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Implementation of total quality management (TQM) in malaysian industrialized building system (IBS) projects

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Abstract: Total Quality Management could be defined as a transformation in management style aimed at constantly increasing customer satisfaction via the design and improvement of organizational systems and processes. It is critical to use an industrialized building system to increase project successful implementation. Awareness of TQM advantages and its application could greatly improve project efficiency and performance. A literature search on TQM was done to determine the TQM implementation present state and level of awareness in IBS construction projects. The purpose of this study is to identify the current TQM implementation status in IBS projects and determine its level of awareness and potential benefits from the Malaysian construction stakeholders' perception. A mixed approach was applied in this research with the participation of consultants, contractors, clients, and academicians from various construction industry public and private sectors in Malaysia. The questionnaire survey was used to conduct the study. A total of 371 questionnaires were collected, for a sample size of 265. The findings indicated that most construction organizations are unaware of the TQM approach. The Cronbach's Alpha coefficient achieved from the study was (0.934), indicating that the questionnaire was reliable. The statistical analysis revealed that increased efficiency, improved customer satisfaction, enhanced teamwork, increased profitability, and improved safety are the most essential TQM benefits that concerned the participants. Furthermore, the results of this study provide IBS construction practitioners with significant awareness of the components that empower TQM implementation in the construction sector. This study contributes to the understanding of TQM and project performance by demonstrating their capacity to enhance the Malaysian construction sector. Additionally, it was found that the Malaysian construction industry has not achieved a high level of quality implementation programs.

Keywords: TQM Implementation, IBS, malaysian construction industry, awareness, sustainability, malaysia.

1. Introduction

Construction activities are dynamic environments with many people, tools, and machines operating at the same time, making worksite management difficult (Alzubi et al. 2022). Sustainable development strives to utilise natural resources in a logical manner that does not impact the environment in the short or long term (Silva et al. 2022). The construction industry is an important part of all countries' economy because it promotes the finance industry and the entire well-being of their citizens (Mohsen et al. 2021). In many developing countries, the construction industry is one of the second most important economic sectors (Maqsoom et al. 2019; Preece, C., Pheng, L., Padfield, R., & Papargyropoulou 2011). Because it incorporates raw

resources, machines, money, technologies, and human resources, the construction industry is complicated (Abdullah O. Baarimah et al. 2021; Tayeh et al. 2018). The construction sector is continuously evolving as new technology and business models emerge (Koota 2003). The fast expansion of the construction sector has put additional demands on the construction stage (Shah et al. 2021). As a result, construction firms must generate new technologies and strategies to remain competitive in the market and thrive in their operations (Musarat, Alaloul, and Liew 2021).

However, it is complicated and fraught with risk, which leads to failure in terms of time, money, and quality (Mahamid 2020). There has been a rise in the number of studies on crucial success/failure elements in recent years, particularly in the project management field (HYVÄRI 2006). Although fast technological and digitization advancements in the previous decade, building projects face enormous obstacles such as cost and schedule overruns, limited production quality, poor productivity and performance, limited strategic competency, and inadequate coordination (Ammad et al. 2021; Abdullah O Baarimah et al. 2021; Musarat, Hameed, et al. 2021). Industrialised Building System (IBS) is defined as an on-site construction process that consists of methodologies, products, and a collection of interconnected components that work together to accomplish a construction project's goal (Nasir et al. 2016). The Construction Industry Development Board (CIDB) of Malaysia has divided the IBS system into five categories: precast concrete, steel formwork, steel framing, prefabricated wood framing systems, and block work systems (Othuman Mydin et al. 2014). In Malaysia, the IBS is one of the options for achieving long-term sustainability (Al-Aidrous et al. 2021). Panel and box systems, reusable prefabrication systems, structural steel frameworks, prefabricated systems, and block work systems are all examples of IBS construction processes, goods, components, or construction systems that incorporate manufactured elements and on-site assembly (Baharuddin et al. 2016).

