BARRIERS OF IMPLEMENTING BUILDING INFORMATION MODELLING (BIM) IN QUANTITY SURVEYING CONSULTANT'S FIRM IN MALAYSIAN'S NORTHERN'S REGION

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Abstract*: Malaysian construction industry plays a crucial part in creating national wealth. In achieving the dream of a well-developed country reputation, technologies and innovation need to be adopted in the industry for Malaysia to readily set in motion for the fourth industrial revolution 4.0. Building Information Modelling (BIM) as one of the processes, supported by various tools, plays a vital role in enhancing the construction projects as well as ease the works for the industry players. Quantity surveyors shall be one of the construction teams to implement the technologies in enhancing their estimating and cost planning game. However, various challenges and barriers preventing the firms to truly apply the innovation. Moreover, the northern's region of Malaysia indicates the lowest application of the software in the firms bring about to this research to take place. The objective of this study is to determine the barriers of BIM implementation in the quantity surveying consultant firms in northern's region. The outcome gained from the distribution of the questionnaire via the 22 respondents of the quantity surveying firms indicates the top two barriers for the BIM implementation were high cost to operate software and high cost of BIM training. Therefore, based on the findings, the government shall give incentives to encourage QS consultants to invest in BIM.*

Keywords*: Building Information Modelling, Quantity Surveyor, Barriers*

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Introduction

With no doubt, adopting new technologies and strategies are necessary to make every work on the construction site much easier. As technology adoption continues to ramp up in our construction industry, the one thing that construction firms are not globally to be aware of is the implementation of building information modeling (BIM). BIM is an intuitive 3D model-based process that eases the works for architects, engineers, and construction professionals to create an efficient plan and design projects. Building Information Modelling ought to have an innovative reception view as it is as much about people and processes as all things considered about innovation. However, a lot of challenges were faced during the implementation of BIM in the industry.

Construction Industry Development Board (CIDB) suggests compulsory employment of BIM in particular private area ventures by 2020. The move was to motivate and inspire the industry players to adopt digital software while Malaysia readily set in motion the fourth industrial revolution 4.0 meanwhile. Not only that, starting in the year 2019, any public sector that handles a RM 100 million or more project, was compel to implement the BIM system in the construction of the project (CIDB, 2020). By using BIM, developing a structure or a framework can be done digitally without the waste of too much paper. Any dispute arises from the project can be solved using the software. It will not be costly as the problem can be detected at the planning and designing stage and the problem can be solved immediately before continuing to the project. Technology adoption such as BIM in the development business can help to abbreviate the time of both the building and planning approval. The research of the technology acquiring of BIM can help open the eyes of the development firms to see the future with Building Information Modelling software.

Problem Statement

BIM is supposed to be one of the answers in creating the best product from the construction industry. According to (Zahrizan et al., 2013), a lot of construction industry players believe that using Building Information Modelling (BIM) software own latent in promoting synergistic activities in the Malaysian development industry. Because of this, customers in the development business expected the utilization of BIM in the projects to enhance the quality of the project, which cause various construction companies to start investing in BIM technology to meet the clients' satisfaction, (Zahrizan et al., 2013). Quantity surveyors are one of the construction companies that make a move in implementing BIM in their working environment. This issue also included Quantity Surveyors to apply the studies of BIM into their old estimating service to gradually increased the roles in cost estimating and cost planning game. However, some certain barriers and challenges prevent the success of BIM implementation in quantity surveying firms.

According to (Zainon et al., 2016) to effectively applying BIM in the firms, every firm has to upgrade their hardware to the latest version. Moreover, they also have to obtain mandatory software, and the employees are required to go through a BIM training module to get used to the new environment. This will extend the time of the company to use the BIM as to use the latest version, they will also have to upgrade their computer to make sure the performance of the software is at their best. A lot of money also needed to pay for the BIM training fees for the employees. Moreover, (Zainon et al., 2016) said the firm needs to know and gain proficiency with everything about the arrangement for the execution cautiously before BIM change can occur.

