and vendor support
I.13	Information Exchange platform for Level 2 BIM
I.14	Compliance, Accreditation & Certification
I.15	Changing Procurements processes
I.16	Business process Change
I.17	Multi-disciplinary BIM education
I.18	Special interest groups
I.19	Research & Development fund
I.20	Forming BIM committee
I.21	Establish BIM reference center
I.22	Registration with international bodies (BuildingSMART International)
I.23	Annual BIM award to recognise advance use of BIM
I.24	Increased exports of AEC/FM professionals through BIM

Step-3 Process: Prioritizing The Initiatives

Step-3 process consists of the analysis of the priority initiatives using the prioritizing tools which used Impact (Imp) and Ease of Implementation (EOI) as the predetermining factors to prioritize the potential initiatives. The factor of Imp consist of two dimensions which is the benefits and coverage; The dimension of benefits is measuring whether the potential initiative will give benefits and proven value to the targeted user, while the dimensions of coverage measuring whether the initiative covers the whole spectrum of industry's stakeholders.

Meanwhile, the EOI consists of the dimension complexity, resistance and resources. Where, complexity will be driven by time taken to undertake the initiatives and the availability of expertise to take up the initiatives within the allocated timeframe. The dimension of resistance deals with the change management and the expected overall resistance from the industry players. Finally the dimension of resources is considering the requirements of resources needed to ensure the initiatives are able to be implemented conversantly.

Figure 1: Prioritizing Concept

PRIORITIZED INITIATIVES

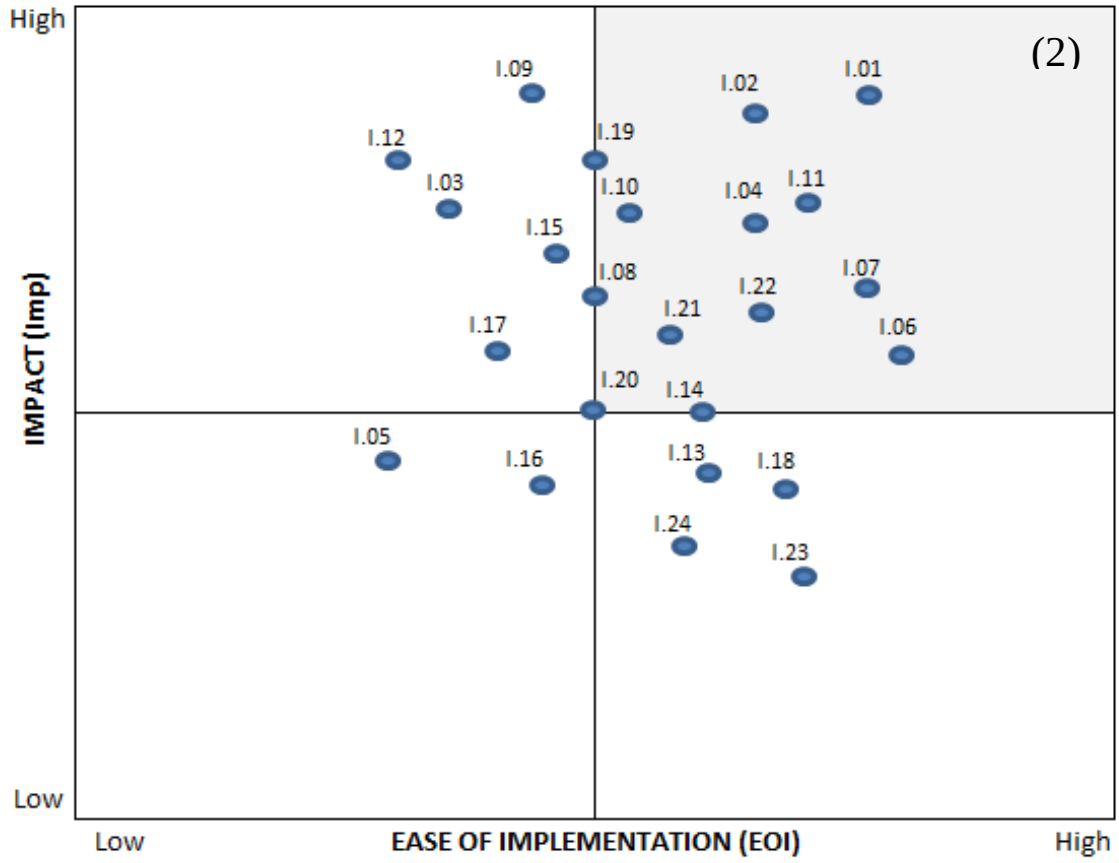
Factors	Dimension	Drivers	
IMPACT (Imp) Score Imp = Σ(DV:Cv)/2	Benefits (B) B = DV	Defined Value (DV)	L/M/H
	Coverage (Cv) Cv = Σ(GI;B;S;P)/4	General Industry (GI)	L/M/H
		Bumiputra (B)	L/M/H
		SME (S)	L/M/H
		Professionals (P)	L/M/H
EASE OF IMPLEMENTATION (EOI) Score EOI = Σ(Cplx:Rt:Rs)/3	Complexity (Cplx) Cplx = Σ(T;E)/2	Time (T)	L/M/H
		Expertise (E)	L/M/H
	Resistance (Rt) Rt = Σ(CM;Ov)/2	Change Management (CM)	L/M/H
		Overall (Ov)	L/M/H
	Resources (Rs) Rs = Rq	Requirement (Rq)	L/M/H

