BIM Training: The Impact on BIM Adoption Among Quantity Surveyors in Government Agencies

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Abstract. Building Information Modelling (BIM) is extensively known as one of the innovations of Information Technology (IT), globally used as a platform to promote collaborative and integrated working environments in the construction project management. This technology has been vastly modernised and upgraded to become a sophisticated technology for generating and managing project information. Nowadays, BIM is utilised to replace the traditional paper-based drawings as main sources of design information, and as a tool for collaborative working. The aim of this paper is to investigate the impact of BIM training on BIM adoption among quantity surveyors in the government agencies. Training is one of the potential factors that could expedite the adoption of BIM. BIM training is significant due to its role to expand BIM knowledge and to increase BIM usage via hands-on training environment. The results are limited to quantity surveyors who have attended BIM trainings only. From the findings, quantity surveyors within the government agencies do not intend to immediately use BIM despite after attending and participating in BIM trainings due to the lack of understanding of the true BIM values and benefits, even after the participants attended the introductory training, technical training or a combination of both trainings.

1. BIM Adoption in the Malaysian Construction Industry

The adoption of BIM as technological advancement and its benefits in the construction industry is a subject of interest of many project stakeholders in Malaysia. Despite of BIM popularity in Malaysian construction industry, the utilisation of BIM among construction players is still at the lower level as they perceive BIM as a new technology (Zakaria et al., 2014). BIM adoption in Malaysian construction industry is very low (Memon et al., 2014), stagnant (Zakaria et al., 2013), and limited in term of implementation (Gardezi et al, 2014). Embracing and adopting BIM has encountered a number of barriers which include the reluctance of changing current work practice (Johnson and Laepple, 2003), lack of clarity on responsibilities and roles (Holzer, 2007) and lack of training (Bernstein and Pitmann, 2004). In Malaysia context, training is becoming a significant factor that affect BIM
adoption. Lack of BIM knowledges (Zakaria et al., 2013), lacked of trained people (Baba, 2010; Rogers et al., 2015) and lack of training (Rogers, 2013) are several major barriers that are related to BIM training in Malaysia construction.

Construction Industry Transformation Plan (CITP) 2016 - 2020 is a Malaysian agenda to transform construction industry and has highlighted several challenges of BIM implementation in Malaysia. The challenges include; a) lack of skilled personnel who is competent and has capability in using BIM effectively and, b) lack of proper training by the local authorities and have a little knowledge of BIM. The government took a step forward by forming a committee that is responsible to select the best BIM platform to be used in both private and public project implementations.

The roles of the committee are also to identify suitable government projects as BIM pilots, and to prepare BIM standard manual for the general use of the Malaysian construction players. Some of the BIM pilot projects in Malaysia are the construction of Multipurpose Hall of Universiti Tun Hussein Onn Malaysia (UTHM) and National Cancer Institute of Malaysia (CREAM, 2012). Simultaneously, the awareness of BIM in the Malaysian construction industry has grown further and more Malaysian construction players are now seen to utilise BIM in their project implementations, especially in the high-profile construction projects. However, the general utilisation of BIM technology by the Malaysian construction players is still not wide enough and still can be broadened and improved.

2. BIM Maturity Stage
The level of BIM adoption in Malaysia can be illustrated using Richards and Bew’s BIM maturity stages (2009) as shown in Figure 1 below:

Although the Malaysian government initiated the use of BIM in construction projects, generally Malaysia is still struggling to adopt BIM processes in construction projects which require 2D working environments to be converted to 3D working environments (Latiffi et al., 2013 and Zakaria et al., 2013). The BIM maturity stage in Malaysia is still at preliminary stage where papers and drawings are still treated as primary source in the data exchange mechanism.

However, the Malaysian construction players have made positive progress by making relevant efforts which resulting the industry to shift from Level 0 to Level 1 in terms of BIM maturity stages.

3. BIM Training in the Malaysian Construction Industry
There are many organisations that provide BIM training to the Malaysian construction players. These organisations consist of government agencies, professional bodies and private organisations. Nonetheless, the focus of this study is more on BIM training provided by the government agencies, namely the Construction Industry Development Board of Malaysia (CIDB) and Public Work Department (PWD). This is because both agencies play significant roles in formulating and organising BIM trainings, and also are actively delivering BIM trainings in Malaysia. The types of BIM training...
programmes organised by CIDB and PWD are introductory trainings, and intensive trainings for the use of BIM software (technical training).

BIM training can be organized as either an in-house training or external training (Pena, 2011). Organisations with more BIM experience are inclined to organize in-house BIM training due to the organizations capability to provide BIM trainer or BIM manager who will conduct the training sessions. Green (2007) advocated that the organizations which have their own trainer and organise in-house training could give benefit to the organization through assisting training customization and reducing cost of training.

