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To cite this article: S Mamter et al 2017 IOP Conf. Ser.: Mater. Sci. Eng. 216 012056

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Stimulating a Sustainable Construction through Holistic BIM Adoption: The Root Causes of Recurring Low BIM Adoption in Malaysia

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Abstract. Fostering the Building Information Modelling (BIM) implementation is one of Malaysia sustainable strategies towards greener construction. Hence, the Eleventh Malaysia plan focuses on transforming construction industry through the increase of technology adoption in order to enhance construction productivity. Therefore, there is a growing and urgent demand to provide BIM competent. However, a significant number of parties are reluctant to develop and invest in BIM due to unsolved root causes. Scholars have identified barriers relating to the infancy stage of BIM adoption in Malaysia. Unfortunately, there is a lack of study to explore deeper the root causes of recurring for the barriers anticipate the low BIM adoption. This paper attempts to delve into the initiatives of BIM stake players in fostering BIM adoption and to determine the root causes of recurring barriers due to low BIM adoption. The study adopted the semi-structured interviews which involved BIM stake players as a sample population. From the findings, authors revealed four root causes of recurring barriers; absence of BIM policy and BIM compulsion, poor holistic readiness, software integration competition strategy, and reluctant in sharing knowledge. The findings espoused here are preliminary and more results are expected to emerge as the research progresses.

1. Introduction
Construction industry keeps contributing significantly to the Gross Domestic Product (GDP) of Malaysia economy. As reported in Construction Industry Transformation Plan (CITP) the construction industry will be expecting to contribute 5.5 per cent to the Malaysia GDP in 2020 [1]. Consequently, productivity in the construction sector will be focusing on increasing BIM adoption. BIM is a collaborative process and provides the environment with tools to manage and integrate information over the project lifecycle [2]. However, challenges faced by potential BIM adopters may result in poor adoption. Identifying the root causes to poor adoption on BIM will foster the holistic BIM adoption in Malaysia. Researchers [3], [4] defined root causes as the most basic reasons for an effect, which if corrected will prevent recurrence. Some scholars have identified the barriers to BIM adoption in Malaysia, unfortunately, there are still lack of studies to explore deeper the root causes of recurring barriers which accountable to the low BIM adoption

2. Fostering sustainable strategies
In Malaysia, sustainable strategies towards greener construction (CIDB Guidebook Green Practices, 2013) have focused on Involvement of stake players, Building Information Modelling, Green Building
Design, and Industrialised Building System. In achieving these strategies, the most recent Eleventh Malaysia plan has focused on increasing the construction productivity by increasing the BIM adoption amongst the construction players. Nevertheless, CITP reported that the adoption of Building Information Modelling (BIM) technology in Malaysia is still low, estimated at only 10 percent adoption amongst construction stake players. Since 2007, Malaysia BIM wave started with the publication of internal implementation by Public Work Department (PWD) or also known as Jabatan Kerja Raya (JKR) throughout BIM pilot projects. The wave of Malaysia adoption can be divided into five waves (Figure 1). Figure 1 shows PROKOM that was established in 2012 as a BIM unit project to handle JKR pilot project [5].

![Figure 1. Malaysia BIM evolution. Authors’ compilation from references [5]-[8]](image)

As stated by one of the interviewees (R3), the adoptions of BIM in Malaysia actually took place first before the Singapore adoption. During that time JKR used UK BIM standard as a reference for their pilot projects. In 2012, in order to overcome the lack of awareness amongst potential BIM adopters, Construction Industry Development Board (CIDB) had set up National BIM committee to forge BIM guide and roadmap. Accordingly, Table 1 indicates a summary of a number of massive initiatives supported by construction stake players to foster the BIM adoption.