Presently, the usage of the IBS system in numerous construction projects in Malaysia is an enhancement, but then the conventional system was unable to survive with the challenges occur was not competent to overcome the challenge (Pozin and Nawi 2017). To meet the rapidly expanding demand for housing, the construction industry has moved its focus to mass manufacturing and prefabrication building technologies (Rahim and Qureshi 2018). Nevertheless, since 1964, there has been a focus on IBS in the construction industry. Before IBS was introduced and used in the construction industry, a few projects encountered a variety of issues that had a negative impact on construction performance (CIDB 2012).

Unfortunately, IBS employment since the early 1960s has been proven to be unsuitable for Malaysia's environment owing to imported materials and methods employed, resulting in leakage and holes in walls that have become apparent, and IBS construction is presently taking longer than intended (Chai et al. 2019). The government of Malaysia has also attempted to connect the IBS system with construction project management, although industry acceptability remains low (Kamar and Hamid 2011) (Mohsen et al. 2019). Although IBS has been around for 40 years, with well-documented advantages and significant government backing, the rate of implementation and use is still modest and falls short of the government's aim (Nawi, Anuar, and Lee 2013).

IBS adoption has been shown in several studies to provide a substantial number of advantages to users (Alawag et al. 2021; Rozaimi A Samad, Ismar Minang Satotoy Usman, and Sudarshan N Raman 2020). As a result, the use of IBS in the Malaysian construction sector would shorten construction time and the number of foreign workers admitted to the state (Zaini and Halipah 2015). These would be in terms of cost and schedule predictability, improving construction quality and productivity, minimising occupational health and safety concerns, reducing the number of skilled employees and reliance on physical overseas labour, and reaching the final aim of lowering the whole price of construction, as well as its long-term performance and profitability (Nasrun, Nawi, and Hamid 2012; Venables, Barlow, and Gann 2004).

The Malaysian government has implemented many programmes and campaigns to promote the Industrialised Building Method (IBS) as a cost-effective and value-building system (Abedi, Fathi, and Muhamad Rawai 2012; Fathi, Mirasa, and Abedi 2012). Based on these advantages, the Malaysian government included IBS as one of the solutions in the National Construction Industry Master Plan, which intended to reduce delivery times and produce more inexpensive and high-quality homes (Nawi et al. 2013).

During the significant development in demand and availability of building projects, the primary objectives are to reduce costs while improving efficiency and quality (Altaf et al. 2021). Edward Deming first established TQM in Japan in the 1920s (Othman, Norfarahhanim Mohd Ghani, and Woon Choon 2019). The effective application and execution of TQM in any company will always rely on the people's dedication to the concept that underpins it (Alawag et al. 2020). The construction industry is a vital economic engine in Malaysia and a vital facilitator of the Economic Transformation Programme (Hussain 2015). The main problem confronted by the construction industry is low labour force and technology production levels, which directly deliver affect the quality of construction productivity and services (Mohd Fateh and Mohammad 2021). The effective implementation of construction projects and maintaining them within the evaluated budget and specified plans rely on the methodology that needs sound engineering assessment. Project success, according to Pheng, is defined as completing a project on time, on budget, and to the satisfaction of the customer (Pheng and Chuan 2006).

The great performance of project indicators can lead to project success. According to Chan, nevertheless, of the difficulty, scale, or environment in which it is built, a construction project is regarded as successful if it is delivered on time, within budget, and of reasonable quality (Chan, Scott, and Lam 2002). Construction performance, on the other hand, is influenced by a variety of variables and uncontrollable circumstances. Construction performance is influenced by the performance of stakeholders, available resources, climatic conditions, and contractual relationships (Alaloul, Liew, and Zawawi 2016).

From the perspective of construction experts, therefore, the idea of project success remains unclear. Meeting participants' expectations and accomplishing the targeted goal are also signs of success. Hence, success in modern construction projects is difficult to define since teams will discover themselves in distinctive scenarios where the concept of a project will differ from one to the next (Alaloul, Liew, and Wan Abdullah Zawawi 2015). Ultimately, the success of the project is a subject that is frequently debated but seldom agreed upon (Gudiene, Banaitis, and Banaitiene 2013).