With the presence of BIM, a new modern and fastest way to create the best quality product can be achieved. However, because of the presence of barriers and challenges stated above, the maximum first-rate product from the construction industry will be hard to achieve. Without the implementation of BIM, the project's cost will be higher and the saving of resources will be hard to do. According to (Al-Ashmori et al., 2020) the absence of a BIM system can lead to the existence of mass documents and the disintegrated information shared among the teams which can high likely lead to major misunderstanding problems. Thus will arise some conflicts among them. In the end, the productivity of the client's project will be affected because of the poor management of time, cost, and quality

Literature Review

Building Information Modelling

BIM is a working technique that includes the mechanization of the whole task group utilizing a model of 4D that can do a considerable lot of the conventional elements of a Quantity Surveyor, (Zainon et al., 2016). According to (Bui et al., 2016), Building Information Modelling (BIM) is perceived to be specific like a bracer for development and efficiency in the development business. (Memon et al., 2014) said that Building Information Modelling (BIM) is another method of the development plan. Not just it can encourage the digital portrayal of plans yet it additionally gives all the fundamental data to any extent before it is built. (Liu et al., 2015) contends that BIM is an agreement to sort the right people and data together viably and efficiently by supplying them with some processes and innovation help.

(Enegbuma & Ali, 2013) said that during the life cycle of the structure, BIM is the way to create and oversee construction information. BIM is one of the new developments to be transmitted in the executives' plan, development, and office, where a computerised representation of the structure is made to promote the trade and interoperability of data in computerised design (CIDB, 2014). Moreover, BIM can be viewed as a combination of cycle and advancement that offers a phase for a planned exertion between different parties in the construction industry by utilizing the occupations of Information Technology (IT) (Zahrizan et al., 2013). According to (Thurairajah & Goucher, 2013) BIM addresses the course of action of advanced models for use during the organizing, plan, advancement, and movement periods of the product's life**.**

Barriers in Implementing BIM

BIM is known for a lot of benefits to the future of the project. However, the Malaysian construction industry needs to take control of the various difficulties to accomplish fruitful BIM usage. A lot of factors can cause a low level of BIM impletion in the construction industry.

Lack Of Professionals

From the (Liu et al., 2015) studies, it was found that one of the major barriers in implementing BIM in the construction industry is the lack of professionals in handling BIM. Moreover, (Bui et al., 2016) also discovered that the major barrier to implementing BIM is the absence of skilful staff to work the product, ignorance of the innovation, and non-accessibility of the parametric library. (Gardezi et al., 2014) also said that the absences of skilled professionals are included in the top five barriers of BIM implementation in the Malaysian construction industry. This statement is also supported by (Haron et al., 2017) who said that the second major problem in implementing BIM in Malaysia is the non-availability of national standards and the shortfall of skilled personnel in handling BIM. (Wong & Gray, 2019) and (Zhen Zhi et al., 2022) contends that, other obstructions to BIM implementation inside the Malaysian development industry is

the lack of assets and expertise in the development industry. Moreover, (Ahmad Jamal et al., 2019) study indicates that the absence of a talented and experienced BIM workforce ranks number one among the other barriers.

Reluctance to Change to BIM Software.

The next problem in implementing BIM is the notable individuals in the firm. As (Zainon et al., 2016, (Memon et al., 2014),(Chen et al., 2023) and (Gardezi et al., 2014) said, seniors or employees in the firms tend to resist the technology as they are used to the old traditional ways which make it a lot harder to change their behaviour into enjoying and tolerating them. Their hesitance to gain some new useful knowledge or attempt the new technology and software will be the hardest barrier that the top administration should overcome in order for BIM to operate successfully (Zainon et al., 2016). Next, in the survey questions by (Wong & Gray, 2019), where they ask the respondents about other barriers to the implementation of BIM, most of them answered that the way of life of the Malaysian Construction industry is reluctant to change to a newly introduced software.

From the study of (Mohammad et al., 2018), their findings contend that the staff resistance scores the highest frequency among the other barriers. (Mat Ya'Acob et al., 2018) discovered that one of the challenges to use BIM software is the management risk which one of which is the resistance to change from the old way. There are also barriers to implementing BIM in other countries than Malaysia such as Yemen (Gamil & Rahman, 2019). (Ahmad Jamal et al., 2019) and (Babatunde, SO, Udeaja, 2020) study indicates that the behaviour of staffs that unwilling to change to BIM was ranked in the top 20 of the BIM implementation barriers. The hesitation of the workers to share information is one of the main drivers of recurring barriers that caused the low level of BIM implementation in Malaysia. (Mamter et al., 2017). "The construction specialists in Malaysia are hesitant to embrace BIM on the grounds that they will not change. It is an extreme age to teach when they are over 40 years of age", said the respondent. (Babatunde, SO, Udeaja, 2020) study indicates that the top 20 barrier that prevents the implementation of BIM in AEC firm, includes the staff resistance to change to a new implementation of new software.

