Journal of Advanced Research in Applied Sciences and Engineering Technology

Journal homepage:
https://semarakilmu.com.my/journals/index.php/applied_sciences_eng_tech/index
ISSN: 2462-1943

The Readiness of the Malaysian Construction Industry for E-tendering After COVID-19 Pandemic

Lee Yee Lin[1], Khoo Terh Jing[2,*], Chow Yan Thung[1], Ha Chin Yee[2]

[1] Department of Quantity Surveying, Faculty of Built Environment, Tunku Abdul Rahman University of Management and Technology, 53300 Setapak, Malaysia
[2] Department of Construction Project Management, School of Housing, Building and Planning, Universiti Sains Malaysia, 11800 Minden, Pulau Pinang, Malaysia

ARTICLE INFO

Article history:
Received 27 April 2023
Received in revised form 4 December 2023
Accepted 1 March 2024
Available online 17 April 2024

Keywords:
Construction industry; COVID-19; E-tendering; Malaysia; Pandemic; Readiness

ABSTRACT

E-tendering implementation can bring significant benefits such as cost savings, transparency in contract and maximize the efficiency and resources to the construction industry. E-tendering also allows users to participate through internet where this increases the competition, lower down transaction cost and minimize the time consumption and errors in the bidding processes. This study determines the readiness level of E-tendering to the Malaysian construction industry so that the construction industries are capable to overcome the possible issues and enhance the implementation of E-tendering in Malaysia. The research applied mixed methodology. 89 respondents have participated in the questionnaire while five respondents were interviewed in the interview sessions. The results showed that E-tendering organization's attitudinal readiness has several factors such as foresee the construction tendering practice trends, aware if the introduction of E-tendering is by the government, interested in E-tendering, foresee the increasingly importance of E-tendering to company and good knowledge of Information Technology (IT). The organization's physical readiness has factors such as software facilities, network access, investment in IT, computer infrastructure and technical staff. The results can be used by policies makers to promote the adoption of E-tendering among the potential practitioners in Malaysia where this can improve the efficiency in construction projects tendering process.

1. Introduction

The tendering process in the construction industry incorporates generating, displaying and managing the tender information and documents to the construction project's parties [1]. The traditional tendering can lead to the inefficiency in construction project where several problems can arise when tender documents are prepared and distributed manually [2]. E-tendering is a better alternative to replace the traditional tendering. According to Rosli and Songip [3], organizations that have utilized E-tendering have achieved significant value growth in their businesses because the

* *Corresponding author.*
E-mail address: terhjing92@gmail.com

https://doi.org/10.37934/araset.43.2.220236

system employs automated business processes that are designed to remove incompetent components in traditional procurement processes.

Kaliannan *et al.,* [4] stated that most of the commercial organizations are still maintaining the attitude of observing other organizations that has adopted E-tendering. Although the government has put many efforts to encourage the usage of E-tendering, reluctance is still a barrier as only 30% of the construction stakeholders endorse and adopt the technology. Lavelle and Bardon [5] pointed that most of the commercial organizations are preferring the traditional tendering because they cannot accept the new approach which consists of uncertainties and the government is unlikely to relinquish the old-fashioned paper tendering system for public projects. According to Yevu *et al.,* [6], it is important to look into the security issues of E-tendering because it requires the use of Information and Communication Technologies (ICT) applications to provide interconnection between the governments, commercial organizations and citizens. Therefore, the readiness such as software facilities and investment in Information Technology (IT) are crucial prior to the implementing the E-tendering in the Malaysian construction industry.

The Malaysian construction industry is facing critical problems due to the pandemic as COVID-19 has stopped the manufacturing and construction activities, limited the logistic delivery and human physical interaction [7]. New standards, regulations and solutions have been introduced to overcome these situations. Most of the industries with an existing robust automation system can traverse effortlessly within this pandemic period as these newly introduced standards and solutions do not fit into the construction industry due to the technology level in this industry is always lag behind other industries. Contract department in the Malaysian construction industry is facing severe issues as most of the construction stakeholders are familiar with the traditional tendering approach which need tenderers to participate physically by submitting hardcopy instead of softcopy of tendering documents. However, the tendering processes in the construction industry is repetitive where this is ideal for automation, thus, E-tendering should be implemented to encourage remote working where this can achieve higher efficiency and effectiveness in tendering processes as tenderers can access the document in anytime and anywhere without the constraints of geographical aspect. Furthermore, E-tendering implementation will bring significant benefits such as cost savings, higher transparency and optimizing the resources which will lead the construction industry to step into a new era in post pandemic world.