Realising the practices of TQM implementation not only can deliver ideas to develop methods to facilitate, but TQM procedures also boost the success of TQM implementation within a local culture (Ahmad et al. 2017). TQM implementation normally requires three to five years to penetrate the company and entirely take impact (Altahayneh 2014). Nevertheless, there is a lack of studies examining the effects of efficient TQM application in the construction division of the Kingdom of Saudi Arabia (KSA) (Alofi and Younes 2019). Additionally, in Jordan, the public sector has implemented fewer principles of TQM when compared with the private sector (Al-Shdaifat 2015).

Similarly, in Nigeria, the impact of TQM practices on administrative implementation in moderate and big-sized construction organisations in Abuja is important to decide what the condition is in those construction companies concerning TQM practices (Richard et al. 2017). In India, the construction industry has reached late TQM due to the unawareness of construction professionals of the TQM principles and practices. In Kosovo, TQM was first implemented in the manufacturing industry and has lately been initiated to be applied in construction, and it can be stated that construction has lagged in the consent of TQM (Management 2021).

Furthermore, even though TQM has been broadly applied in the construction industry of Japan since the 1970s and in the United States construction industry since the 1990s, it has not been implemented extensively and effectively in the construction sector of Turkey (Turk 2006). The construction industry in Malaysia has a slow adoption of the TQM concept, and it has been struggling with its implementation, which the industry is reluctant to change (Anuar, Sumarjan, and Radzi 2017). Additionally, they do not maintain these constant development programmes because they fail to generate a conducive environment for implementation enhancement and fail to manage change in their organisations (Samsudin et al. 2012). There are still many stakeholders in the construction industry of Malaysia who reject to implement of TQM due to some challenges such as a lack of knowledgeable employees, a low-bid mentality, a lack of efficient communication, more costs and time, a lack of senior management support, and measurement challenges (Abdullah, Misnan, and Mahmud 2008; Tey and Ooi 2014).

Effective TQM implementation through the companies needs key changes in the core four features of information management, i.e., storing, forming, implementation and distribution (Kahreh, Shirmohammadi, and Kahreh 2014). The benefits of TQM encourage the construction industry to its implementation. Several researchers have proven that numerous companies

can accomplish considerable enhancements through TQM implementation, such as relief of customers, financial results, and high-quality (Bolatan et al. 2016; Flynn, Schroeder, and Sakakibara 1994; Ynoh and Ali 2015). The purpose of the article is to establish the present state of TQM implementation in IBS projects as well as its level of awareness. Furthermore, this study makes recommendations for methods to improve the performance of all construction stakeholders by focusing on the useful features and overcoming the negative aspects. Implementing TQM in Malaysian Industrialised Building System (IBS) projects can have a few positive impacts and provide value to a variety of stakeholders. Some of the potential benefits of implementing TQM in IBS projects in Malaysia include:

1. Improved quality of completed projects: By focusing on continuously improving the quality of products, services, and processes, TQM can help to ensure that IBS projects in Malaysia are completed to a high standard and meet or exceed the expectations of clients and other stakeholders (Alawag et al. 2022).
2. Increased efficiency and productivity: TQM can help to identify and eliminate waste and inefficiencies in the building process, resulting in a more streamlined and efficient construction process. This can lead to cost savings and improved productivity.
3. Enhanced customer satisfaction: By involving all members of the organization in the quality improvement process, TQM can help to ensure that the needs and requirements of customers are met or exceeded. This can lead to increased customer satisfaction and a stronger reputation for the organization.
4. Improved organizational competitiveness: By adopting TQM principles and practices, IBS projects in Malaysia can achieve higher levels of quality, which can help the organization differentiate itself from competitors and gain a competitive advantage in the market. Overall, the implementation of TQM in Malaysian IBS projects can provide significant value to a variety of stakeholders, including clients, project managers, construction workers, and the organization itself. By focusing on continuous improvement and quality, TQM can help to ensure the success and sustainability of IBS projects in Malaysia.

