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Building Information Modelling (BIM) Implementation: Challenges for Quantity Surveyors

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Abstract

Building Information Modelling (BIM) is a multidimensional model platform that functions as an information centre and database for projects. It has become the current trend in the construction industry as the application of BIM software offers a lot of advantages such as digitalization, communication, and collaboration among project participants. However, there are rising concerns on the readiness of quantity surveyors to cope with this digital technology. Hence, this study aims to assess the implication and challenges of BIM on the quantity surveying (QS) profession in Malaysia. This research utilised qualitative methods in which semi-structured interview was conducted with quantity surveyors that use BIM in their practices. Data abstracted from interview transcripts were then coded through NVivo and analysed using the content analysis method. The findings show that challenges posed by BIM implementation are all related to each other. Narrow BIM application is the main primary challenge. The unfamiliarity of the industry towards BIM leads to the non-utilization of BIM models and files. This research elaborates fundamental challenges faced by the QS profession and provides a way forward to integrate the traditional practice into the current technology.

Disciplinary: Construction Project Management, Built Environment.

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1 Introduction

Building Information Modelling (BIM) is a technology and associated set of processes to create, insert, share, exchange, and manage the information in a centralized model to improve designs, constructions, operations, and maintenance processes (Raphael & Priyanka, 2014). It is

also deemed to be an appraisal approach that promotes digital information across the entire life cycle of project management (Georgiadou, 2019). BIM operates on an integrated platform where designs and information from different parties are combined and interconnected, reflecting the entire constructions projects (Charehzehi et al., 2017). It allows for real-life scenarios simulations and detects possible problems in a virtual environment before the actual construction project is developed. Issues like clashes and errors should be detected early so that they can be rectified to mitigate the effects. BIM has already changed the ways projects are conceived, designed, communicated, and constructed by integrating the fragmented architecture, engineering, and construction (AEC) industry (Abd Hamid et al., 2018).

With BIM gradually being incorporated in the industry, it is certain that all construction profession disciplines including quantity surveying are inextricably linked to the paradigm shift engineers during the project lifecycle. According to Raphael & Priyanka (2014), designers have been using BIM widely for visualization of design whereas contractors have been using BIM for planning and scheduling. The possible future impact of BIM in the construction industry in Malaysia cannot be disregarded, be it good or bad. This research aims to assess the implication of BIM on the quantity surveying profession in Malaysia and its challenges.

2 Literature Review

BIM has become the standard in the construction industry in developing countries as building design and work are becoming more complex. The positions of multiple professionals in the construction industry, including quantity surveying (QS) practitioners, are also affected inevitably. The Royal Institution of Chartered Surveyors (RICS), the Royal Institutions of Surveyors of Malaysia (RISM), and the Board of Quantity Surveyors (BQSM) vigorously encourage the use of BIM among QS in Malaysia.

There is significant evidence to show the impact of digital technology on QS. The successful introduction of BIM would not occur without influencing the profession of quantity surveying. Olatunji et al. (2010) noted that the implementation of BIM is a major challenge to the services historically rendered by quantity surveyors and other construction disciplines.

Traditionally, QS services include the preparation of feasibility studies, preliminary estimates, quantity bills, cost plans, and schedules (Olatunji et al., 2010). QS prepares and compiles documentation for construction contracts such as preparation of tenders, selection of contractors, and financial supervision. Additionally, QS offers services such as construction project management, dispute resolution, and value management, making them a key contributor to the project.

A primary issue in the quantity surveying field is the method of measurements. Different locations have different methods based on the contractor and suppliers. In the United Kingdom, the Standard Method of Measurement (SMM) has been switched to the Standard Method of Measurement 7 (SMM7) and then to the latest version of the New Rules of Measurement 2 (NRM2). However, in Malaysia, the Standard Method of Measurement 2 (SMM2) is still being used. The

development of technology has seen a steady rise, but the transformation of QS has sluggish growth. Therefore, the current issues in the Malaysian QS industry are expected to be resolved through the evolvement of QS in following the technology trend.

Undeniably, the application of BIM technology has brought a lot of advantages with the automation of software. Nevertheless, many QS practitioners across the globe are concerned that only those who are competent enough to evolve according to the industry demand, can survive in the next century of modernization and technology (Wee, 2017). As opposed to the growth of the profession, it is also worrying that the advancement of BIM would eventually overtake the QS job scope such as quantity take-off. This is because BIM can perform most of the conventional QS practices which may lead to a situation whereby QS is no longer needed in the industry (Raphael & Priyanka, 2017). For instance, BIM systems have the capability to automate the measurement of quantities from construction drawings (Olatunji et al., 2010).

