

Malaysian SME's Contractors Adoption of Building Information Modeling (BIM) (Penerimaan BIM di Kalangan Kontraktor PKS dalam Industri Pembinaan Malaysia)

Mohd Zul Aswad Zulkifli^a, Noor Akmal Adillah Ismail^b, Noorsaidi Mahat^{a*}, Mohd Dzuliqyan Jasni^a, Sheikh Ali Azzran Sh Said^b & Mohd Iskandar Abd Malek^c

^aCollege of Built Environment, Universiti Teknologi MARA Cawangan Sarawak, Kota Samarahan, Sarawak, 94300 Malaysia,

^bCollege of Built Environment, Universiti Teknologi MARA Shah Alam, Selangor, 40000 Malaysia,

^cFaculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia 43600 Malaysia

*Corresponding author: noorsaidi@uitm.edu.my

Received 9 January 2023, Received in revised form 27 April 2023

Accepted 8 July 2023, Available online 31 October 2023

ABSTRACT

Building Information Modelling (BIM) is a modelling technology that provides construction professionals with digital tools for use in project planning, design, monitoring, and control. The potential advantages of putting BIM into practice are known to the Malaysian government. The Malaysian government has taken a number of steps to promote BIM in the hopes that Malaysian construction industry experts will utilize it extensively. However, significant difficulties are delaying the introduction of BIM in Malaysia. Implementing BIM typically presents difficulties for smaller businesses. Even though there are numerous benefits to utilizing BIM, small and medium-sized construction companies are still cautious to do so in the course of their work. This study examines BIM adoption in Malaysian small and medium-sized construction firms. The present degree of BIM adoption in Malaysia's construction industry as well as the best tactics to encourage SME contractors in Malaysia's construction industry to embrace BIM more effectively were the subjects of a questionnaire survey that was conducted. According to the survey's results, SME contractors are still trailing behind in adopting BIM due to a number of obstacles that stand in the way of its adoption. In order to increase BIM adoption among SME contractors, it is crucial that government agencies successfully promote and encourage BIM use across the whole Malaysian construction sector. The importance of this study is in gathering data on the extent of BIM adoption among SME contractors, which might be utilized as a benchmark and reference for the development of BIM in the Malaysian construction industry.

Keywords: BIM; Building Information Modelling; adoption; way forward

ABSTRAK

BIM ialah teknologi pemodelan yang terdiri daripada alat digital yang boleh digunakan dalam perancangan projek, reka bentuk, pemantauan dan kawalan di kalangan profesional pembinaan untuk memastikan projek pembinaan disampaikan dengan cara yang cekap yang boleh memastikan kejayaan keseluruhan projek. Kerajaan Malaysia sedar akan potensi faedah pelaksanaan BIM. Oleh itu, kerajaan Malaysia telah membuat beberapa inisiatif untuk mempromosikan BIM dengan harapan ia akan digunakan secara meluas oleh profesional pembinaan di Malaysia. Walau bagaimanapun, pelaksanaan BIM di Malaysia terganggu oleh beberapa cabaran. Cabaran untuk melaksanakan BIM biasanya di kalangan syarikat bersaiz lebih kecil. Dengan semua kelebihan menggunakan BIM, kontraktor PKS masih enggan melaksanakan BIM dalam melaksanakan tugasnya. Matlamat penyelidikan ini adalah untuk mengkaji penggunaan BIM dalam Industri Pembinaan Malaysia di kalangan kontraktor PKS. Tinjauan soal selidik telah dijalankan untuk mengenal pasti tahap penggunaan BIM semasa, dan cara terbaik untuk menggalakkan penggunaan

BIM yang lebih baik di kalangan Kontraktor PKS dalam Industri Pembinaan Malaysia. Penemuan daripada tinjauan menunjukkan tahap penggunaan BIM semasa dalam kalangan kontraktor PKS masih ketinggalan berikutan beberapa cabaran yang menjadi penghalang dalam pelaksanaannya. Cara terbaik untuk penggunaan BIM yang lebih baik di kalangan kontraktor PKS adalah peranan daripada agensi kerajaan untuk berjaya mempromosikan dan menggalakkan penggunaan BIM dalam industri pembinaan Malaysia secara keseluruhan. Kepentingan penyelidikan ini adalah dari segi mendapatkan input mengenai tahap penggunaan BIM di kalangan peserta pembinaan yang memberi tumpuan kepada kontraktor PKS yang boleh digunakan sebagai titik rujukan dan penanda aras ke arah pembangunan BIM dalam Industri Pembinaan Malaysia.

