

Building information modelling (BIM) after ten years: Malaysian construction players' perception of BIM

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Abstract. Building Information Modelling (BIM) concept has expanded widely in many countries for more than a decade with its role of improving current practices in construction projects. However, the understanding of BIM differs among construction players, depending on how construction players utilize the concept in their projects. Therefore, this paper aims to explore the understanding of BIM concept among construction players in the Malaysian construction industry. A literature review on BIM concept and semi-structured interviews with construction players in BIM such as client, civil and structural (C&S) engineer and mechanical and electrical (M&E) engineer, quantity surveyor (QS), contractor, facilities manager and BIM consultant have been conducted in order to achieve this study's the aim. The results show that the understanding of BIM concept among the construction players is limited to BIM as a process and technology. It is important for the construction players to improve their understanding of BIM as it can be used to enhance performance and productivity of construction projects.

1. Introduction

Building Information Modelling (BIM) concept has become a trend in the Architecture, Engineering and Construction (AEC) industry for improving construction projects [1, 2]. BIM is being implemented in the current practices of construction projects. However, the understanding of BIM varies among construction players in different countries such as the United States of America (USA), Finland, Australia, United Kingdom (UK) and in Malaysia as well. This is due to the different capability levels of construction players in adopting and mastering the concept [3]. Construction players in the AEC industry perceive BIM as a new evolution of leveraging project data, which results in efficiencies in building life cycle. This paper aims to explore the understanding of BIM concept among construction players in the Malaysian construction industry.

2. Building Information Modelling (BIM)

A literature review by various researchers in BIM from 1996 to 2016 shows that the understanding of BIM can be divided into five categories. The categories are design, technology, process, performance and productivity. The definition of BIM has been improved in line with the construction industry development. Within this period, BIM is described as a revolutionary technology in managing construction projects [4] with the use of BIM software by developing project design into a virtual building; it is a 3-Dimensional (3D) model [2, 5-7] and in computable information [8].

BIM also creates a paradigm shift in the AEC industry [9] for generating and managing the project information more effectively and efficiently [10, 11]. In addition to that, the utilization of BIM concept



can enhance communication and collaboration among construction players through the project life cycle. This is because BIM can be applied during the entire project life cycle. As a result, the performance of construction projects can be improved. This is shown when Love et al., (2013) [12] and Ahmad Latiffi et al. (2014) [13] defined BIM from a performance perspective. In 2016, BIM has been defined using new terminology, where BIM is seen as the use of technology that can increase the productivity of construction and hence provide value to the project stakeholders [14]. It can be concluded that BIM is a suitable method to increase profit and value of construction projects.

3. Methodology

The aim of this paper is achieved through literature review and a semi-structured interview. A literature review was done to get an overall understanding of BIM concept. Apart from that, a series of semi-structured interviews was conducted with twenty-six (26) respondents to gain information on the involvement of various construction players and their experience in projects using BIM as well as their understanding of BIM concept.

4. Results and Discussion

From the twenty-six (26) interviews, the results provide detailed information related to the respondents and how they define BIM in construction projects. Therefore, discussion of the results consists of respondents' designation, respondents' experience in projects using BIM and respondents' understanding of BIM concept. The details are as follows:

4.1. Respondents' Designation

There are eight (8) different designations among the respondents. The designations are as shown in Table 1:

Table 1. Respondents' Designation

Designation	Respondent	Total
Client	R17 and R25	2
Architect	R9, R13, R14 and R22	4
Civil and Structural (C&S) Engineer	R3, R4, R20	3
Mechanical and Electrical (M&E) Engineer	R10, R16, R18, R23, R24 and R26	6
Quantity Surveyor (QS)	R6	1
Contractor	R2, R7 and R8	3
Facilities Manager	R10 and R11	2
BIM Consultant	R1, R5, R15, R19 and R21	5
Total		26