This study is noteworthy because it adds to the volume of knowledge-relevant information gathered from IBS participants in the Malaysian construction industry. By applying TQM principles and techniques to IBS projects, organizations can help to improve the quality of the finished product. Hence, this can be achieved through several steps, such as establishing clear quality goals and objectives, involving all members of the organization in the quality improvement process, and implementing continuous improvement. Therefore, the application of TQM in IBS construction projects can help to improve the quality of the finished product and increase the performance of the organization.

2. Research methodology

The survey was designed to achieve the research objectives, which included raising awareness of TQM adoption, identifying TQM advantages, and determining the present state of TQM implementation. For its investigation aims, this study utilized qualitative and quantitative data collection methods. To evaluate the present status of TQM implementation in IBS construction projects, comprehensive semi-structured interviews, and a questionnaire survey (mixed approach) were undertaken. The questionnaire was tested on a specified sample in a pilot study. Participants were asked to assess and comment on the questionnaire, stressing its validity and relevance to the study's objectives. In general, they agreed that the questionnaire would be effective in achieving the study's goals, with comments and key points addressed. The construction firms with a valid enrollment in the Malaysian Construction Industry Development Board (CIDB) data system for documented contractors, the Consulting Engineers Association for recorded consultants, Companies registered with CIDB for IBS services, and the Real Estate and Housing Developers' Association (REHDA) Malaysia for listed developers in each state were the target population.

The purpose of the current study's questionnaire was to assess the present status of TQM in IBS construction project performance, determine its degree of awareness, as well as other questions regarding identifying and distinguishing the participants' and their organizations' profiles. Moreover, Likert scales have been widely accepted as a standard technique for gathering data on participants' attitudes and perspectives in the survey questionnaire.

2.1. Semi-structured interview

The interviews aim to gain in-depth opinions on the present state of TQM on IBS projects. Sanders claims that ten interviews are a suitable number for this type of study since data saturation is usually attained (Sanders 1982). Following this, interviewees were carefully selected based on their professional experience, academic qualifications, and job titles. The responders all had considerable construction experience, spanning from 3 to 34 years. Top management, managers, scholars, project and residence engineering, and director were among the responsibilities of the participants. The practitioners operate in public or private sector, or as consultants for individual firms, and their companies' main responsibilities include all-important market positions like a contractor, client/developer, and analyst, bringing in a mass of information from many perspectives.

2.2. Sample size

The population is thought to be roughly 848 individuals, based on the authorized IBS certified players in the Malaysian Construction Industry Development Board (CIDB)(CIDB ibs n.d.; Engineering et al. 2013). Clients/developers, consultants, and contractors involved in IBS projects in four provinces were the sole responders for this study (Kuala Lumpur, Johor, Selangor and Perak) respectively. A sample size of 265 is representative of the entire population. The questionnaire was created using the findings of the literature study, and it was improved by discussions with specialists in the field. Furthermore, before going on to the next level of distribution, the ideas from the interviews were carefully considered and changes were implemented. 400 questionnaires were distributed to research respondents, and 371 responses were valid for reviewing the study's primary goals (Akadiri 2011).

2.3. Data collection

The data for this study were collected using a closed-ended questionnaire that was given to a representative sample of the population. After changes for validity and pilot research, the questionnaire was distributed. To determine the present state of TQM adoption in IBS projects, the final version of the questionnaire was delivered to selected respondents. The questionnaire was divided into four sections. The first section consists of questions aimed to reveal the business profiles of the companies. The second section provides information about TQM implementation efforts undertaken by organizations. The third part addresses common problems about TQM implementation of IBS projects in the Malaysian construction industry. Lastly, in the fourth section, there were questions regarding the success criteria for implementing TQM in IBS projects.