Kata kunci: Membina Pemodelan Maklumat; BIM; penerimaan; ke hadapan

INTRODUCTION

One crucial sector of the Malaysian economy is the building sector. The national GDP (Gross-Domestic Product) growth of Malaysia has a significant influence on the construction GDP growth. In the third quarter of 2019, the contribution to Malaysia's GDP from this sector rose to RM 16950 million from RM 16064 million in the previous quarter. (Department of Statistics Malaysia 2020). The supply of fundamental infrastructure by the Malaysian construction sector promotes social development and is a crucial component of the country's economy. (Construction Industry Development Board (CIDB) 2007).

The government of Malaysia recognizes the potential in this market and has launched a number of initiatives to help push the building industry in the country to new heights. Implementing Information and Communication Technology (ICT) as a management solution is one of the ways that the efficiency of the construction industry may be improved. This is because ICT gives a solution. Electronic procurement (e-procurement) is one method employed by many construction professionals (Mahat et al. 2022). According to Hamid and Kamar (2010), in the Malaysian construction sector, the most effective model for a program that emphasizes best practices is one that places an emphasis on tools and programs related to information technology.

The acronym BIM, which stands for "building information modelling," can have a number of different connotations depending on the setting. BIM is an emerging technology for design, construction, and facility management that uses digital representations of buildings to exchange and interoperate information (CIDB 2014). The definition of BIM varies across the globe and depends on the user's understanding and experience. BIM comes up with different tools and each tool can be used by different and specific construction professionals. Thus, the definition of BIM can be derived from different perspectives of the users.

According to Levy (2010), The AEC-FM industry (consisting of architects, engineers, and builders) has adopted BIM as a standard method for controlling the

duration of building projects. According to Paul (2018), BIM is used in Australia, the UK, the US, Europe, France, Germany, Denmark, the Netherlands, Singapore, Spain, Norway, Italy, China, Japan, and others. The Director of the Public Work Department (PWD) in Malaysia introduced BIM adoption in 2007. Since then, beginning in 2009, the corporate sector has dominated efforts to advance BIM.

The government of Malaysia recognizes BIM's potential for averting design-related issues, minimizing construction cost overrun, and lowering the risk of project delay. (Lim, 2013; Ahmad Latiffi et al. 2013; Zakaria et al. 2013). The Malaysian government has taken a number of steps to promote BIM in the hopes that Malaysian construction industry experts will utilize it extensively. However, the implementation of BIM faces several barriers and challenges. There are several barriers and challenges that might be hindering the implementation of BIM. According to Lindblad (2013) and Gardezi et al. (2014), while cost savings is a major benefit of building information modeling (BIM) implementation in most developed countries, it is one of the main obstacles in Malaysia. Nevertheless, when it comes to deploying BIM, money is not the primary issue for large organizations. Implementing BIM can face unique difficulties, depending on the scale of the business.

PROBLEM STATEMENT

By the year 2020, Building Information Modelling (BIM) be declared mandatory in certain private-sector projects (CIDB 2016). As the preparation to usher in Fourth Industrial Revolution 4.0, the adoption of digital technology is crucial and thus Datuk Ahmad Asri Abdul Hamid has encouraged the use of Building Information Modeling (BIM) among construction professionals. The proposal is under the Construction Industry Transformation Programme (CITP), but the enforcement period has not been determined due to the low acceptance and slow BIM adoption among construction professionals in the industry even after several attempts in encouraging and promoting BIM (Bernama, 2019). BIM adoption is also related to sustainability

aspects, as findings from residential construction also showed low to medium adoption of sustainable construction (Mahat, Tah, & Vidalakis 2016, 2019). The Malaysian government has made the use of BIM mandatory for a select few large businesses, whereas, beginning in 2019, all publicly funded projects with a budget of RM100 million or above will be required to use Building Information Modelling (BIM) technology. On top of that, CIDB also has inked a strategic partnership with Gamuda Industrial Building System Sdn Bhd (GIBS) on information research and data sharing to enhance construction productivity in Malaysia. This strategic partnership between CIDB and GIBS marks a significant step for the Works Ministry, through CIDB, to stimulate the adoption of the online design tool BIM (CIDB 2014).

The encouragement of the adoption of BIM has been done by the government this includes the establishment of myBIM Centre as a one-stop reference, support, services, and capacity-building center. Aside from that, regular technical training has been provided, as well as collaboration with many colleges to train the future generation of construction workers. According to Shuratman (2012), although current technologies are ready for mass production, construction professionals appear to be hesitant to use BIM. The promotion of BIM has become the top priority of the government worldwide but due to some existing barriers construction professionals seems to be reluctant in adopting BIM. (Gu and London 2010; McAdam, 2010; Alreshidi et al. 2018). According to CIDB (2014), The seminar hosted has gathered the variables under four headings: cost, system needs, lack of expertise, and readiness to change.