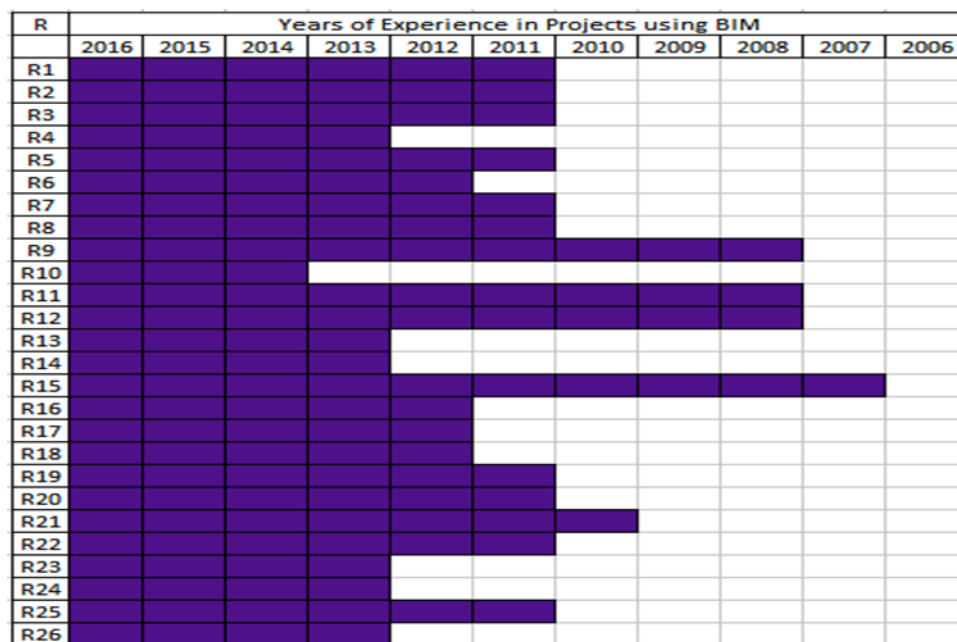
Based on Table 1, R1 to R26 is used to represent each of respondents involved in the interviews. The respondents' designations were identified as client, architect, C&S engineer, M&E engineer, QS, contractor, facilities manager and BIM consultant. It can be concluded that the involvement of different designations is similar to that of projects without BIM. In addition, there is another BIM related designation specifically assigned to a project using BIM, which is BIM consultant. The role of BIM

consultant was introduced in projects using BIM to support greater coordination in developing and maintaining an integrated BIM model. This is supported by Barison, Bernadate and Santos, (2011) [15], whose research states that BIM specialist is needed to assist construction players in the implementation of BIM in projects.

4.2. Respondents' Experience in Projects using BIM

This section highlights the inception of respondents' involvement in projects using BIM in the Malaysian construction industry. Figure 1 shows the years of experience in projects using BIM:

Figure 1. Respondents' Experience in Projects using BIM.



Based on Figure 1, the colored box represents the experience of the respondents in projects using BIM. The earliest year of respondents' involvement in BIM was in 2007. Nineteen (19) respondents possess at least five years of experience in projects using BIM. This shows that most of the respondents are familiar with issues at hand [16] that relate to BIM concept as mentioned by Ku and Taiebat (2011) [17]. It can also be concluded that the selection of the respondents is relevant and appropriate in providing information related to BIM concept. Not only that, the experience of the respondents in projects using BIM has shown that the construction players have initiated the use of BIM since 2007. This is supported by Porwal and Hewage (2013) [18] and Ahmad Latiffi et al. (2016) [19] as PWD has established BIM committee in 2007 to support BIM implementation in the Malaysian construction industry.

4.3. Respondents' Understanding of BIM Concept

Various responses were gathered from the respondents on their understanding of BIM. Table 2 shows the comments of the respondents related to BIM concept.

Table 2. Construction Players' Comments on Their Understanding of BIM

PROCESS AND TECHNOLOGY	
R1	<i>"BIM is a process that enables construction players to have transparency of project information so that it can help to avoid any hidden agenda in construction projects. This is because project team is available to access the information in the 3D model for making project decision...BIM software is only used as a tool for developing a 3D model in construction projects."</i>
R3	<i>"BIM is a process to develop a 3D model with BIM software which contains project information, and the information will be used by different parties from various backgrounds for their own purposes."</i>
R5	<i>"BIM as a methodology and process that involve the development of 3D models as a medium to communicate, extract and manage project data. It is not about software...BIM software is only used as a tool in developing the 3D model."</i>
R6	<i>"BIM is a process that improves construction projects from an early phase of construction. The process improves current projects by the development of project design and its information into the 3D model by using BIM software."</i>
R10	<i>"BIM is about 3D model that consists of project information and can be used by all parties from design, construction and facilities management."</i>
R11	<i>"BIM is an improvement process with the use of related BIM software that makes your life more efficient."</i>
R12	<i>"BIM is a process to develop project information into the 3D model by using BIM software... The information in the 3D model will be used by the project team to do project analysis and make project decisions."</i>
R13	<i>"BIM is an efficient process workflow with the use of BIM software for developing project information into the 3D model."</i>
R14	<i>"BIM is a process of workflow which involves the use of technology. It is not about software."</i>
R16	<i>"BIM is a process of managing project information into a 3D model that involves the use of BIM software."</i>
R17	<i>"BIM is a process of managing project information using 3D model, and it depends on the competencies of people."</i>
R18	<i>"BIM is a process that involves the development of a 3D model by the use of BIM software."</i>
R19	<i>"BIM is a process and technology assistant that comes with the software that helps to improve construction projects...BIM is not a software. If you buy the software but you do not know the process, do not know how to utilize the 3D model and never use the model for doing analysis or making a decision, then it is not BIM."</i>
R21	<i>"BIM is a process that helps construction players to make a decision on projects by utilizing digital platform (3D)."</i>
TECHNOLOGY	
R2	<i>"BIM is a very good technology tool that can manage project information from design to operation and maintenance of the building."</i>
R4	<i>"BIM can be defined as a technology tool for AEC industry whereby parametric model with digital information can be used to visualize and simulate in order to achieve better coordination and integration amongst the stakeholders throughout the project life cycle."</i>
R7	<i>"BIM is an information center that involves the use of technology which can be used during all project phases."</i>
R8	<i>"BIM is technology which it is not limited to 3D model, it is about an information center that can be used by all construction players in all project phases."</i>
R9	<i>"BIM is a technology which involves software enabler that enables construction players to have collaboration and doing analysis for the project. Without the software, definitely, BIM cannot be implemented in a project."</i>