2.4. Analytical statistics

2.4.1. Analysis of reliability

The reliability of the obtained data was assessed using the Cronbach's alpha coefficient. The coefficient ranges from 0.00 to 1.00, with a value of 1.00 indicating improved internal reliability. If the resultant coefficient value is more than 0.6, the measuring process is considered consistent (Toke and Kalpande 2020). The degree to which measurements are "free of mistakes and hence provide consistent findings," which is a needed condition for validity, is referred to as reliability (Peter 1979). The degree to which a measure is reliable is determined by how it is utilised. The standards are based on Drost's statement that, in the early stages of research on predicting tests or hypothesised construct measures, reliability values of 0.70 or greater will satisfy (Drost 2011). According to Drost, increasing reliabilities well above 0.80 is usually a waste of time and money at

this point since correlations at that level are weakened very little by sampling error. To achieve a dependability of 0.90, for example, extensive attempts at standardisation are required, as well as the inclusion of components.

3. Result and discussion

The questionnaire findings are analysed in this part in light of the study objectives. The present TQM implementation and degree of awareness will be discussed. The collected data were analysed using the Statistical Packaging for Social Science (SPSS) application in the statistical study, descriptive statistics such as frequency, percentage, mean, and standard deviation were utilised.

3.1. Respondents 'demographic profiles

The key questions regarding the questionnaire participant are the major entry point for assessing the questionnaire's strength, and the demographics of the participants' results could be summarised in Figure 1.