Absence of BIM Legislation/Policy

According to (Gardezi et al., 2014) one of the barriers in BIM implementation is the deficiency of BIM standard modelling policy to ease the implementation. The lack of standard policymakers of BIM also contributed to a small percentage of BIM implementation barriers according to (Mohammad et al., 2018). According to (Mat Ya'Acob et al., 2018), their study stated that the absence of a BIM license policy which is included in the technology risk type is one of the barriers in implementing BIM in the company. Moreover, the lack of governmental legislation contributed to the barriers of BIM implementation as stated by (Gamil & Rahman, 2019) study. Next, included in the top ten ranks for BIM implementation barriers is the absence of BIM contractual agreement to be used in the construction industry (Ahmad Jamal et al., 2019). (Mamter et al., 2017) study indicates that the truancy of BIM policy is one of the main causes of the low implementation of BIM.

Low Awareness of BIM

(Haron et al., 2017) research stated that with references from (CIDB,2014) the low knowledge and information of BIM are one of the barriers that resulted in the low implementation of BIM in this country with a total percentage of 11.5%. The unawareness of BIM technology was ranked second place for the BIM implementation barriers in the construction industry according

to (Memon et al., 2014) study. According to (Abd Hamid et al., 2018), some of the construction companies actually utilizing old rendition programming, types of gear and not refreshed with current advancements need thus the level of information is poor and don't have any ability to improve the expertise and technology.

In the survey questions by (Wong & Gray, 2019), where they ask the respondents about other barriers to the implementation of BIM, most of them answered that there is a lack of BIM information currently. Lack of awareness and knowledge of BIM also ranked in the top three barriers in implementing BIM according to (Mohammad et al., 2018). According to (Mat Ya'Acob et al., 2018), their study stated that the absence of BIM implementation knowledge which is included in the management risk type is one of the barriers in implementing BIM in the company. Moreover, the lack of knowledge about BIM software also contributed to the barriers of BIM implementation as stated by (Gamil & Rahman, 2019) study. BIM and coordinated effort training is not satisfactory, bringing about graduates with deficient information on these subjects (Oraee et al., 2019). (Babatunde, SO, Udeaja, 2020) study indicates that the top barrier that prevents the successful implementation of BIM is the low level of BIM knowledge and awareness on how to operate the software.

High Cost to Operate Software

(Haron et al., 2017) research stated that with references from (CIDB,2014) the cost of the software is one of the barriers that resulted in the low implementation of BIM in this country with the highest percentage which is 26.2%. Moreover, the client in the construction industry also positioned the expensive software of BIM from the outset position as it is the significant barrier in the execution of the BIM application. According to (Abd Hamid et al., 2018) and (Toyin & Mewomo, 2023), some of the construction companies reluctant to adopt BIM because of the high cost to implement BIM in the organization such as the BIM software. They also need to upgrade the software and equipment to ensure the process of undertakings and documentation are moving good, add them. (Gardezi et al., 2014) also said that the high initial cost for BIM software and hardware are in the top five barriers of BIM implementation in the Malaysian construction industry.

The cost from benefiting the BIM implementation also included in the top five barriers in implementing BIM according to (Mohammad et al., 2018) study. According to (Mat Ya'Acob et al., 2018), their study stated that financial risk such as lack of funds in investing in the new software and hardware is one of the barriers in implementing BIM in the company. Moreover, the expensive cost of BIM software when implemented also contributed to the barriers of BIM implementation as stated by (Gamil & Rahman, 2019) study. Next, included in the top three ranks for BIM implementation barriers is the expensive cost of software, hardware, and the operation of BIM to be used in the construction industry (Ahmad Jamal et al., 2019).

Lack of Client Demand

There is also a barrier to the lack of client enforcement according to (Memon et al., 2014) study. Same as (Zahrizan et al., 2013) study, one of the challenges faced by the construction industry to adopt BIM software into their work is the lack of demand from the client. (Gardezi et al., 2014) also said that the non-availability of demand for BIM implementation is in the top five barriers of BIM implementation in the Malaysian construction industry. There is also limited use of BIM in the current construction industry. The lack of demand from the construction industry client is also included in the barriers in implementing BIM according to (Mohammad et al., 2018) study. Moreover, the absence of interest from the customer in the construction

industry also contributed to the barriers of BIM implementation as stated by (Gamil & Rahman, 2019) study. Next, included in the top ten ranks for BIM implementation barriers is that clients rarely enforced the use of BIM in their construction project (Ahmad Jamal et al., 2019).