The readiness level of technologies adoption in the Malaysian construction industry is always lag behind other industries before the pandemic but the pandemic has caused significant paradigm shift to the construction industry. Therefore, this study intended to study the current readiness level of the Malaysian construction industry to adopt E-tendering in the tendering processes. The objective of this study is to analyse the readiness level of E-tendering implementation in the Malaysian construction industry, so that the construction industry is capable to overcome the possible issues and enhance their recognition of E-tendering. According to Choen and Lou [8], the tendering process is the most crucial process throughout the construction project lifecycle. The data in the process of a tender is intensive as it involves the planning, reviewing, collecting, compiling, and completing tender documents which consist of instructions to tenderers, form of tender, articles of agreement, specifications, Bill of Quantities (BQ), architectural drawings, and structural drawings. These tendering processes are still mainly manual and relying on papers heavily.

2. Literature Review

The Malaysian construction industry has been severely affected by COVID-19 in numerous ways such as fewer employment opportunities, critical delay due to the work disruptions that were caused

by several constraints set by the government to stop the outbreak and shortage of materials and equipment due to the limitation on the construction supply chain [9]. Furthermore, the interrupted supply chain and shortage of employee due to the quarantines has caused this situation worse [10]. As the spreading of COVID-19 is highly related to the human physical interaction, thus physical distancing policies that announced by Malaysian government is intended to decrease the virus spread in construction sites which further limit the communication among stakeholders and efficiency of traditional tendering approach [11]. There are studies that conducted to solve the problem due to COVID-19 but less could be found on the E-tendering issue in Malaysia [12]. Gamil and Alhagar [13] have studied the COVID-19 pandemic's impact on the survival of the Malaysian construction industry and the results show construction stakeholders should work hard to mitigate the impacts by encouraging remote working environment to avoid the outbreak of the contagious virus. Therefore, the application of E-tendering that emphasize on remote working should be encouraged as it not only helps to stopping the outbreak but improving the productivity and efficiency of tendering processes.

2.1 Traditional Tendering System Versus E-tendering System

Table 1 shows the differences between the traditional tendering system and E-tendering system.

Table 1
Differences Between Traditional Tendering System and E-Tendering System

Traditional Tendering System	E-tendering System
Audit trail is poor and no system to organize all the data. Every action needs to be done by manually and histories are difficult to trace back.	Provides a systematic audit trail as every action such as accessing, submitting, or downloading tender document will be captured and easy to trace.
Requires a storage to store all the documents and high paper usage. All the tender documents are submitted by hardcopy which is not environmentally friendly.	A physical storage space is no longer needed as all the tender documents can be viewed and accessed online and this resulted the usage of paper can be minimized up to 90 percent.
Lead time will be longer as the traditional tendering requires the tenderer to come to the specified location to purchase, collect and submit the tender documents physically. According to Rosli and Songip [3], the completed tendering process is about 74 days.	E-tendering can reduce the lead time by about 80 percent as compared to the traditional method. All the tender documents can be purchased, downloaded, and submitted online regardless of the geographical boundaries of the users. The completed tendering process is about 31 days, and this is a much easier and more convenient approach.
All the tender documents are received in hardcopy, and this may easily cause the loss of data and resulted in poor information safety.	Only the authorized users can access the tender documents and all the tender documents are securely stored online and backed up by remote server, which guarantees 99.9 percent confidentiality.
High transaction or operation cost.	Kaliannan *et al.,* [4] claim that the E-tendering will be saving 42 percent in transaction cost where cost of printing and the transportation will be lesser.
High potential of dispute and poor transparency.	The system acts as an "administrator" and is responsible for managing all matters of tender information and documents. By using E-tendering, it will assure all the tenderers will receive the same tender documents.
Inefficiency and time consuming due to the occurrence of human errors	More efficient as it provides an automated documentation flow to reduce the human errors.

The disadvantages of traditional tendering are poor audit trial which has caused the difficulty of tracing documents, high consumption of paper, locational limitation, security of the information,

inefficiency, and high operation cost. In contrast, the benefits of E-tendering are systematic audit trial, environmentally friendly, promotes the interaction among the users with the system, high confidentiality system, fixed cost, and better efficiency.