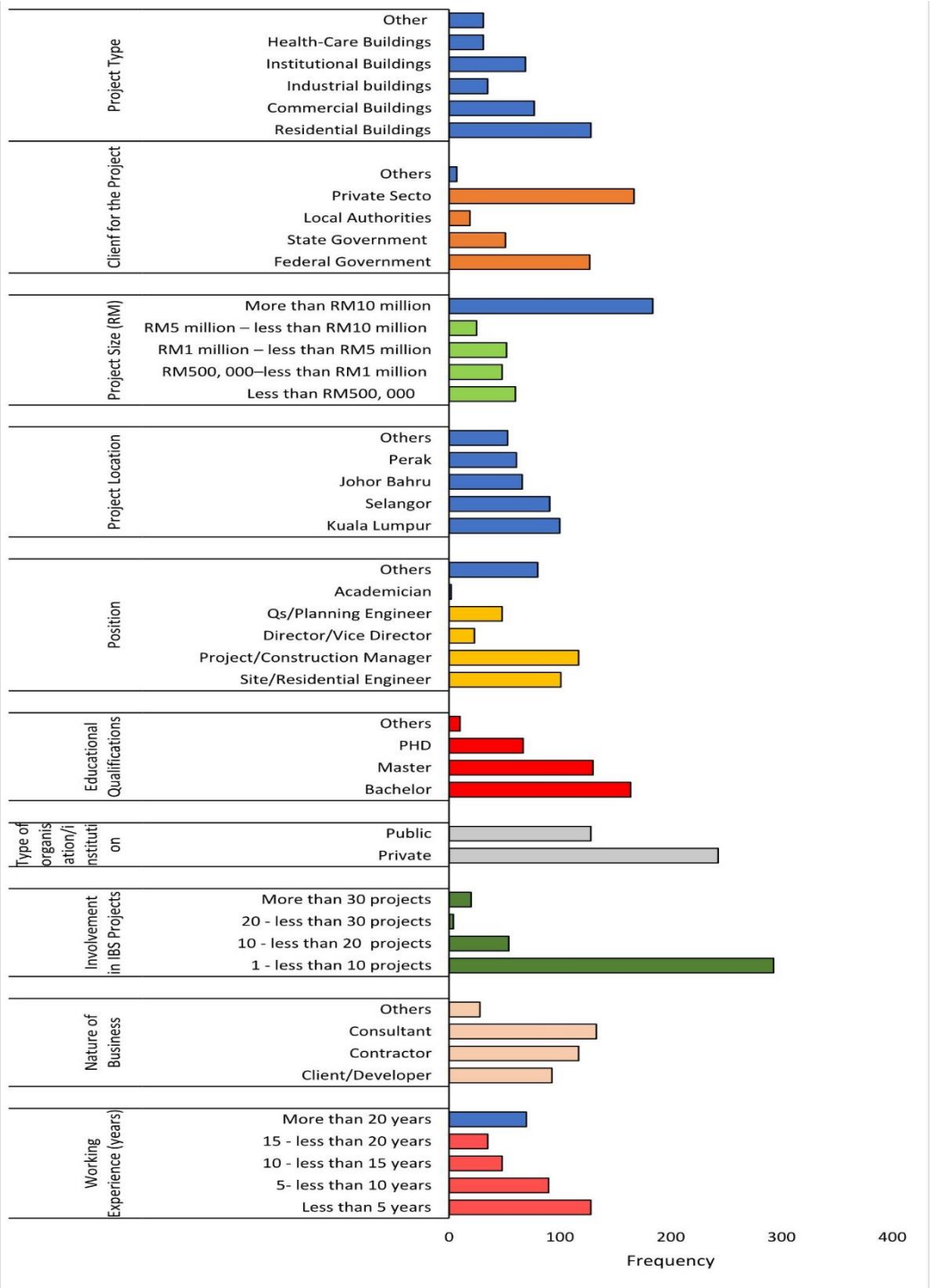

Figure 1. Classification of respondents (demographic analysis)

With 44.5 per cent of the respondents having a bachelor's degree, the demographic data revealed that bachelor's degree holders were the most common. The findings revealed that graduates with advanced degrees were aware of IBS. Furthermore, due to the obvious clear impression of incentives within alumni to be engaged in more IBS projects, it demonstrated an efficient motivation by Malaysian construction societies such as the CIDB to be participating in more IBS projects. Moreover,

more than 34.2 per cent of the respondents had fewer than five years of job experience. Furthermore, it indicates that the project/construction manager role was held by the greatest number of respondents (31.5%). In terms of the respondents' field of work, 35.8% of the survey participants were consultants. According to the demographic results, 65 per cent of all respondents looked to be engaged with a private organisation, whereas only 35 per cent appeared to be linked with a public organisation. Moreover, 79 per cent of the respondents had worked on IBS projects ranging from one to ten.

Therefore, total respondents may be utilised to estimate Malaysia's TQM adoption level. Experts were also questioned about the proportion of responders during the interviews, and they agreed that this appropriately reflected Malaysia's TQM implementation. In terms of project location, Kuala Lumpur accounts for nearly a quarter of all projects (27 per cent). It has also been discovered that 50% of the projects cost more than RM10 million. In terms of the nature of the participants' businesses, the consultant division had the greatest share of respondents.

3.2. TQM implementation in IBS projects of the construction sector in Malaysia

TQM adoption is often predicted by a firm's willingness to embrace and incorporate technologies in the business climate. Figure 2. depicts the proportion of firms that have applied the introduction of TQM in their IBS building schemes, and it is apparent that the number of businesses adopting TQM is very limited in both the private and public sectors. This demonstrates that some organisations have not implemented TQM. The majority of the observed firms indicated that they are not using TQM due to various factors such as an absence of experience, expense, a lack of understanding, and impediments to shifting away from conventional practices.