**Table 1. BIM Stake Players Initiatives**

<table>
<thead>
<tr>
<th>Stake Players</th>
<th>Involvement Initiatives</th>
</tr>
</thead>
</table>
| PWD (Public Work Department) | • Publishing JKR BIM Standard and Guideline  
• BIM pilot projects  
• Adoption roadmap for in-house design for consultant/contractor [5] |
| CIDB (Construction Industry Development Board) | • Coordinating with all BIM principles and players  
• Provide high quality training [8]  
• Set up the National BIM Committees for BIM guide and Roadmap  
• Establish BIM Centre  
• Subsidised BIM training programs  
• BIM transformation fund [8] |
| ACEM (Association of Consulting Engineers Malaysia) | • Provide awareness workshops and road shows [8] |
| IEM (Institution of Engineers Malaysia) | • Provide awareness, buy-in program and internal trainings [8] |
| PAM (Pertubuhan Akitek Malaysia) | • Provide awareness, buy-in program and internal trainings [8] |
| RISM (Royal Institute Surveyor Malaysia) | • Formed 5 BIM sub-committee on Building, Civil, ICT, SMM and academic aspects  
• 5D BIM workshop  
• BIM educational framework  
• BIM conference [RISM Annual Report 55th] |
To overcome the low BIM adoption, CIDB initiative strategies in 2016 were launched with BIM centre, certification program, national guide, roadmap, subsidised training programs and transformation fund. Since BIM was adopted, the entire professional bodies ACEM, IEM, PAM, RISM, BIPC, and MBAM have participated in all BIM initiative programs. Khairul [9] determined that most SME contractors do not have high capability to implement BIM. Thus, CITP involves High-performing small and medium enterprises (SMEs) to form strategic partnerships with multi-national companies (MNCs) and government-linked companies (GLCs) which will further drive the BIM adoption.

3. Methodology
Data collection for this paper is gained through a literature review and expert interviews conducted by authors. A literature review was conducted to explore on the initiatives to foster the BIM adoption in Malaysian construction industry. In addition, the preliminary semi-structured interview was conducted with construction experts with more than 10 years of experience and exceeding 5 years of experience in BIM projects in order to cater the second objective of this study i.e. to determine the root causes of recurring barriers due to low BIM adoption. Various samples of BIM stake players were approached by the authors for interviews through email, telephone calls, and face to face consultations, however at the time of writing this paper, a total of six semi-structured interviews were conducted. Although the sample size is slightly small, the in-depth nature and detailed explanations of the issues provided by experienced interviewees are in line with Romney [10] recommendation of samples size of four to six interviews when interviewees have an expert knowledge in the area of study. From Table 2 below, various position groups can be deciphered. These interviews lasted for an average of sixty (60) minutes each. The data collected from these interviews were transcribed and subsequently analyzed. During these interviews, the interviewees were asked to indicate their organisational position and years of experience in BIM practices.

Table 2. List of Interviewees

<table>
<thead>
<tr>
<th>Interviewee’s Coding Detail</th>
<th>Industry Background</th>
<th>Philosophy adoption*</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Manager</td>
<td>Supplier/Vendors</td>
<td>Innovators</td>
<td>R1</td>
</tr>
<tr>
<td>Director of company</td>
<td>Quantity Surveyor</td>
<td>Innovators</td>
<td>R2</td>
</tr>
<tr>
<td>BIM Manager</td>
<td>Architect</td>
<td>Adopters</td>
<td>R3</td>
</tr>
<tr>
<td>BIM Engineer</td>
<td>Civil &amp; Structural Engineering</td>
<td>Adopters</td>
<td>R4</td>
</tr>
<tr>
<td>Head of Unit</td>
<td>Building</td>
<td>Innovators</td>
<td>R5</td>
</tr>
<tr>
<td>BIM Engineer</td>
<td>Mechanical &amp; Electrical Engineering</td>
<td>Adopters</td>
<td>R6</td>
</tr>
</tbody>
</table>

*System Dynamic Modelling Philosophy adoption classification[11]; Potential adopter, Innovator, Imitator, Adopter
Other questions asked were to include the best categories to describe their organisation’s philosophy adoption. The classification of philosophy adoption is essential to analyse adoption rate using system dynamic modelling [12] for subsequent study. System dynamic model provides a holistic methodology hence BIM stake players may gain insights into the causal factors influencing potential BIM adopter in decision making processes, and thereby into the potential diffusion patterns resulting from those adoption decisions.