- R15 *“BIM is a **3D model** that is used to extract project data and is not limited to visualization...If a person understands BIM as a software, in my opinion, they do not understand BIM concept well.”*
- R20 *“BIM is a **3D model** that consists of project information.”*
- R22 *“BIM is a supporting **technology** tool that helps a lot in construction projects.”*
- R23 *“BIM can be defined as a supporting **technology** tool used in construction, especially in design coordination.”*
- R24 *“BIM is a good tool that involves **technology** and helps us to visualize in the project.”*
- R25 *“BIM is a **technology** that serves as a tool that helps construction players to complete construction efficiently and effectively.”*
- R26 *“BIM is a **technology** that enables construction players to have virtual construction so that they can detect any possible clashes before the construction takes place.”*
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The answers given by the respondents shows that there are two (2) categories of understanding of BIM concept, which are process and technology. The understanding of BIM as a process is associated with the improvement of construction activities and sequence of work in managing project information resulting from development of 3D model by construction players. Apart from that, the understanding of BIM as a technology is correlated with technology's elements, which are the use of BIM software and 3D model as a medium of communicating information in construction projects.

Fourteen (14) respondents defined BIM as a process and technology. Those respondents understood that BIM could improve current practices in projects through the process of developing project information into 3D models in construction projects with the use of BIM technology. This is similar to [17], [20] and [21] where BIM is accepted as a process that corresponds to the use of technology to improve the efficiency and effectiveness of delivering a project from inception to operation and maintenance. In addition to that, five (5) respondents understood BIM as an efficient workflow process in managing project information that involves 3D model. This is similar to the understanding of BIM expressed by several researchers where BIM is defined as a process in managing project information in a more effective and efficient way [10, 11, 22].

Alternatively, twelve (12) respondents defined BIM as a technology that could help construction players to manage construction projects. The respondents emphasized that the use of BIM technology to develop 3D model was not limited to visualization of the project, but it also served as an information centre for construction players in projects. The understanding of BIM as a technology is similar to findings in previous researches [6, 23]. In addition, BIM concept is also used as a virtual construction that helps in ensuring project design is free from any design clashes. This is in line with understanding of BIM by Forsythe et al. (2015) [24] and Shengyi et al. (2016) [25] where BIM can also emerge as virtual reality in producing project design.

Compared to the literature review on BIM concept, the data prove that the understanding of BIM among Malaysian construction players is limited to only two (2) categories: process and technology that help to improve construction projects. The limited scope of understanding may be related to the numbers of years of experience of each of the respondents involved in BIM projects and how they utilize the concept [3].

5. Conclusion and Further Work

The understanding of BIM among construction players is influenced by their years of experience and capabilities in using BIM to improve current process and technology used in construction projects. This has also been proven by several literature reviews related to BIM philosophy, where the nature of BIM can be understood by analyzing how BIM model is actually used in the project [3]. Further to that, it also shows that construction players still need to improve their understanding of BIM concept. This is because BIM is capable of enhancing the development of project design, project performance and productivity throughout the project life cycle.

Further work can focus on how construction players utilize BIM concept in construction projects.