4. Research Method
An empirical study was conducted using survey questionnaire among Quantity Surveyors in the government technical agencies. This survey questionnaire was conducted online and all potential respondents for this study were invited via email. The invitations were sent to the participants who attended BIM training. A total of 47 completed online questionnaires were received from the respondents and the results are analysed in the discussion below.

5. Results and Discussion
5.1 Awareness and Use of BIM
The level of BIM awareness and its use are the main aims of this study. From the survey, the results indicated that the level of BIM awareness is very high where 100% of the respondents are aware of BIM. On the contrary, the usage of BIM is very low where only 6% of the sample are currently using BIM and 28% of the sample have used BIM. These results are illustrated in Table 1.

| Item                                | Frequency | Percent |
|-------------------------------------|-----------|---------|
| Aware and currently using BIM       | 3         | 6%      |
| Aware and have used BIM             | 13        | 28%     |
| Aware of BIM but have not used it   | 31        | 66%     |
| Not aware of BIM                    | 0         | 0%      |

These findings offer clear evidence that BIM is already a well-known technology in the Malaysian construction industry. However, the low usage of BIM indicates that BIM is still a ‘young’ technology in Malaysia despite its introduction long time ago, and it has not been fully developed and improved to maximise its potential.

5.2 Participation of BIM Training
The result in Figure 2 shows respondents from the quantity surveying background who have attended BIM training and also who have not participated any BIM training. The result showed that 46.8% (n=22) have not participate any BIM training and 53.2% (n=25) have participate BIM training organised by PWD or CIDB. In the questionnaire, the respondent had been given opportunity to choose more than one training that they have attended either introductory training or technical training. From 25 respondents who have participated BIM training, 64% has participated introductory training and 36% has participated technical training organised by CIDB and PWD.
5.3 The BIM training and BIM adoption

Table 2 highlighted BIM training and adoption in terms of usefulness and ease of use of the BIM software.

Table 2: BIM training in terms of usefulness and ease of use

| Variables                                              | Average Index/Mean |
|--------------------------------------------------------|---------------------|
| **Usefulness**                                         |                     |
| My interaction with BIM will be clear and understandable| 3.24                |
| I believe that it will be easy to get BIM to do what I want it to do | 3.32                |
| It will be easy for me to remember how to perform tasks using BIM | 3.16                |
| **Ease of use**                                        |                     |
| Using BIM will enhance my effectiveness doing my job   | 3.84                |
| Using BIM will give me greater control over my work    | 3.72                |
| Using BIM will enable me to accomplish tasks more quickly | 3.64                |
| Using BIM will improve my work performance             | 3.64                |
| Using BIM will improve the quality of the work I do    | 3.68                |

Earlier literature by Davis (1989) interpreted usefulness as the extent of individual belief in utilising a particular technology system that will increase his or her job performance. This result may be explained by the fact that usefulness has a moderate significant for the individuals who attend training, as they might have enhanced their awareness on the usefulness of BIM after attending the training and consequently increasing their behaviour towards BIM adoption.

The perspective of ease of use in technology implementation is a key attribute that individuals would consider about. The review of the literature suggested that individual’s positive perception of ease of use might increase the behavioural of BIM adoption. Therefore, it seems possible that the easier BIM is used and interacted with, the better the attitude of the user regarding behavioural towards BIM adoption.

6. Intention to use

The intention to use BIM among respondents after they attended BIM trainings was examined, i.e. if they intended to use BIM immediately after the training or if they intended to use it sometime after the training. The results are shown in Figure 3.
The results showed that the participants have less interest in using BIM even though after they have participated in one of the courses or both. As BIM implementation is still in its infancy in Malaysia, it is likely that we are not going to see a more positive BIM results in the local construction scene soon as most construction professionals are found to possess lack of interest to learn BIM and only participate in the trainings to obtain the certificate of attendance.

7. Conclusion
With the view of BIM adoption in the Malaysian construction industry, it seems that effective training programmes are essential to enhance the construction professionals’ BIM proficiency. It is clear in the findings of this study that most quantity surveyors within the government agencies do not intend to immediately use BIM despite after attending and participated in BIM trainings. This could be due to the lack of understanding of the true BIM values and benefits, even after the participants attended the introductory training, technical training or a combination of both trainings. With the goal of promoting BIM implementation, construction players therefore need to be trained accordingly. If BIM trainings is seen to be significant in the BIM adoption – that is not just as a knowledge delivery and learning mechanism, then attention need to be paid to design a more effective teaching/learning methods so that attitudes towards BIM can be improved, in both content and learning experiences. The training contents and teaching/learning methods delivered by experienced trainers could create a more conducive and beneficial training environment. This factor may help to influence the participants to use BIM immediately after they attended BIM trainings, and could be a potential research area in future studies.

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