According to Gee (2010), BIM's capabilities of automating the production of bills, which is one of the quantity surveyors' fundamental tasks, will have both positive and negative effects on the QS discipline. Unfortunately, the automatic processing for bills of quantities also often brings pitfalls to the table. The automation of this task will help quantity surveyors to get more work done with a smaller production team. That would lead to a decrease in the number of workers required. As a result, the unemployment of quantity surveyors might be an issue if there is no evolution or adaptation of QS practices with the blossoming of BIM.

2.1 Challenges of BIM Implementation in QS Practices

According to Gee (2010), BIM is a multi-dimensional paradigm that acts as an information and coordination mechanism throughout the lifecycle of a building project consisting of 3-dimensional (3D) modelling features, cost estimating features as well as scheduling and programming features. For the cost estimation aspects, 5D BIM enables the design visualization, the fastening of the quantity take-off, the development of an efficient and accurate cost estimate and measurement (Jiang, 2011). Consequently, the future development and increasing traction of BIM technology demand that quantity surveyors operate faster in delivering high-quality work. This situation has brought new challenges to the QS profession.

According to Latiffi et al. (2013), the greatest rewards could be obtained through BIM application if the companies could encompass in-depth knowledge about construction and coordinate the design phases. The owners will benefit more when the contracting arrangements prioritize outstanding cooperation during BIM implementation in a project. Furthermore, a building model will be created and shared among the project team when BIM is applied in a certain project. Knowledge and time are the key components to facilitate the changes that will be experienced by the firms for all kinds of technology incorporation.

Several issues might occur during BIM implementation although it has provided new cooperation strategies among the project team (Ellul et al., 2017). For example, the team members might not agree upon the way of sharing model information. There are cases where a third party

must construct their own model for estimating and planning the construction project when the architect provides design in traditional paper drawings. Moreover, a situation may become complicated if different BIM tools are used for modelling by the architect and engineer as compilation and combination of the design models require a special platform that offers the transference and mobilisation of models. Consequently, the project designs are prone to error which leads to poor performance of the project.

While it is understood that BIM provides unrestricted sharing of electronic data, the management of professions, businesses and people remain stuck across geographical and cultural constraints, and also political identities in Malaysia (Gardezi et al. 2014). Furthermore, apart from the large ventures, several local firms are mostly run by local workers who obey relevant rules and terms of reference. Therefore, BIM implementation has several possible obstacles in each country including Malaysia. Hence, the involvement of experts or practitioners armed with the knowledge and experience is important to sustain the effectiveness of BIM execution. It is also in accordance with the results found by Ho & Rajabifard (2016), where the involvement of cultural and behavioural moulding in Singapore's BIM approaches creates a constructive reaction to chance and embrace BIM.

Presently, there are no clear instructions or directions available for the application or execution of BIM in construction. Yaakob et al. (2016) also claimed that there have not been any specific guidelines for incorporating BIM in work or practices. While a few tech firms have created several tools to assist the introduction of BIM, they also mostly tried to address the aspects of quantity rather than applying it as a whole. The company can, however, by prioritizing the time, cost, budget, and resources as their guidance assign managers to direct the team in charge of preparing for the adoption of BIM. In fact, an integration strategy should be created to anticipate potential influences and effects of the future implementation changes on the company's clients, partners, and internal departments.

In order for BIM to be implemented by organizations, concise, clear, and consistent guidelines must be enforced. The stakeholders also posed questions of accountability for designing models and allocation of costs as the challenge of management. Thus, to tackle this problem, all parties including researchers, vendors, and professional organizations need to create solutions together to expand the usage of BIM in the Malaysian construction industry (Latiffi et al. 2016).

2.2 Limitation of BIM in Quantity Surveying Practices

BIM approach definitely gives competitive advantages to the QS in their services. Yet every program has its strengths and weaknesses (Kensek, 2014). It was identified by Soon et al. (2016) that technical issues such as software constraints, lack of standard, and rules constraints as well as communication and people constraints affect the deployment of BIM in Malaysia. Also, the cost involved is one of the restrictions impacting the BIM incorporation (Keng & Ching, 2011).

Software limitations are the most vital shortcomings in the application of BIM as they can directly influence the result of the project (Soon et al., 2016). Although the BIM tool is capable of performing most manual work quickly, it is unlikely to address all quantification issues (Kamran, 2015; Olof et al., 2012). A survey by Monteiro et al. (2013) revealed that BIM modelling is limited by the tools available. For example, with the most advanced software for take-off systems, it is still not possible to extract the quantities without adapting the model to a certain extent.

Bryde et al. (2013) show that 20% of the projects reported that BIM software is not able to manage massive volumes of data and there is a lack of software engineering expertise. For instance, Glodon software was found to have complicated interfaces where heavy drawing cannot be held. Thus, the QS could not be performed effectively.