The NBS BIM study (2017) found that smaller practises were less likely to employ BIM than larger ones. Compared to larger companies, small practises are roughly 65% less likely to have used BIM. The NBS (National Building Specification) in its 2016 report about BIM Implementation found that small firms are concerned about the cost of BIM as the costs of software, training, and business process changes. The issues arise when it comes to promoting BIM to Small and Medium enterprises (SMEs). According to Kouch (2018), The majority of active SME contractors are not knowledgeable about or comfortable using BIM. According to Anuar (2015), in spite of the numerous positive aspects associated with utilizing BIM, small and medium-sized contractors are still cautious to do so when carrying out their duties therefore, identifying BIM's capabilities in managing the construction life cycle effectively requires investigating its deployment across SMEs.

In addition, the Malaysian government is planning to transform the construction industry to be more professional

and recognized globally. With this agenda, the government has come out with a transformation program known as Construction Industry Transformation Program 2016-2020 (CITP). There are four (4) strategic thrusts under CITP which include Quality, Safety and Professionalism, Environmental Sustainability, Productivity, and lastly Internationalization (CIDB, 2016). Under the productivity-related issues, it was stated that there is still limited use of technology such as BIM. Furthermore, it was also mentioned that the capacity and capability of the SME need to be improved and intensified. Thus, SME has been targeted to be the driver of BIM adoption in order to assist the government to accomplish the agenda to transform the construction industry to be more professional and recognized worldwide. (CITP, 2016). Thus, the purpose of this article is to analyse the use of BIM by small and medium-sized enterprises (SMEs) in Malaysia's construction sector.

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY FLOW

Figure 1 depicts the four (4) stages that make up the research methodology flow. The first step is to collect background information in order to define the research problem, select a topic, formulate a problem statement, and establish goals. A brainstorming session for the research topic was conducted to identify current issues on BIM implementation in construction projects. Stage 1 shows a literature review that was started initially prior to providing more information that can be used as a guideline and reference.

The second stage shows the data collection. In the data collection stage, the data collection technique was identified. The quantitative method was selected as the data collection technique which was by using a questionnaire survey. In order to learn more about how BIM is being used in the Malaysian construction industry, specifically by SMEs, a comprehensive literature review was conducted. Materials such as books, journals, papers presented at international conferences, and online resources were analyzed for data on BIM's dissemination and uptake.

The third stage is data analysis. At this stage, the data is analyzed by descriptive data analysis. Tools like Microsoft Excel and SPSS are used to assist researchers in analyzing all the collected data Discussion of the results and findings gained constituted the final part of the process. Subsequently, the discussion of results and findings, conclusion, and recommendation are generated.