4. Finding
Due to limited pages, the following root causes of recurring barriers in BIM adoption were revealed and grouped under four themes:

4.1. Absence of BIM policy and compulsion
The absence of BIM policy is one of the root causes highlighted by the interviewees. Contrary to [13], who found an adequacy of Malaysian Government policies for BIM. The interviewees mentioned that the adoptions of BIM in Malaysia actually took place first before Singapore adoption. During that time Singapore adopted BIM only as a requisite for submission plan to the authority, but Malaysia adopted BIM at the preliminary stage until the production of construction drawings. As quoted by one of the interviewees; “Actually, BIM was already here since 1999 with the introduction of these software; ArchiCAD, Orion, and QTO as tools to expedite the construction processes. Unfortunately, no parties knew about the arrival of BIM and its integration inside software” (R3). In addition, “Since BIM was adopted in Malaysia, there had been no standard guideline being launched from Malaysian government. Currently, we have been using only client term and condition of BIM contract as a per-time basis” (All interviewees). All interviewees highlighted that the top managements of Malaysian Government are poorly educated in BIM and agreed that the future trend of BIM remains stable until there are compulsions from the government. Therefore, it is evident that the absence of a policy on the BIM implementation has led to the low adoption of BIM in Malaysia.

4.2. Poor Holistic Readiness
The interviewees suggested that the holistic readiness among construction stake players is the best way to fostering BIM process. Recently, BIM scholars found that the readiness among construction stake players is very positive. Contrary to [14], the seminar revealed that the land surveyor’s roles are not formally recognised in BIM implementation based on the CIDB roadmap document. This is also supported by one of the interviewees; “In Malaysia, the key role of land surveyor is still missing in the BIM process” (R4, R5). Nevertheless, Ference Acs[15] found that the land surveying profession as an integral part of the AEC industry can substantially affected by the growing role and importance of the BIM environment.

4.3. Software Integration Competition Strategy
The nature of software development is constantly changing with the periodic hype of a new software invention [15]. Furthermore, any change or improvement of the BIM model is accessible in real-time and almost simultaneous for the stakeholders’ utilisation. Moreover, various BIM authoring software can be used with a different software integration strategy to challenge with other competitors. The holistic BIM adoption therefore depends much on the integration of all BIM software. The collaboration of all the authoring software requires high cost to purchase by the BIM stake players. The interviewees opined that “Software is a tool for a successful BIM collaboration amongst construction team. Unfortunately, every year, BIM authoring software competition strategies are a burden to us because it involves high cost” (R3).

4.4. Reluctant to change & Reluctant to sharing knowledge
The interviewees suggest a good relation among stake players is the best way to foster the BIM adoption. On the other hand, the positive collaboration is capable to transfer knowledge and enhance the BIM knowledge among the team members. As observed by one interviewee; “The construction experts in Malaysia are reluctant to adopt BIM because they refuse to change. It is a tough age to
educate when they are more than 40 years old.” (R1). In addition, the interviewees opined that they are reluctant because of “The process coordination is much longer than preparing CAD drawings but for amendment works during construction stage; BIM can speed up the construction pace” (R4, R5, R6). Reported by [16], BIM requires a dedicated group of stakeholders to drive and facilitate the BIM implementation process. Interestingly, these isolated root causes arise in Malaysia are manifested from focal person who has high knowledge and expertise in software but reluctant to sharing was observed in the views espoused by two of the interviewees; “That focal person is the only one expert and competent with high capability in running the software to do concurrent analysis and prepare model in Malaysia. We need high knowledge and time to gain expertise on software which capable to do rigorous risk analysis in the infrastructure projects” (R4, R3).

5. Conclusion
The study has found that the absence of BIM policy and compulsion; poor holistic readiness; software integration competition strategy; and reluctant to sharing knowledge are the root causes of recurring barriers due to low BIM adoption in Malaysia. These findings will be further used to construct causal loops diagram in system dynamic model. As a limitation, the findings espoused here are preliminary and should be regarded with caution. It is expected that more results will emerge as the research progress.

6. Acknowledgment
The authors acknowledge the support from Universiti Teknologi MARA and Malaysia Ministry of Education.

7. References