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The Application of Building Information Modeling (BIM) in Quantity Surveying Firm Towards Quality Improvement

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Abstract

Building Information Modelling (BIM) is a detailed process of designing and building in construction industry collaboratively by using one integrated system generated by computer rather than separate the work by separate drawings. On the other hand, it provides a large amount of benefit in terms of cost saving and time, much better accuracy in estimation and reducing arithmetical error and any amendment due to loss of information. Existing studies have determined the quantity surveying firm readiness due to BIM implementation in Malaysia. However, this research is aimed to establish the status of BIM application in quantity surveying firms for quality improvement, especially in current practices by unveiling the present findings. The study objectives are to find out the importance of BIM in the construction industry, to investigate the challenges faced by quantity surveying firms in the implementation of BIM and to suggest a suitable solution for quality improvement to quantity surveying firms. The data collection was conducted by using the quantitative method, which is through the questionnaire survey. The scope is narrowed down to quantity surveying firms that registered in Board of Quantity Surveyors Malaysia at Northern Region of Peninsular Malaysia only. The findings of this study revealed that quantity surveying firms had difficulties in implementing BIM due to lack of capability and complexity in using BIM software itself such as Cubicost by Glodon. It also revealed difficulties in collaboration during implementing BIM software which causes the firms to decline from using BIM. Hopefully, this research will help the quantity surveying firms by giving a clear exposure on the BIM implementation and how to use it in their current practices for quality improvement.

Keywords: Building Information Modelling, Implementation, Quantity Surveying Firm, Quality Improvement

Introduction

Building Information Modelling (BIM) has become popular in the construction field since 1970s. In 1962, American engineer and inventor known as Douglas Engelbart said in his paper "Augmenting Human Intellect" on the prediction of architect vision is the data entry by architects such as series of specification, slab floor, concrete walls in excavation and roofing, he revised these on the computer screen and these entries become larger and detailed, data is interconnected and interlinked between each other and they represent the actual design itself (Quirk, 2012). This shows that Engelbart's dreams really happened several years later as he suggested object-based design, parametric manipulation and relational databases that is known today as BIM. BIM is currently accepted as a detailed process of designing and building in construction industry collaboratively by using one integrated system generated by computer rather than separate the work using separate drawings (Babbie, 2009). Evolutions in software and hardware technologies have been the main enablers of the development of BIM in developed countries (Lee & Borrmann, 2020). Developing countries in general have been slow in adopting BIM. The situation is the same in Malaysia, since 2007 BIM only recorded 17% of adoption (Roslan et al., 2019 and Ikhsan, 2019). This still happens although BIM offers benefits that could provide a large amount of benefit in terms of cost-saving and reduction in time, much better accuracy in estimation and reducing arithmetical error and any amendment due to loss of information. Moreover, for the past decade, BIM has proven to be beneficial not only during pre-contract phase, but as well as improving efficiency throughout the life-cycle building (Editor, 2015).

Literature Review

According to Kumar & Cheng (2015), many consultants were not able to determine their productivity or rework rates when running projects with no implementation of BIM. It appears to be a systemic lack of understanding among project stakeholder of the cause of the project problem and effect relationships related to field productivity rates. Research conducted by Bliss (2017) claims that about 24% of rework claims are due to lack of details or inaccurate specs and logistics. Delays in getting the latest and accurate information to the field results in more RFIs and less accurate work. By using BIM application, it can provide a single, cloud-based repository for all project documentation, making real-time communication, collaboration and document exchange possible between the stakeholders. With the implementation of the right BIM software, documents, and communications can also be managed on smartphones and tablet, making it easier for staff to be continuously in the loop with the office. This will ensure and improve understanding of difficult project conditions, creating the ability to engage and collaborate with remotely located team members and accelerate issues resolution and RFI communications. The building will directly go up right the first time, without the need to redo things, and eliminating the associated cost of those changed orders (Buncio, 2017). Uncertain information about designers or lack of updates or changes in design information might lead to minor or major reworks which might heavily cut the client's finances. As BIM is centralized and implemented, any updates or changes made by any stakeholders are instantly reflected leading to uniformity of information and work which leads to zero construction errors (Poirier et al., 2015).

Various authors discuss the BIM benefits in quantity surveying firms such as cost checking for decision making (Matipa et al., 2010), automation of quantity take-off (Wijayakumar and Jayasena, 2013), improved project performance by time, cost and quality aspects (Wong et al., 2014) and value-added to services (Crowley, 2013). However, utilizing BIM software requires a huge amount of money because every organization that bought this software need to upgrade and maintain the license. This is because the software itself contains numerous amount of bugs that need be reprogrammed by the developer. This will ensure the software's capability to handle much more complex design (Arayici et al., 2012). An online search reveals that CAD software packages that is available on market is cheaper compared to BIM software packages. For example, Autodesk Revit costs about RM 8,500.00/year, for only one user. To implement BIM for a small office, at least three types of softwares are needed which is included in BIM known as Revit, collaboration and estimating. Collaboration for Revit helps project stakeholders from multiple disciplines, locations, and firms to collaborate in the cloud with centralized access to Revit models. For estimating, Autodesk Navisworks Simulate integrated with 2D and 3D quantification which supports project measurement and generate quantity workbook. All this three-softwares cost about RM 15,000.00/year for one user. For hardware, it needs to be powerful enough to handle complex design, which ranged from RM4,000.00 to RM 10,000.00 for custom desktop or laptop. Moreover, on-site staff also need to be trained using this software. The training cost is ranging from RM8,000.00 to RM10,000.00 depending on the course chosen. To conclude, implementing BIM is suitable for a large firm that has the full potential of its capital because it requires a huge amount of investment to cover all the mentioned cost (Poirier et al., 2015). Buncio (2017) stated that internal staff, external firms, incoming entry-level staff and more readily available training in BIM were required to realize the potential value of BIM. According to McGraw-Hill Construction et al (2010) it shows that BIM training was placed among the top three targets for investment by the industry but percentages allocated for the required skills needed by BIM is still low.