2.2 Readiness of Malaysian Construction Industry

In Malaysia, there are many initiatives from private sector but the implementation of ICT in the construction industry is comparatively low. Elias *et al.,* [14] discovered that failure to investigate personal readiness level in the construction industry will result in the decline of IT adoption. Since the development of IT models tends to emphasize their adoption, the evaluation of individual readiness level will be ignored. In another words, if the implementation of IT has been made without any planning and preparation, the failure of IT executed project will also be reasonably high. That being said, the evaluation of individual readiness level outlines their confidence in integrated new ideas into their work practices. Table 2 shows the references for organization's attitude readiness.

Table 2
Organisation's Attitudinal Readiness

Variables	Sources
Good knowledge of IT	[11], [13], [12], [15], [1]
Aware of the introduction of E-tendering by the Government	[12], [15], [1], [16]
Foresee the increasingly importance of E-tendering to company	[12], [15], [1], [16]
Foresee the construction tendering practices trends	[12], [15], [1], [16]
Interested in E-tendering	[12], [15], [1], [16]

In the view of Lou [17], a good knowledge of IT is the most critical factor of attitudinal readiness in an organization accompanied by the vision of improving business opportunities. Nevertheless, the organization readiness level will not be affected by the awareness and attentiveness of introducing E-tendering. This is because the organizations often strive to employ innovative business practices to enhance competitiveness and business opportunities. Foresight in the construction tendering practices trends has been ranked lower than the organization's attitudinal readiness. E-tendering allows the construction tender to move forward while keeping the social distancing practice, it has become a favourite tendering practice used by private sector since COVID-19 pandemic. Furthermore, the number of E-tendering users has increased compared to the period before the pandemic. Thus, the trend of construction tendering practices is contributing an important part to the readiness level. Table 3 shows the references for organization's physical readiness.

Table 3
Organisation's Physical Readiness

Variables	Sources
Network access	[11], [15], [1], [16]
Computing infrastructure	[11], [12], [1]
Technical staff	[11], [15], [1], [16]
Investment in IT	[12], [1], [16]
Software facilities	[11], [15], [1], [16]

According to the research study carried by Yevu *et al.,* [6], most of the organizations were physically ready to implement E-tendering with sufficient computer infrastructure and technical staff. However, the lack of software facilities is the main setback of physical readiness level, and the

company has made moderate investments on IT and network access to overcome this situation. Table 4 shows the references for the factors that contribute to the readiness in participating in E-tendering.

Table 4
Factors That Contribute to The Readiness in Participating E-Tendering

Factors	Sources
Increase transparency	[11], [15], [1], [16]
Saving in storage space	[1], [16]
Systematic and accurate audit trail	[15], [1]
Improve business opportunity	[15], [1], [16]
Improve company's competitiveness	[12], [1], [16]
Low administration cost	[15], [1], [1], [16]
Time saving	[15], [16]
Ease of use	[15], [1]

Saving in storage space remains the most significant factor contributing to the readiness level of organizations to participate in E-tendering followed by improve organization's competitiveness and business opportunities. According to Yevu *et al.,* [18], E-tendering will become more popular in the next few years as younger generation is joining the construction industry. Tendering process will be digitized, and large physical storage space is no longer needed. Based on the research studies by Tan and Suhana [19] and Betts *et al.,* [20], they concluded that increased business opportunities and the competitiveness of the organization is still a most important variable of organization's readiness to implement E-tendering in the Malaysian construction industry. As mentioned earlier, organizations are always finding an innovative way to enhance their business competitiveness and opportunities which will be beneficial to them from the economic view. Moreover, the factors such as saving in time and storage space also help to increase the readiness level of individuals to adopt E-tendering.

3. Methodology

This study adopted mixed method where quantitative and qualitative analysis were carried out. By adopting both approaches, the study were equipped with more opinions and statistical results to generate a wider coverage of analysis. To obtain statistical results that are relevant to the objectives of the research, a well-designed question is essential. Thus, conducting and distributing questionnaires to specific respondents is the primary data sources to resolve the purpose and objectives of this study. Questionnaire survey offers a short period of time and in a reasonably cost-effective manner to obtained large amount of information from targeted respondents. The questionnaires survey was adopted for the quantitative research method which is to obtain sufficient data from respondent population regarding their views, experiences, and judgments to generate reliable statistical results. The targeted respondents for this study were the experienced quantity surveyors in the Malaysian construction industry as they have better understanding on the research objectives. The survey was only conducted within the Klang Valley area, so the result does not represent the entire market in Malaysia and can only be applicable in Malaysia. The research was prepared in the form of questionnaires and interview where the data collected was examined. The questionnaires were distributed to 130 targeted respondents either by phone, email or through online survey.