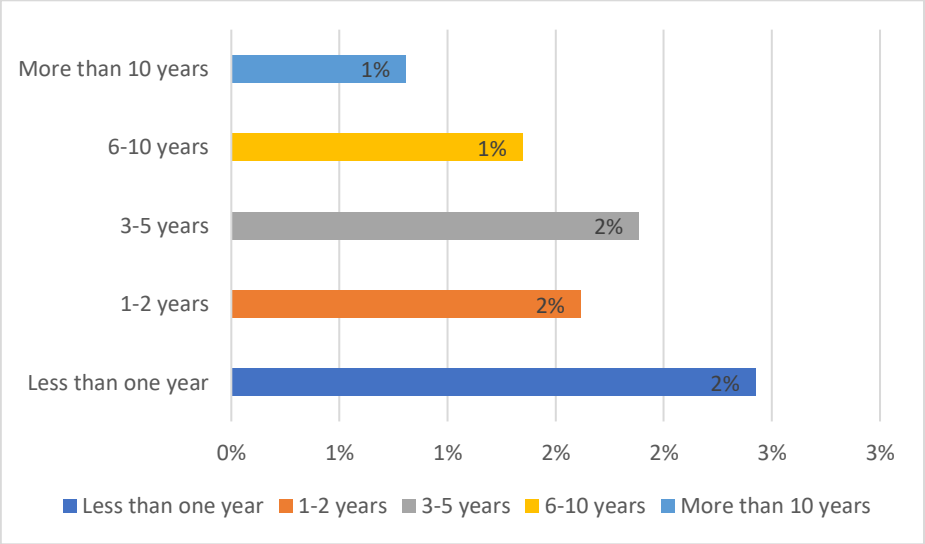

Figure 2. Period of implementing TQM for IBS construction projects

The greatest values were found among users in less than a year, 1-2 years, and 3-5 years in both private and public sectors (2%, 2%, and 2%, accordingly). Similar proportions in both sectors were reported for organizations utilising TQM for 6-10 years and more than 10 years. Since the government encourages the use of TQM and the construction industry requires TQM as part of the agreement in government projects, the use of TQM in public organizations is greater than in the private sector. On the contrary, the private sector faced difficulties such as commercial operational processes, technological costs, and work skills. Adapting and awareness of the Effective TQM implementation will have a major influence to boost professional's understanding of TQM deployment. To date, few Malaysian construction firms have implemented TQM. Therefore, experts inside the organisation environment will be unable to experience and engage with technology, which will have a substantial influence on the construction team's technical and managerial abilities. Based on the result, however, indicates

that the degree of TQM adoption is still quite inadequate, and the construction sector has to make more efforts to improve practitioners' commitment to the TQM concept.

3.3. Awareness of TQM implementation

The understanding of TQM deployment and growth in construction projects has a considerable influence on top management decisions to convert to a TQM-based approach. TQM deployment is a complex mission that requires several pieces of information from different stakeholders but understanding the mechanism will assist in controlling the challenges of implementation. This study has assessed the consciousness of participants in the TQM procedure application, as shown in Figure 3. Most respondents are unaware of the TQM method. However, if the private sector has a better track reputation than the public sector, this does not imply that the private sector is higher conscientious. The heterogeneity in this rate may be attributed to differences in the contributors from each market. The percentage of practitioners in both fields who have a positive technology view deployment and procedure. Companies in Malaysia tended to increase their interest in TQM and other resources by participating in CIDB-related initiatives. Several participants suggested that the Malaysian government include a detailed directory to understand TQM application policy and how different organisations should handle TQM projects. Furthermore, TQM applications should be permitted in the public and private sectors accordingly. It seems that the TQM awareness level is still low in Malaysia. Various proportions of participants' awareness were assessed as presented in Figure 3. Levels of not aware, moderately aware, and above average were considered low levels of awareness. The lowest extreme awareness level was found to be 0% then slightly aware at 1% respectively.