High Cost for BIM Training

According to (Abd Hamid et al., 2018) and (Chen et al., 2022), some of the construction companies reluctant to adopt BIM because of the high cost to implement BIM in an organization such as sponsoring the BIM training to all of the employees. The lack of a ready pool of skilled BIM trainers contributed to the low implementation of BIM in the Malaysian construction industry. However, funds that can cover the costs for BIM training need to be provided (Zahrizan et al., 2013). Next, according to (Wong & Gray, 2019), the barrier that contributed the most percentage is the lack and unavailability of education and training about BIM software. This appears to contribute to the issue that there is a genuine absence of BIM training from Malaysian development firms.

BIM training challenges are also included in the barrier from the study of (Mohammad et al., 2018). Moreover, the inaccessibility of BIM training for the employees in the company also contributed to the barriers of BIM implementation as stated by (Gamil & Rahman, 2019) study. Lack of training was the major barrier in implementing BIM as high (Chan, 2014). Next, included in the top twenty ranks for BIM implementation barriers is the shortage of BIM training to spread the awareness of BIM to be used in the construction industry (Ahmad Jamal et al., 2019). (Babatunde, SO, Udeaja, 2020) study indicates that one of the barriers that prevent the successful implementation of BIM in AEC firm is that BIM training is quite expensive which makes them resistant to the software. According to (Marefat et al., 2020) absence of BIM education and training were the most critical boundaries to BIM implementation.

Methodology

This research used a quantitative method where the respondents were selected based on purposive sampling. The researcher already knew about the targeted respondents (Amir & Borhan, 2022). Based on the Board of Quantity Surveying (BQSM) website, the number of quantity surveyor consultant's firms in Malaysian's northern's region is 29 (Refer Table 1).

Table 1: Total of Quantity Surveying Firms in Malaysia's Northern's Region

No	State	Population Size / Total of Quantity Surveying Firms
1	Kedah	9
2	Perak	4
3	Perlis	0
4	Pulau Pinang	16
Total Population		**29**

(Source: BQSM website)

Thus, the questionnaire was distributed to 29 company. The reason northern's region is chose because based on the Construction Industry Development Board (CIDB) report 2016, the northern region has the least percentage of BIM adoption in Malaysia which is 2% compared to other regions in Malaysia (Refer to Figure 1.0).
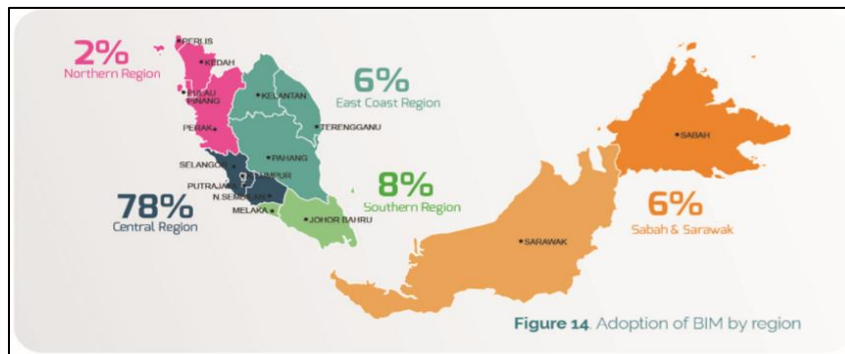
Figure 1: Level of BIM Adoption by Region in Malaysia
(Source: CIDB Report 2016)

For this research, 29 questionnaires were distributed. However, only 22 questionnaires were returned which equal to 76 percents response rate. Fincham (2008) stated that 60% response rate is acceptable. Data gathered is analysed using descriptive analysis via SPSS version 26.

Table 2: Summary of respondent rate

Description	Sample
Quantity of distributed questionnaires	29
Quantity of returned questionnaires	22
Percentage (%)	76

The questionnaire for this research is based on four (4) Likert scale. 4 points Likert scale is fundamentally a constrained Likert scale. There is no safe 'neutral' in the questionnaire. The explanation it is named as such is that the respondents were compelled to form a positive or negative assessment (Hassanain et al., 2012).

Table 3: Interpretation of Likert Scale

Choice	Scale	Interpretation
1	Strongly Disagreed	Totally disagreed with the term of the question
2	Disagreed	Disagreed with the term of the question
3	Agreed	Totally agreed with the term of the question
4	Strongly Agreed	Agreed with the term of the question

Descriptive statistics are specific methods basically used to calculate, describe, and summarize collected research data in a logical, meaningful, and efficient way. Descriptive statistics are reported numerically in the manuscript text and/or in its tables, or graphically in its figures (Vetter, 2017). The mean, median, and mode are three (3) measures of the center or central tendency of a set of data. In addition to a measure of its central tendency (mean, median, or mode), another important characteristic of a research data set is its variability or dispersion (ie, spread). In simplest terms, variability is how much the individual recorded scores or observed values differ from one another. This research use mean for the data analysis. The mean is likely the most widely known descriptive statistic. All of these average values were an arithmetic mean, which is defined as the total sum of the values divided by the number of observations (sample size) (Vetter, 2017).