Next, the reason to choose qualitative research is because it is used for understanding views and perceptions of the respondents for the research study. Therefore, interviews were carried out in this study as it allowed the interviewees to express their opinions. The interview questions were in the form of open-ended question so that the respondents were allowed to give their opinions and not

only answer based on the selections. This method was chosen because it allows respondents to openly express their thoughts and provide information outside of the interviewer's assumptions and perceptions [21]. Descriptive analysis method was used in this study to assess the background of the respondents, strengths and impedes that they are facing in the implementation of E-tendering after the COVID-19 pandemic. A 30 to 60 minutes in-depth interviews in English with five respondents via telephone have been conducted. These in-depth interviews were semi-structured and based on the authors' original interview criteria, which were tailored for quantity surveyors. The questions in the interview were based on the feedback of the questionnaire where the intention was to further confirm the reliability of the results from the collected questionnaire. Figure 1 shows the research process of this study.

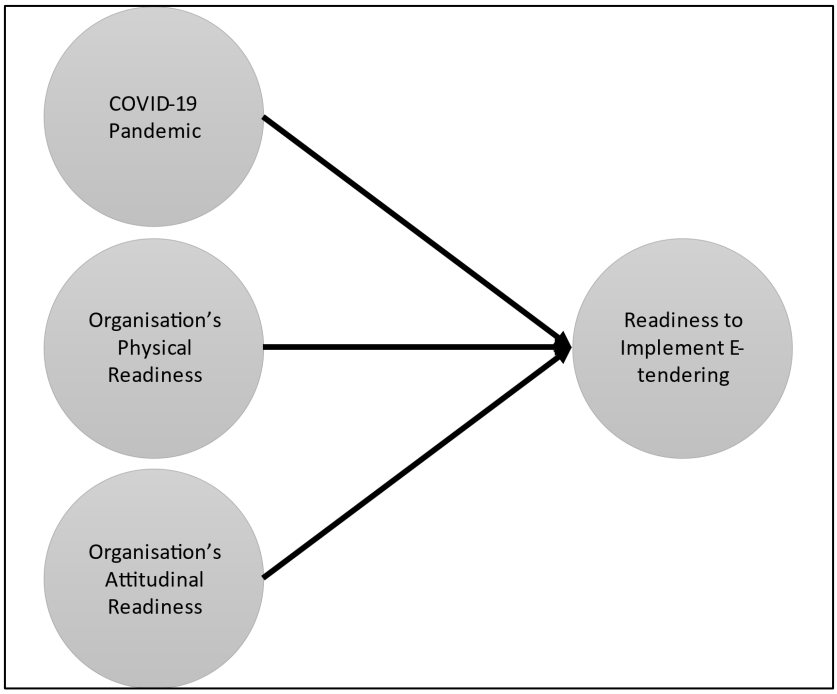

Fig. 1. Research Process

4. Analysis and Results

Due to the restriction of Movement Control Order (MCO), the questionnaire surveys and interviews were conducted online. There was a total of 130 sets of online questionnaire surveys generated and distributed by using Google Form through email and WhatsApp to the targeted respondents. Within two months of sending out the questionnaires, 50% of 130 responses were expected. Throughout the total questionnaire surveys, the overall response rate was 68%. There were in total of five interviewees and seven questions were asked.

Table 5 shows the background of all respondents. The demographic of the respondents for the questionnaire survey is illustrated and discussed in Table 6.

Table 6 shows the demographic of respondents. Respondents in the research are within the range of five years' experience in the industry, their perspectives are more neutral between the traditional tendering and E-tendering. Furthermore, the interviewees from different backgrounds can contribute different perspectives and the diversity of the experiences enriches the research through different knowledge and information. Majority of respondents in this research are from consultant firms. This is good because the initiative of the implementation of E-tendering usually is from the

client where they will assign their representative who is the consultant firm to host the tendering process.

Table 5
Background of The Respondents

Research Instruments	Background of the Respondents		
Interview	Interviewee A	Position: Year of Experience: Current Company: Sector of Company's Project:	Quantity Surveyor 15 years Developer Firm Private
	Interviewee B	Position: Year of Experience: Current Company: Sector of Company's Project:	Quantity Surveyor 3 years Interior Design Private
	Interviewee C	Position: Year of Experience: Current Company: Sector of Company's Project:	Quantity Surveyor 2 years Contractor Firm Private
	Interviewee D	Position: Year of Experience: Current Company: Sector of Company's Project:	Quantity Surveyor 9 years Consultant Firm Public and Private
	Interviewee E	Position: Year of Experience: Current Company: Sector of Company's Project:	Quantity Surveyor 10 years Consultant Firm Public and Private
Questionnaire Survey	89 respondents	89 respondents are quantity surveyors and they are from different type of construction companies which are consultant firms, developer firms, contractor firms and interior design companies except one respondent who is from a precast company.	