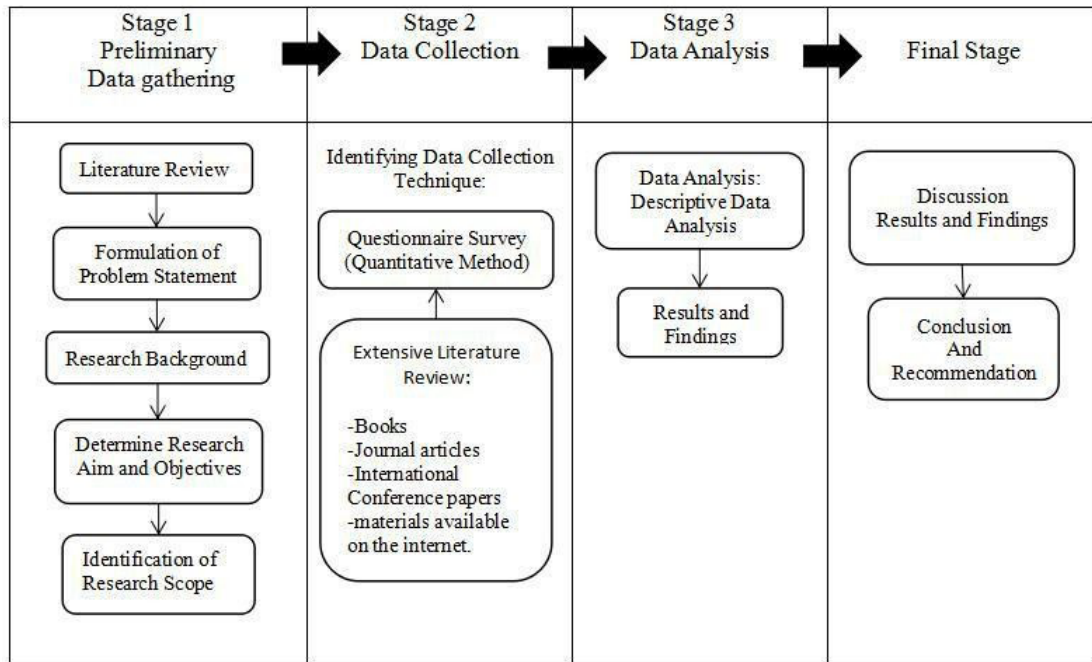


FIGURE 1. Research Methodology Flow

THE FINDINGS

LEVEL OF BIM ADOPTION

Practicality of Adopting BIM		Frequency (number)	Percent (%)
Valid	Yes	35	34.7
	No	66	65.3
Total		101	100.0

FIGURE 2. The practicality adopting BIM

The involvement of Company in Project Implementing BIM		Frequency (Number)	Percent (%)
Valid	Very low	9	8.9
	Low	44	43.6
	Neutral	38	37.6
	High	9	8.9
	Very high	1	1.0
Total		101	100.0

FIGURE 3. The involvement of company in project implementing BIM

From the survey conducted in this research, it was found that the current level of BIM adoption amongst SME contractors in the Malaysian Construction Industry is **moderately low**. Of the total of one hundred one (101) respondents, 66 respondents were not practically adopting BIM. Furthermore, more than half of the respondents have stated that their company involved in projects implementing

BIM is on a scale of low to very low. On the other hand, the respondent’s company’s BIM project count was mostly still low ranges from 1-5 projects only. From the survey, it was observed that BIM is adopted mostly during the pre-construction stages which is during the scheduling, designing, and estimating only. Also, the BIM software that is mostly used among the SME’s contractors were

Navisworks and Revit by Autodesk. The SME's contractors were moderately knowledgeable about Building Information Modelling (BIM). Overall, SME contractors

are now using BIM at a moderately low level, which calls for substantial attention and effort to complete a successful construction project.

BIM, A WAY FORWARD

Questions	Best Ways Category	Best Ways Statement	Mean	Rank
DA2	Roles of Government	Providing BIM standard or guidelines for the BIM practitioners	4.2475	1
DA5	Roles of Government	Providing CIDB portal for seeking for BIM information	4.2376	2
DB2	Roles of Construction Professionals	National leadership and better coordination between government and the industry players	4.2178	3
DA1	Roles of Government	Organizing a series of programme such as seminar and workshop about BIM for the BIM practitioners	4.2079	4

FIGURE 4. The three most effective methods for boosting BIM adoption

From the survey conducted, government agencies play a major role in the best approaches to promote BIM adoption among SME contractors. The SME contractors believe that the Government is the driving force in encouraging construction industry's embrace of BIM technology. The best way can be done by providing a BIM standard or guideline for the BIM practitioner. Also, the Government needs to provide the CIDB portal for providing information and support services as this will give them greater clarity. National leadership and coordination made by the Government can also minimize inefficiencies and avoid the many problems that may arise. Government agencies should lead this leadership, but significant industry players including private sector clients, contractors, and industry/professional groups must support and collaborate. Moreover, the Government also needs to organize a program such as a seminar and a workshop more frequently in making sure that the BIM knowledge is spread widely, received rightly, and understood properly by the SME's contractors. Subsequently, the Government can also provide certifications and accreditation or licenses to the SME's contractors as this may boost their motivation to grow and adopt BIM for their projects. Moreover, the Government also needs to assist the SME's contractors with a few incentives such as tax reductions for adopting BIM. According to the report, government agencies play a major role in the best approaches to promote increased BIM use among SME contractors.

CONCLUSIONS

Since there are so many obstacles to overcome during implementation, the amount of BIM adoption that is now seen among SMEs is still significantly lower than average. The best way to increase BIM adoption among SME

contractors is for government entities to actively promote and encourage its use throughout the Malaysian construction sector.

ACKNOWLEDGEMENT

The authors are appreciative to UiTM for funding this research. The registration fees are funded by *Pembiayaan Yuran Prosiding Berindeks (PYPB)*, *Tabung Dana Kecemerlangan Pendidikan (DKP)*, Universiti Teknologi MARA (UiTM), Malaysia. The authors would also want to express their appreciation to the various institutions, groups, and individuals that helped make this research possible.