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References

- [1] Kensek, K.M., *Building Information Modeling*. 2014: Routledge.
- [2] Miettinen, R. and S. Paavola, Beyond the BIM utopia: Approaches to the development and implementation of building information modeling. *Automation in construction*, 2014. 43: p. 84-91.
- [3] Kerosuo, H., et al., Challenges of the Expansive use of Building Information Modeling (BIM) in Construction Projects. *Production*, 2015. 25(2): p. 289-297.
- [4] Azhar, S., M. Khalfan, and T. Maqsood, *Building Information Modelling (BIM): Now and Beyond*. *Australasian Journal of Construction Economics and Building*, 2012. 12(4): p. 15-28.
- [5] Kymmell, W., *Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations* (McGraw-Hill Construction Series): Planning and Managing Construction Projects with 4D CAD and Simulations. 2008: McGraw Hill Professional.
- [6] Migilinskas, D., et al., *The benefits, obstacles and problems of practical bim implementation*. *Procedia Engineering*, 2013. 57: p. 767-774.
- [7] Knotten, V. and F. Svalestuen, Implementing Virtual Design and Construction (VDC) In Veidekke – Using Simple Metrics To Improve The Design Management Process. 2000.
- [8] Krygiel, E. and B. Nies, *Green BIM: Successful Sustainable Design with Building Information Modeling*. 2008: John Wiley & Sons.
- [9] Wong, A., F.K. Wong, and A. Nadeem. Comparative roles of major stakeholders for the implementation of BIM in various countries. in *Proceedings of the International Conference on Changing Roles: New Roles, New Challenges*, Noordwijk Aan Zee, The Netherlands. 2009.
- [10] Gu, N. and K. London, *Understanding and Facilitating BIM Adoption in the AEC Industry*. *Automation in Construction*, 2010. 19(8): p. 988-999.
- [11] Ahmad Latiffi, A., et al., *Building Information Modeling (BIM) Application in Malaysian Construction Industry*. *International Journal of Construction Engineering and Management*, 2013. 2(A): p. 1-6.
- [12] Love, P.E., et al., From Justification to Evaluation: Building Information Modeling for Asset Owners. *Automation in Construction*, 2013. 35: p. 208-216.
- [13] Ahmad Latiffi, A., J. Brahim, and M.S. Fathi, *The Development of Building Information Modeling (BIM) Definition*. *Applied Mechanics & Materials*, 2014(567).
- [14] Nath, T., M. Attarzadeh, and R.L. Tiong, *Precast workflow productivity measurement through BIM adoption*. *Proceedings of the Institution of Civil Engineers-Management, Procurement and Law*, 2016.
- [15] Barison, M.B. and E.T. Santos. The Competencies of BIM Specialists: A Comparative Analysis of the Literature Review and Job Ad Descriptions. in *Proc., Int. Workshop on Computing in Civil Engineering*, ASCE, Reston, VA. 2011.
- [16] Mohd Nordin, R., A Framework of Transparency Initiative (TI) to Fight Corruption for Public Construction Projects, 2014, University Teknologi Mara.
- [17] Ku, K. and M. Taiebat, *BIM Experiences and Expectations: The Constructors' Perspective*. *International Journal of Construction Education and Research*, 2011. 7(3): p. 175-197.
- [18] Porwal, A. and K.N. Hewage, Building Information Modeling (BIM) partnering framework for public construction projects. *Automation in Construction*, 2013. 31: p. 204-214.
- [19] Ahmad Latiffi, A., J. Brahim, and M.S. Fathi. Transformation of Malaysian Construction Industry with Building Information Modelling (BIM). in *MATEC Web of Conferences*. 2016. EDP Sciences.

- [20] Ding, L., Y. Zhou, and B. Akinci, Building Information Modeling (BIM) Application Framework: The Process of Expanding From 3D to Computable nD. *Automation in Construction*, 2014. 46: p. 82-93.
- [21] Eadie, R., T. McLernon, and A. Patton, An Investigation into the Legal Issues Relating to Building Information Modelling (BIM). *Proceedings of RICS COBRA AUBEA 2015*, 2015.
- [22] Abanda, F., et al., A Critical Analysis of Building Information Modelling Systems Used in Construction Projects. *Advances in Engineering Software*, 2015. 90: p. 183-201.
- [23] Grover, R. and T.M. Froese, Knowledge Management in Construction Using a SocioBIM Platform: A Case Study of AYO Smart Home Project. *Procedia Engineering*, 2016. 145: p. 1283-1290.
- [24] Forsythe, P., S. Sankaran, and C. Biesenthal, *How Far Can BIM Reduce Information Asymmetry in the Australian Construction Context?* *Project Management Journal*, 2015. 46(3): p. 75-87.
- [25] Shengyi, L. and W. Jia. Research on integrated application of virtual reality technology based on BIM. in *Control and Decision Conference (CCDC)*, 2016 Chinese. 2016. IEEE.