Table 6
Demographic of Respondents

Categories	Questionnaire	Interview
Respondents' experience		
Below 2 years	35	0
2-5 years	35	2
6-10 years	13	2
Above 10 years	3	1
Respondents' Company		
Consultant Firm	37	2
Contractor Firm	35	1
Developer Firm	13	1
Interior Design Firm	3	1
Others	1	0
Respondent's Company Projects		
Private	65	3
Public and Private	24	2
Indicators	Traditional Tendering	E-tendering
Respondent's Preference in Tendering System	55	34
	Yes	No
Respondents' Experience in E-tendering	47	42
	Yes	No
Respondents' Willingness to Participate in E-tendering	83	6

Most of the respondents prefer traditional tendering. This can be due to the fact that the construction industry in Malaysia has been practicing the traditional paper-based approach for many years. Therefore, they do not prefer adopting E-tendering which they are not familiar with. Most of the respondents never get involved in E-tendering. This could be due to the usage of E-tendering was impacted by the size of the company involved. Smaller firms usually lacking the technology or knowledge to make use of such innovative systems. Larger firms tend to have the infrastructure in place to utilise such systems, as well as a dedicated information technology department to assist with E-tendering security, development, and implementation. However, almost half of the respondents have some experiences in E-tendering. This depicts a shift in the construction community toward information technology adoption. When more younger generations enter the construction industry, the information technology trend will accelerate. Majority of the respondents have the intentions to participate in E-tendering projects in future. This result indicates a better prospect for E-tendering.

Based on the interviewee's perspective shown in Table 7, there are two interviewees who preferred the traditional tendering while three interviewees are in the favour of E-tendering. This result shows that Interviewee A and Interviewee E are concerned about the reliability of the system. Interviewee E also pointed out the security concerns and legal issues are the main weaknesses of the E-tendering and unavailability of the system may lead to the failure of submission of tender. Interviewee B, C and D stated differently and more favourable to E-tendering. Revision of drawings are frequently occurred in every construction project, E-tendering offers faster responses and clarification compared to the traditional tendering according to Interviewee B. The age and experience of the interviewee have a significant impact on their opinions. Interviewee A and E are considered as more experienced quantity surveyors who have a more mature business perspective, they are sceptical of the hype surrounding new technology efforts. Younger quantity surveyors are educated in the highly technological era, therefore integration of information technology in the tendering process is easily acceptable.

Table 7
Interviewees' Tendering Practices Preferred

In your opinion, which tendering method do you prefer to adopt?	
Interviewees	Responses
Interviewee A	Traditional tendering as it is more reliable.
Interviewee B	E-tendering.
Interviewee C	E-tendering as it gives many benefits.
Interviewee D	E-tendering.
Interviewee E	Traditional tendering. Although E-tendering may have many benefits, the security concern and legal issues are the main setback of the implementation of E-tendering.

Table 8 demonstrates the interviewees' participation of E-tendering. According to Interviewee A, E-tendering is not widely adopted in the Malaysian construction industry, even though he has participated in E-tendering projects previously. Interviewee B, C and D having the same perspective that E-tendering enables businesses to obtain tender documentation easily and is efficient to be used.

Table 8
IInterviewees' Participation in E-Tendering System

Do you involve in E-tendering in your previous projects and how was your experience?	
Interviewees	Responses
Interviewee A	Yes. However, E-tendering is not common enough in Malaysia and most of the project are still using the conventional tendering method.
Interviewee B	I didn't use E-tendering in my current company, but I do have some previous experiences in my ex-company which was a developer firm. E-tendering is user friendly and very efficient.
Interviewee C	Yes. At first, I was unable to understand the function and features of the system but after I used E-tendering and I notice it is very convenient to use, and the main differences is it do not need to hand over physical tender documents to tenderers and skip the need of having physical meeting. Other than that, everything else is quite similar to the traditional system, which allowed me to quickly adopt to this system.
Interviewee D	Yes. E-tendering is convenient to use.
Interviewee E	Yes, but not significant experiences.