Hence, a BIM model still has drawbacks and is not able to meet all the user needs, whether those correspond to quantity take-off, extraction of model views, or others (Monteiro et al., 2013). It is crucial for QS to be able to adjust to these new tools and standards.

3 Research Method

Since the study is subjective in nature with more emphasis on the interviewees' experiences and opinions that are often described verbally, adopted a qualitative approach has been adopted to address the research objective. The collection of in-depth and adequate information to further identify the challenges faced by a quantity surveyor with the implementation of BIM in Malaysia, a semi-structured interview was considered as the most ideal technique for this research. In order to allow the respondents to express their opinions freely during the interview, some open-ended questions were designed and added.

Board of Quantity Surveyors Malaysia (BQSM), real estate, Housing Developers' Association Malaysia (REHDA), and Construction Industry Development Board (CIDB) were the source for the respondents' selections. The purpose for selecting a registered company is to have a broader spectrum of evaluation on quantity surveyors in each group as registered companies are financially capable of using BIM and have encountered BIM implementation in their projects. The interviewees were subject to senior staff who have expertise in the field of quantity surveying, such as senior quantity surveyors who had participated in a BIM project or adopted BIM in their work. A total of 20 interview participants were selected.

In this research, data collected from the interview sessions were transcribed into written form on Microsoft Word 2010 and classified into categories based on the main themes they communicate. This method of data analysis is called the content analysis method. To easily undertake this thematic analysis, computer programmes such as Nvivo 12 Pro were used to transform raw data obtained from the interview into meaningful information which can be analysed to achieve the research objectives.

4 Results and Discussion

In this section, the challenges brought by BIM were identified based on the views of the interviewees. Table 1 summarizes the key findings from the interviews.

Table 1: Challenges of BIM Implementation in Quantity Surveying Practices.

No.	Item	Percentage (%)
1	Narrow BIM application environment	45
2	Limited for post-contract	35
3	Limitation of BIM tools itself	35
4	Drawing not according to standards	25
5	Challenge in learning BIM tools	25
6	Lack of BIM experience, knowledge, and expertise	25
7	File not updated by contractor	20
8	Interoperability issues	15
9	Incomplete details during initial stage	15
10	Complexity - Lost track of latest file	15
11	Communication issues	15
12	Discrepancy of drawings	10
13	High Installation cost	10
14	High computer specification requirements	10
15	Time Constraint	10
16	Extra Coordination Work for QS	10
17	Different standards in all countries	5
18	Reluctance to change	5
19	Management of Scope	5
20	Delay in post-contract drawing production	5
21	A lot of changes after post-contract	5
22	Minimal challenge	5

Almost half of the interviewees noted that the narrow BIM application environment is a major challenge. It was described by the interviewees that BIM is not commonly implemented in the market, and added, "*In Malaysia, I think it is not widely adopted because it needs very strong teamwork between all consultants which come from different companies and different backgrounds. It is also related to whether it is useful to the developer.*" In this case, the surroundings of the Malaysian construction industry (CI) are not familiar with the BIM approach, which leads to difficulty in communication among the QS that adopt BIM with other construction parties. An example was quoted from an interviewee, *"...the clients who are not using BIM will question our accuracy in our task, because they're not familiar."* Collaboration and communication would become difficult when one of the individuals among the project team is not familiar with the digital tools in the BIM project.

The findings indicated that narrow BIM application is the main stem that branches out the rest of the challenges. The unfamiliarity towards BIM by the industry leads to the event of BIM models and files not being utilized by the contractor during the construction period where they do not update their work progress in the file. Corresponding to that, the factors of high installation cost, high computer specification requirements, and reluctance to change by people might be the roots of the situation. Figure 1 illustrates the hierarchy chart model of the challenges faced by the QS profession.