Figure 1 outline the method used to prioritize each potential initiative obtained in Step 1 and Step 2. Each potential initiative will be calculated separately on the factor of Impact (Imp) and Ease of Implementation (EOI). The overall score of Imp and EOI will be weighted

average of its relevant dimensions, and the dimensions to be weighted average of its drivers. While, the drivers is assessed based on Low, Medium and High value of Imp and EOI. High impact and high EOI will be given a value of 3.0; Medium = 2.0; and Low = 1.0. The average value received from each category then will be cascade up to the dimension and finally will be weighted average to the factors of Impact and EOI.

The score achieved by each factors (Imp and EOI) is plotted onto the prioritization matrix in figure 2. The prioritization matrix consists of 4 quadrants where the Imp and EOI as axis y and axis x. Quadrant 2 indicates the high Imp and high EOI areas. The initiatives that is plotted in this quadrant is taken as the priority initiatives for BIM. A total of thirteen (13) high impact and implementable initiatives had been identified through this measurement method. These initiatives is brought forward to the final 4-Step process; Validation of expert panel.

Figure 2: Prioritizing Matrix



Step-4 Process: Validation by Expert panel

A total of 13 initiatives is brought forward to be validated by an expert panel through the means of a workshop. The expert panel is selected from the professional bodies, government agencies, contractors and academia. Twelve (12) experts attended the workshop; consist of 7 from the professional bodies, 1 from government agency, 2 contractors and 2 academia. Table 3 show some initiatives that are proposed to be set as activities of similar initiatives for better coordination and implementation.

Item I.06 is proposed to be an activity for I.01; I.01 as activity of I.07 due to the similarity of function; I.04 is the activity of I.14 because of its nature; while I.10 and I.22 to be the activities of I.21 since the libraries and International registration can be done through the BIM center after the establishment.

Table 3: Initiatives and Activities

	INITIATIVES		ACTIVITIES
I.01	Establishment of National BIM Roadmap	I.06	Forming BIM committee
I.02	Incentives for software and training		TBD
I.07	Building capability & capacity of people	I.01	Awareness, training and education
I.08	Mandating BIM for public sector		TBD
I.11	BIM Guidelines		TBD
I.14	Compliance, Accreditation & Certification	I.04	BIM Standard and common practice
I.19	Research & Development fund		TBD
I.21	Establish BIM reference center	I.10 I.22	Product Information & BIM libraries Registration with international bodies (BuildingSMART International)

In general, the participant agreed that these 8 initiatives are the highest impact and implementable areas need to be focus within the next 5 years of BIM initiatives to be implemented in Malaysia construction industry.

CONCLUSIONS

This paper has outlined the initial development of BIM initiatives in Malaysia construction industry. The review of the relevant literature points to the urgency of starting to implement BIM and the long-term benefits for all parties. Based on this proposed BIM approach, it can be deduced that eight (8) initiatives are needed as focus areas to ensure that BIM will survive and thrive in Malaysia construction industry, those are: Establishment of BIM Roadmap; Incentives for BIM software and training; Building the capacity and capability; Mandating BIM for public sector; BIM guidelines; Compliance, Accreditation and certification; Research and Development fund; and establishment of BIM reference centre.

Several recommendations were also recorded during the workshops including areas for further research together with identification of some of the main challenges likely to be encountered. Meanwhile, it is also recorded that I.09 (In-house proprietary BIM solution) will provide a high Impact to the industry at large, however having a relatively low implementable due to the lacking of experts in this area. Hence, the development of capability and experts towards this aspect may eventually move the I.09 towards the priority quadrant in the evaluation of future initiatives of BIM in Malaysia.

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