Based on the interviewee's perspective, there are two interviewees who preferred the traditional tendering while three interviewees are in the favour of E-tendering. This result shows the Interviewee A and Interviewee E are concerned about the reliability of the system. Interviewee E also pointed out the security concerns and legal issues are the main weaknesses of the E-tendering and unavailability of the system may lead to the failure of tender submission. Interviewee B, C and D stated differently and more favourable to E-tendering. Revision of drawings are frequently occurred in every construction project, E-tendering offers faster responses and clarification compared to the traditional tendering according to Interviewee B. The age and experience of the interviewee have a significant impact on their opinions. Interviewee A and E are considered as more experienced quantity surveyors who have a more mature business perspective, they are sceptical of the hype surrounding new technology efforts. Younger quantity surveyors are educated in the highly technological era, therefore integration of information technology in the tendering process is easily acceptable.

4.1 Readiness of E-tendering - Questionnaire Surveys

Fig. 2. shows there are a total of 60 respondents believe that the Malaysian construction industry is ready for the E-tendering while the remaining 29 respondents opine that the Malaysian construction industry is not ready to be involved in E-tendering project. Majority of the respondents are ready to shift from traditional tendering to E-tendering because the government has established the digital platform such as National E-tendering Initiatives (NeTI) to provide several platforms to deal with the tendering process electronically such kkr.gov.my, jkr.gov.my, E-perolehan.gov.my and tender.selangor.my to ensure majority of the construction projects can be tendered electronically in Malaysia where most of the respondents may be involved previously. These platforms allow the contractors to participate in the public construction projects electronically. Moreover, the reasons for the respondents who answered that Malaysia is not ready for E-tendering may be attributed to the private E-tendering projects are lacking a central notification mechanism which will make parties unaware, and there are fewer relevant private sector tender opportunities.

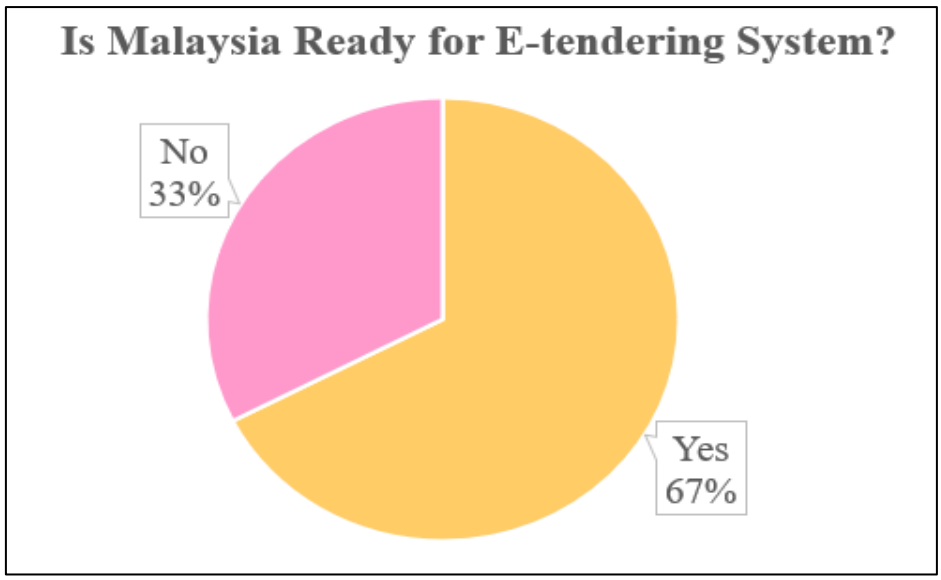

Fig. 2. The Readiness of E-Tendering in The Malaysian Construction Industry

Table indicates each factors have more than 70% of the respondents in agreement which will influence the organization attitudinal readiness toward E-tendering. The "trend of construction tendering practices" is contributing to the most important part of the readiness of the construction industry followed by the "aware of the introduction by the government" and "interested in E-tendering projects". E-tendering has become a favourite tendering practice used by private sectors in this COVID-19 pandemic. E-tendering allows the tender processes to move forward while keeping the social distancing practice. The respondents believe that if the organizations can catch up with the current trend, they will be able to acquire more projects.