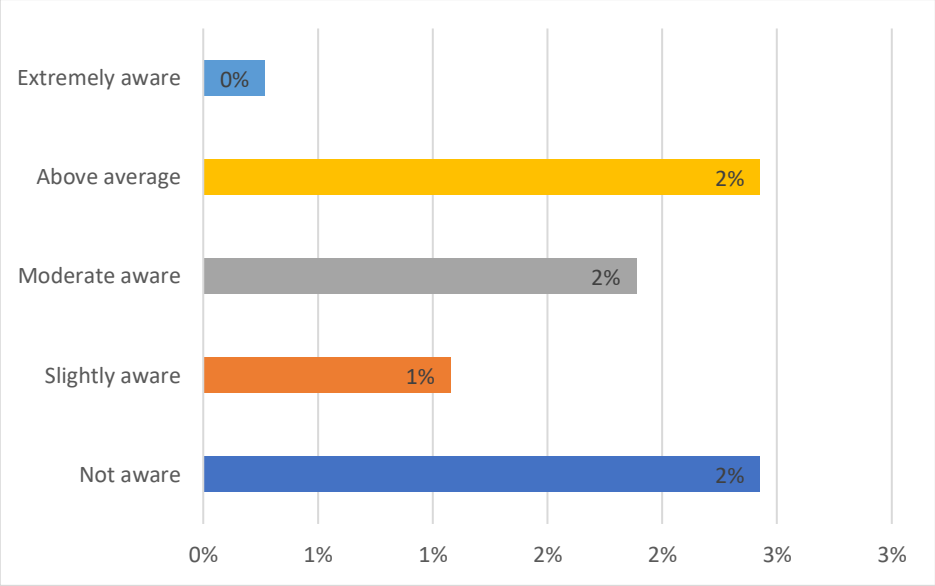

Figure 3. Awareness of TQM implementation

Furthermore, the highest portion showed a low awareness level (not aware, moderately aware and above average) in all four states. Overall, the findings revealed that Malaysians had a relatively low degree of awareness. Nonetheless, the Malaysian construction sector has a tremendous potential to raise awareness via annually structured programmes such as conferences, exhibits, and workshops. This technique has shown its ability to promote TQM implementation by motivating local organisations to transition from traditional construction processes to TQM-based technologies. This study assesses the most critical advantages that impact stakeholders' choice to begin TQM adoption for a successful transition.

The findings show that most of the respondents are not conscious of the TQM procedure. Even though the private sector has a better record than the public sector, it does not mean that the private industry is more conscious. The variation in this

percentage might be due to variations in the respondents from each sector. The percentage of professionals in both sectors who had a strong comprehension of technology application and procedure (in this survey, slightly aware and extremely aware) is still lower than expected. Numerous participants have claimed that the Malaysian government should give a holistic guide to comprehend the TQM implementation strategy and how various organizations may handle TQM projects.

TQM adoption should also be mandatory in both the public and private sectors. This study indicates how the implementation of TQM inside a firm has a substantial influence on the degree of awareness of its staff. Surprisingly, "awareness" was shown to be consistent with the Construction Industry shift of promoting TQM in building projects (Yusr et al. 2017). Furthermore, government policy is seen as being consistent with stakeholders' perceptions of the value obtained through TQM adoption (Idris 2011).As previously indicated, companies should accept responsibility for implementing TQM procedures and progressively shifting to fulfil the construction industry transformation strategy.

4. Conclusions

This research examined the current state of TQM adoption in IBS projects, the level of awareness of TQM implementation in IBS projects as well as the impact of TQM advantages on Malaysian construction players' decisions about TQM implementation. The study was carried out by identifying the significant advantages of TQM implementation. This study was based on a questionnaire survey. From a total respondent population of 850, a sample size of 265 was achieved. Only 371 out of roughly 400 questionnaire surveys were considered valid for analysis. The findings indicated that Malaysian construction organizations' adoption of TQM is quite low. Therefore, the construction sector must promote TQM in accordance with practitioners' demands. Though evaluating TQM efficiency is challenging, case studies are frequently required as proof to exhibit TQM effectiveness. A valid case study demonstrating the prospect of achieving practitioners' advantages via TQM implementation might encourage and expand TQM implementation. The advantages of TQM and the prerequisites for its successful implementation are both well accepted.

Therefore, the authors of this research argue that communication and collaboration among professionals in the Malaysian construction sector need to be improved. Case studies from the area should be highlighted to show how TQM can be used successfully and assist companies to reach their objectives.

Furthermore, SME firms should recognize their capabilities to begin TQM implementation and motivate personnel to enhance their skills. Based on the results, the construction sector should encourage construction practitioners, particularly SMEs, to establish confidence, respect, collaborate, and engage via participation to effectively implement TQM. The effect of the stakeholders' interest in the TQM advantages should be stated for each project participant. It is a smart approach for the construction sector to concentrate on a case study involving local SMEs to discover TQM implementation concerns and challenges.

The authorities should provide a framework for project participants to show how they can achieve their targeted advantages. The benefits offered in this study could be utilised as a helpful guide to represent practitioners' opinions and how they impact the critical variables for effective TQM implementation. Future work will concentrate on the effects of TQM obstacles to TQM implementation and Success factors to TQM implementation, therefore providing a full framework for successful TQM implementation, since the current study only addresses the awareness and benefits that affect TQM adoption.

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