Methodology

This research is conducted by using a quantitative method which is the questionnaire survey. The population is among of the northern region of peninsular Malaysia quantity surveying firms. The list of firms used as data is obtained from Board of Quantity Surveyor Malaysia (BQSM) and the sampling method used for this research came from one type of non-probability sampling method which is purposive sampling method. İt received 100 per cent response rate from the total of 28 quantity surveying firms located at the northern region. Based on a fundamental statistical viewpoint, this research adopted descriptive analysis in means of report using Likert scale, which is thought to be the most appropriate statistical test (Saunders et al., 2016).

Fındıngs and Discussions

Based on Table 1, improving the productivity of construction industry appears to be at the highest rank of importance of Building Information Modeling applications. Most of the respondents also agreed with the ten (10) importance of Building Information Modeling applications listed below. It clearly shows that BIM helps in improving productivity since all of the information will all link up together and later integrated into the cloud storage. From there, all information such as building models, bill of quantities and schedules can be easily

accessed; making it an effective platform for identifying, estimating and planning the different sequences in construction (Park et al., 2013).

Table 1
Significant of BIM Application in quantity surveying firms

Criteria	Mean	Rank
Improving productivity	4.64	1
Giving better visualization in construction project	4.57	2
Improving the accuracy of takeoff and estimating	4.57	3
Help in reducing the overall cost	4.43	4
Producing higher quality output	4.29	5
Detect clash between structure design	4.29	6
Improving coordination between department	4.29	7
Help in giving customer better satisfaction	4.29	8
Decreasing reworks and leads to zero construction errors	4.21	9
Controlled whole-life costs and environmental data	4.21	10

Challenges

Referring to Table 2, the high cost of hardware appears in the top rank of challenges faced in the implementation of Building Information Modeling in quantity surveying firms. This finding is consistent as discussed before, as the high cost of hardware becomes the main challenge for the firm to implement BIM (eConstruct, 2017). However, this contradicts another finding that discovered major challenges in implementing BIM is lack of competent staff to operate the software (Memon et al., 2014). Consultant needs to have a large sum of the capital cost to invest in order to implement BIM. This is because BIM implementation requires high-end hardware so that BIM software can run smoothly. BIM needs to be set up on a server as well as at each of the project stakeholder's office. The server acts as a centralized information center and cloud storage (Olsen & Taylor, 2017). New finding indicates that difficulties in collaboration during BIM software implementation is causing quantity surveying firms to stop from using BIM in the upcoming projects. Therefore, the implementation of BIM software requires holistic collaboration between every party involved in the particular project such as the architect, engineer and others.

Table 2
Challenges faces in the implementation of BIM in quantity surveying firms

Criteria	Mean	Rank
The high cost of hardware	4.57	1
The high cost of software	4.43	2
The high cost of training	4.29	3
Lack of BIM knowledge amongst staff	4.29	4
Difficulties in collaboration during implementing BIM software	4.14	5
Insufficient availability of BIM training	4.00	6
Incompatibility between software platform	3.93	7

Solution for Quality Improvement to Quantity Surveying Firms

Based on Table 3, the financial support from the government appears as the highest rank in encouraging the application of Building Information Modelling in quantity surveying firms. This shows that government plays an important role in implementing BIM in Malaysian construction industry. Moreover, by having additional financial support from the government, it can aid newly established firm that has a low initial capital to buy new hardware to support BIM implementation. The research finding is significant with all developed countries; in which the government and its subsidiary authorities have played a key role in demanding and fostering the adoption of BIM (Lee et al., 2020)

Table 3
Encourage the application of BIM in quantity surveying firms

Criteria	Mean	Rank
Government provide financial support for BIM implementation	4.43	1
Provide BIM knowledge in a higher education institution	4.36	2
Government produce guidelines for BIM implementation	4.21	3
Government enforce BIM adoption in Malaysian Construction industry	4.14	4
Service tax redemption	4.07	5
Increase awareness of the implementation of BIM in industry	3.93	6
Government provide financial support for BIM implementation	4.43	7

Conclusion

This research proffers a contextual contribution through the analysis of the findings and its implications to the existing BIM study. Based on the findings, BIM application in quantity surveying firms were significant in improving the firms productivities. It greatly increases the productivity of project stakeholders starting from the inception stage until completion stage. In addition, it is not easy to implement BIM in firms in the construction industry. The highest challenges face in the implementation of BIM in quantity surveying firms are the high initial cost of acquiring the technology. Instead of mastering new technology that requires a large sum of money, the firms prefer sticking to the traditional method that is cheaper, easier, and more user-friendly that can be used by staff and project stakeholders. Therefore, the recommendation made from this study which the government plays a crucial role in providing support to reduce the burden in implementing BIM in the construction industry.

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