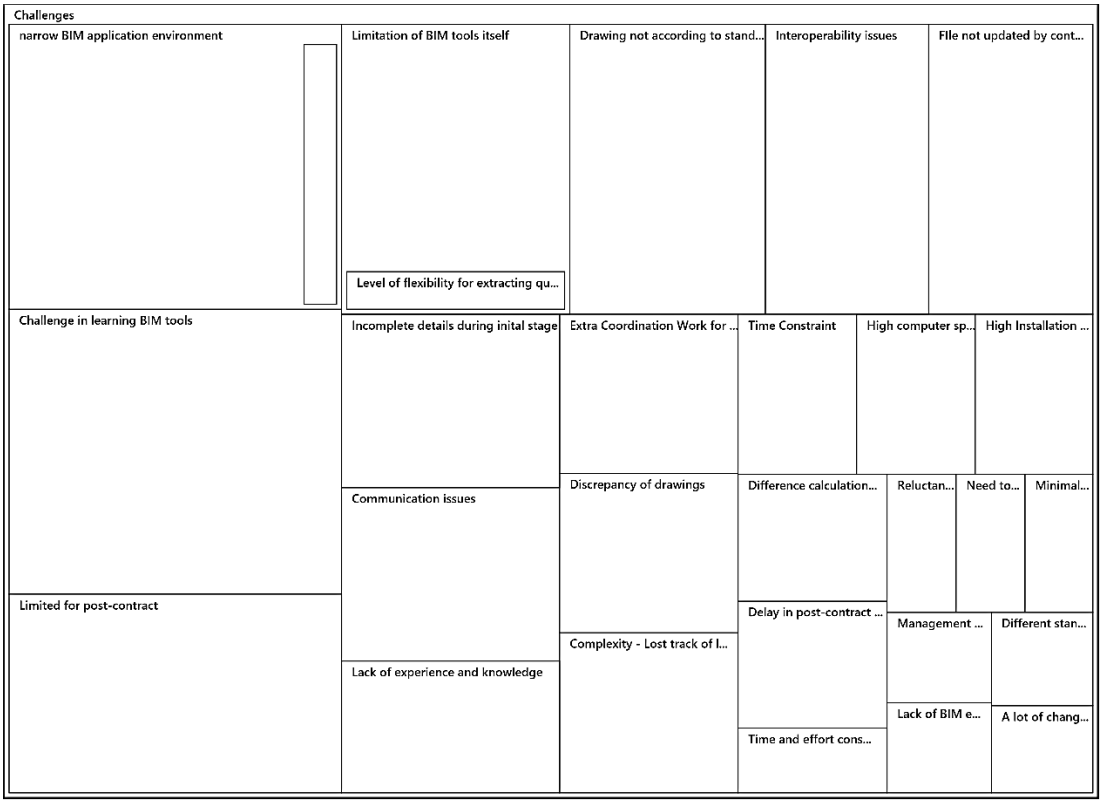

Figure 1: Hierarchy chart model from NVivo.

Due to the immaturity of BIM adoption in the country, collaboration and communication problems occur, including the interoperability issues where tools and software used by all the construction professional parties vary. The collaboration issues cause extra coordination work for quantity surveyor who tends to play the role of a middleman. Furthermore, the lack of BIM experience, knowledge, and expertise leads to the challenge of learning BIM tools by quantity surveyors.

It was also discovered that there are several results from the fieldwork that matches the findings of the desk study. The data analysis of the shortcomings of BIM tools discussed in Section 4 supports the claim of Soon et al. (2016) as mentioned in the literature review that BIM software limitation restricts the performance of QS where the level of flexibility to control the tool is still low.

Next, the outcomes of interoperability issues correspond with the findings of Kim & Park (2016) in which the designers such as architects and engineers used a different BIM tool and produced models with dissimilar precision that caused compatibility issues.

Moreover, the interviewee stating that BIM experience, knowledge, and expertise constraint as a challenge in applying BIM has confirmed the statement presented in the studies of Wang & Song (2017) about the importance of professional support to provide consultations and motivations.

In-line with the hypothesis by Ademci & Gundes (2018) that the complications of teamwork and collaboration occur during BIM execution, the results of the analysis indicate that poor coordination does occur due to communication issues.

Furthermore, the results of a narrow BIM application environment correlate with the claims of Ismail et al. (2017); Wong et al. (2014); and Zahrizan et al. (2013) that the adoption of BIM is still limited in the current construction industry domestically.

Also, the results agree with Kim & Park (2016) who reported that the incomplete details and information of the BIM models render inconvenience to the quantity surveyors in completing their task. More time is needed by them to overcome the information gap in terms of essential dimensions for quantities measurement and cost estimation.

The data suggests that reluctance to change has been one of the challenging concerns. It is consistent with the previous studies of Monazam et al. (2016) that the factor of human resource poses a hurdle in implementing BIM followed by the organizational issue.

5 Conclusion

This paper identified the challenges brought by BIM towards the quantity surveying profession in Malaysia. From the findings, the implications posed by the advent of BIM were distinguished. The most significant challenge in implementing BIM in QS practices is the environment's unfamiliarity with BIM. In Malaysia, BIM application is still considered as narrow. This situation makes it inconvenient to adopt the BIM approach in QS practices as communication and collaboration issues arise between professional parties in a project.

These results may remind the board of QS to be aware of the severity of BIM implications so that they would understand the crucialness and urgency to increase their value as a professional party in the sector. The commitment to improve their knowledge continuously via life-long learning is inevitable. Future research could be directed towards the strategies to overcome the challenges of BIM among quantity surveyors.

6 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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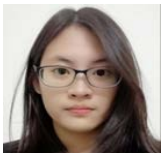

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