REFERENCES

- Ahmad Latiffi, Aryani & Mohd, Suzila & Kasim, Narimah & Fathi, Mohamad Syazli. 2013. Building Information Modeling (BIM) application in Malaysian construction industry. *International Journal of Construction Engineering and Management* 2(6). 10.5923/s.ijcem.201309.01.
- Alreshidi, Eissa, Monjur Mourshed, and Yacine Rezgui. 2016. Requirements for cloud-based BIM governance solutions to facilitate team collaboration in construction projects. *Requirements Engineering* 23(1): 1–31. <https://doi.org/10.1007/s00766-016-0254-6>.
- Anuar, K. F., & Zainal, M. H. I. 2015. The challenges in implementing Building Information Model (BIM) for SME's contractor in the construction industry. *Infrastructure University Kuala Lumpur Research Journal* 3(1): 40–49.
- CIDB. 2007. Construction Industry Transformation Plan.
- CIDB. 2014. Construction Industry Transformation Plan.

- CIDB. 2016. Construction Industry Transformation Plan. Construction Research Institute of Malaysia, CREAM.
2014. Issues and Challenges in Implementing BIM For SME's in the Construction Industry. Department of Statistics Malaysia. 2020. <https://www.dosm.gov.my/portal-main/release-content/gross-domestic-income-2019#:~:text=OVERALL%20PERFORMANCE%202019,recorded%20a%20value%20of%20RM912>.
- Gardezi, S. S. S., Shafiq, N., Nurudinn, M. F., Farhan, S. A., & Umar, U. A. 2014. Challenges for implementation of Building Information Modelling (BIM) in Malaysian construction industry. *Applied Mechanics and Materials*, 567(JUNE)
- Gu, N. and London, K. 2010. Understanding and facilitating BIM adoption in the AEC industry. *Automation in Construction* 19(8): 988-999.
- Hamid, Z.A. and Kamar, K.A.M. 2010. Modernising the Malaysian construction industry. Proceedings of the W089 - Special Track 18th International Council for Research and Innovation in Building and Construction (CIB) World Building Congress, Publication 380, pp. 267-280.
- Kouch, A. M., Illikainen, K., & Perälä, S. 2018. Key Factors of an Initial BIM Implementation Framework for Small and Medium-sized Enterprises (SMEs). Proceedings of the 35th International Symposium on Automation and Robotics in Construction (ISARC). doi: 10.22260/isarc2018/0126
- Levy, S. M. 2010. *Construction Process Planning and Management: An Owners Guide to Successful Projects*. America: Elsevier, Inc.
- Lim, Chong Fong. 2013. *The Malaysian PWD form of Construction Contract: First Supplement to the Second Edition*. Petaling Jaya, Selangor, Malaysia: Sweet & Maxwell Asia.
- Lindblad, H. 2013. Study of the implementation process of BIM in construction projects: Analysis of the barriers limiting BIM adoption in the AEC industry. (Unpublished Master's Thesis). University of Stockholm, Sweden.
- Mahat, N., Tah, J. H., & Vidalakis, C. 2016. Adoption of sustainable construction in the Malaysian residential construction sector: A conceptual framework. Paper presented at the 4th International Conference on Advances in Agricultural, Biological & Ecological Sciences (AABES-16) Dec.
- Mahat, N., Tah, J. H., & Vidalakis, C. 2019. Sustainable construction and residential building developers in Malaysia: factors affecting the adoption. Paper presented at the Thirty-Fifth Annual Conference.
- Mahat, Noorsaidi, Asmah Alia Mohamad Bohari, Mohd Azrai Azman, Natasha Khalil, Amira Shazlin Adnan, Mohd Iskandar, and Abd Malek. 2022. e-procurement adoption in the Malaysian construction sector: Integrating diffusion of innovations and theory of planned behaviour framework. *Jurnal Kejuruteraan* 34(3): 347-352.
- McAdam, Brodie. 2010. Building Information Modelling: The UK Legal Context. *International Journal of Law in the Built Environment* 2(3): 246–59. <https://doi.org/10.1108/17561451011087337>.
- NBS. 2016. National Building Specification, National BIM Report., n.d. <https://www.thenbs.com/knowledge/national-bim-report-2016-articles>.
- NBS. 2017. National Building Specification, <https://www.thenbs.com/knowledge/bim-building-information-modelling>.
- Paul, S. 2018. BIM adoption around the world: How good are we? <https://www.geospatialworld.net/article/bim-adoption-around-the-world-how-good-are-we/>
- Shuratman, Z. 2012. Building Information Modelling in Local Construction Industry, PhD Thesis, Universiti Teknologi Malaysia.
- Zakaria, Z., Mohamed-Ali, N., Haron, A. T., Marshall-Ponting, A. & Abd-Hamid, Z. 2013. Exploring the adoption of Building Information Modelling (BIM) in the Malaysian construction industry: A qualitative approach. *International Journal*.