Table 9
Ranking of Organisation's Attitudinal Readiness Toward E-Tendering

Organization's Attitudinal Readiness	Yes	No	Total Respondents	Important Index	Ranking
Foresee the construction tendering practice trends	80	9	89	90%	1
Aware if the introduction of E-tendering by the Government	78	11	89	88%	2
Interested in E-tendering	76	13	89	85%	3
Foresee the increasingly importance of E-tendering to company	74	15	89	83%	4
Good knowledge of IT	66	23	89	74%	5

Table shows that all factors were agreed by the respondents which are influencing the organization's physical readiness level toward E-tendering where 93% of the respondents pointed that "software facilities" remains as the most important criteria which followed by the "network access" and "investment in IT" respectively. According to the respondents, organizations will be ready to embrace E-tendering if software facilities such as the data encryption systems, mass mailing software and electronic signature capture solutions can be adequately established. Next, the access to internet is an indispensable requirement for E-tendering implementation. As compared to other countries, the internal penetration of network in Malaysia is still considered poor. The internal penetration in urban areas is still average but rural areas are weak. The unstable network connection may result in inaccessibility. Besides, the "computer infrastructure" and "technical staff" were placed in the fourth and fifth where there are 68 respondents and 60 respondents agreed with these criteria

respectively. The results are in the same line with Wimalasena and Gunatilake [1] where the computer infrastructure seems to be the necessity in every organization, but the organizations shall also provide necessary training to the staff to have smooth implementation.

Table 10
Ranking of Organisation's Physical Readiness Toward E-Tendering

Organization's Physical Readiness	Yes	No	Total Respondents	Important Index	Ranking
Software facilities	83	6	89	93%	1
Network access	78	11	89	88%	2
Investment in IT	71	18	89	80%	3
Computer infrastructure	68	21	89	76%	4
Technical staff	60	29	89	67%	5

Table 10 demonstrates the factor of "improve company's competitiveness" has been determined as the strongest contributory factor followed by the "improve business opportunities" and "saving in time" respectively. This result has the same view with the Yevu *et al.,* [6] and Elias *et al.,* [14] who advocated that the organization's competitiveness and business opportunities are still the most essential factors implement E-tendering. As mentioned previously, the organizations are constantly looking for new and innovative ways to improve their competitiveness and opportunities to maximize their profit. Moreover, "increase transparency" and "saving in storage" were placed fourth and fifth respectively which are the less concern factors that affect the readiness level in participating E-tendering. The overall results in the questionnaire surveys have indicated that majority of the respondents agreed all these factors were contributing to the readiness level in participating E-Tendering while economic rewards will influence respondents' desire to participate in E-tendering initiatives.

Table 11
Ranking of Factors That Contribute to The Readiness in Participating E-Tendering

Factors that contributing to the readiness in participating in E-tendering	Yes	No	Total Respondents	Important Index	Ranking
Improve company's competitiveness	77	12	89	87%	1
Improve business opportunity	76	13	89	85%	2
Saving in time	75	14	89	84%	3
Increase transparency	63	26	89	71%	4
Saving in storage	60	29	89	67%	5

4.2 Readiness of E-tendering – Interviews

Table 12 shows the responses of the interviewees' readiness level on e-tendering implementation.

Table 12
The Responses of The Interviewees' Readiness Level on E-Tendering Implementation

Is the Malaysian construction industry ready for E-tendering and what are the factors that contributing to the readiness level in participating E-tendering?	
Interviewees	Responses
Interviewee A	I do not think that the Malaysian construction industry is ready. However, due to the COVID-19 pandemic, most of the companies have started to adopt E-tendering. The trend of tendering system has changed, and E-tendering can overcome the limitation of geography but some of the old generations refuse to change and stick to the conventional tendering method which will lead to the low readiness level in participating in E-tendering.
Interviewee B	Malaysia is definitely not ready. Malaysia is having ageing population in the construction industry, and they are still not preferring the traditional tendering. If the company is big enough and want to be more international and commercial, they will adopt the E-tendering as they might want to improve their business opportunities but if the company is small, they will not adopt it as the company need to pay extra money to implement E-tendering where the initial cost is high.
Interviewee C	I would consider the Malaysian construction industry is fully capable of implementing E-tendering. As the system itself is not that difficult to utilize, all you need are computers, laptops or even smartphones with internet connection and you will be all ready to go. Nowadays, there is no company which has no computer or internet connection in their working environment. Furthermore, early exposure of E-tendering as part of the program in university students will contribute to the readiness level improvement to fully implement E-tendering.
Interviewee D	Yes, Malaysia is ready for the E-tendering, but this method is still not widely being used by the industry. I can see efficiency in E-tendering, especially during this pandemic. With E-tendering, we can still run the project smoothly while reducing human interaction. This also gives more opportunities to my company to be exposed to more construction projects. The government or the developers need to encourage the incoming projects by using E-tendering.
Interviewee E	Not ready. Although there are many private sector initiatives but the implementation of ICT by business in the construction industry is quite low. Furthermore, there are risks associated with the security and availability of procurement information and matters of data protection and privacy, security is still an issue and yet needs to be solved.