This research also used analysis of ranking data. Ranking data are frequently collected when judges (or individuals) are asked to rank a set of t items according to a certain preference criterion. Such data may be observed directly or come from ranking a set of scores or ratings assigned to the items. (Yu et al., 2019). Examples of ranking data are abounded and can be found in a wide range of areas including market research, sports and so on. The main objectives of analysing ranking data are to identify the relationship among several sets of rankings and to explore the possible factors that influence individuals' choice decisions. For this research, higher mean and number one (1) ranking indicates that specific variables or criteria are getting highest 'strongly agree' or 'agree' judgement. The results for descriptive analysis which consist of frequency, average mean and analysis of ranking data are being calculated by using SPSS version 26.

Analysis And Findings
The data was analysed using descriptive analysis for the Likert scale questions respectively. The data was ranked accordingly based on percentage and mean by using SPSS version 26. The results of the data are shown in Table 4 below.

Table 4: Barriers to BIM Implementation in the Construction Industry

Item	Descriptions	Mean	Rank
1)	High cost to operate software	3.55	1
2)	High cost of BIM training	3.36	2
3)	Absence of BIM Legislation/Policy	3.27	3
4)	Lack of professionals	3.23	4
5	Lack of client demand	3.23	5
6)	Low awareness of BIM	3.18	6
7)	Reluctant to change to BIM	2.95	7

Apparently, from Table 4, several barriers prevent the full implementation of BIM in the construction industry. The high cost to operate the software with (mean=3.55) was found as the major barrier in the implementation of BIM in the construction industry. Most of the respondent strongly agree with this barrier overtop the other barriers. As supported by (Haron et al., 2017), with references from (CIDB,2014) the cost of the software is one of the barriers that resulted in the low implementation of BIM in this country with the highest percentage which is 26.2% from the data collected. While the high cost to operate the software was ranked the first in this research, it was included in the top five barriers of BIM implementation in the Malaysian construction industry as said by (Gardezi et al., 2014). This was followed by the unavailability / high cost of BIM training in the industry with a slight decrease in the mean score (mean=3.36). This finding is quite similar to findings from (Wong & Gray, 2019), which discovers that the barrier that contributed the most percentage is the lack and unavailability of education and training about BIM software. The barrier at the third rank is the absence of BIM legislation/policy with a mean score of 3.27. The absence of BIM legislation/policy might be the top 3 barriers in this research, however, it differs with (Ahmad Jamal et al., 2019) and (Babatunde, SO, Udeaja, 2020) where this barrier is in the top 10 ranks from their research. The barriers that score the same mean score are the lack of professionals in handling BIM at the fourth rank and lack of client demand for the use of BIM at the fifth rank.

There is also a barrier to the lack of client enforcement according to (Memon et al., 2014) study. Next is followed by the low awareness of BIM as the sixth barrier with a slight decrease in the mean score, (mean=3.18). Not to forget the senior's attitude and reluctance to change to BIM implementation in the company with last ranking and a mean score of 2.95. This is also supported by the (Wong & Gray, 2019) study where they ask the respondents about other barriers to the implementation of BIM, most of them answered that the way of life of the Malaysian Construction industry is reluctant to change to a newly introduced software.

Conclusion
In a nutshell, Building Information Modelling is rapidly being implemented in most of the developing countries around the world including Malaysia. Especially, from the view of quantity surveyors, it moreover leads the quantity surveyors as figurer in understanding BIM advantages which can maximise their records and expertise of the undertaking operation and deal with to assist quantity surveyors in organising extra reliable fee estimates. However, in order to reach a successful BIM implementation, challenges and obstacles are being obstructed. From the frequencies, percentage and mean score for the answers responded by the respondents, there are numerous obstacles to BIM implementation withinside the construction industry. Based on the data analysed, the top three barriers ranked by the respondents are the high cost to operate the software, high cost of BIM training and the absence of BIM legislation. All of these barriers might be handled or reduced with the involvement and cooperation from government for example like giving incentives or tax exemption to company whom implement BIM in the construction project.

As a recommendation, the study can be conducted to another region in Malaysia such as East Region, Southern Region, West Region and Sabah and Sarawak to identify barriers of implementing BIM in their firm in Malaysia. The scope of study can be broadened also to another consultant's team like Architects and Engineer's consultants' firm as they also implement BIM in their construction project as well.

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