Interviewee C and D advocated that Malaysia is ready for the E-tendering while the Interviewee A, B and E opined that Malaysia is not mature for the implementation of E-tendering. As mentioned previously, COVID-19 pandemic has changed the trend of tendering practices where many organizations have taken the opportunities to begin the E-tendering adoption. Interviewee D added that his organization was able to participate in more tender projects as E-tendering improves the organization's competitiveness and enhances the business opportunities. Moreover, the organizations are primarily concerned with profit and possible benefits from this change. They always hope that their staff can spend more time on the "profitable" tasks instead of the administration works. E-tendering serves as "cost cutting tool" where it can save time and eliminate the administration work during the tendering process. Besides, the factors such as reluctance to change may contribute an important part on the low level of readiness in participating E-tendering. The traditional mindset which will have the preconceived idea that the implementation of E-tendering is very complex. As a result, the benefits of E-tendering will be neglected and reduce the readiness of organizations in participating in E-tendering.

Based on the information shown in Table 13, Interviewee A, B and D pointed that the Malaysian construction industry are not 100% attitudinally and physically equipped whereas the Interviewee C and E claimed differently where the organizations are attitudinally and physically ready. These results can be due to the organization's size of the interviewees. In term of the physical readiness of E-tendering, it is easy to be satisfied for most of the organizations because the computer infrastructure and internet accessibility seems to be necessity, and this is the only requirement to participate in the

E-tendering processes. Nevertheless, the most significant impediment to organization's attitudinal readiness in the adoption of E-tendering is the people who opposed to the technology. Yevu *et al.,* [6] added that the organizations always look for the way to improve their business opportunities, so the larger organizations will tend to adopt such innovative system to maximize their profit. However, the smaller organizations have lesser opportunities to participate in the E-tendering projects, which means they will be less aware of the needs and value of digital transformation.

4.3 Summary of Questionnaire Surveys and Interviews on the Readiness of E-tendering System

The results show that most of the respondents are ready for E-tendering in the questionnaire surveys but not all the interviewees agree on this. In term of the organization's attitudinal readiness, the most contributory factor is the trend of tendering practices. The result from the study is contradict to the literature review because COVID-19 pandemic has made E-tendering more compelling, and the adoption rate move in tandem with the trend of tendering. Next, most of the organizations in Malaysia is physically equipped with software facilities and IT knowledge. Although 93% of the respondents pointed the lack of software facilities is the main setback of physical readiness, but Malaysia has established the software facilities well and ready to embrace E-tendering. The results indicate the economic rewards are influencing the organizations' desire of participation and the readiness level in E-tendering initiatives. To improve the Malaysian construction industry's readiness level in embracing E-tendering, the organization must be willing to change, the management should have enough courage to adopt the system to increase the readiness level in implementing E-tendering.

Table 3
The Responses of The Interviewees on Organisation's Attitudinal and Physical Readiness Level Toward E-Tendering

Do you think that the organizations in the Malaysian construction industry are attitudinally and physically equipped?	
Interviewees	Responses
Interview A	Not 100% ready and not fully equipped. E-tendering are possible to be implemented in all cities in Malaysia. However, most of the remote areas are still unreachable through internet connection or having very weak signal. Most of the projects are still using conventional tendering. Therefore, to implement E-tendering fully, these companies should also increase the use of E-tendering in their projects.
Interview B	Not attitudinally equipped. Lack of promotion by the government is one of the factors that contributes to the low readiness level in participating E-tendering. Nobody likes to step out from the comfort zone, if the government did not promote or increase the adoption of E-tendering in the construction projects, these companies will not shift to the new tendering system. Not physically equipped. Everyone is busy, the staff do not have time to learn a new system. The issue of IT is another problem, hacker might attack the system and caused problems such as leakage of the tender prices.
Interview C	I believe that the Malaysian construction industry is ready in terms of physical equipment. As computer and internet connection are now necessities for every company, and this is the only requirement for participants to take part in the E-tendering processes. Unless in some cases, in which the construction drawings are provided in AutoCAD drawing, or it needs to be opened by using Autodesk Revit which requires the computer's hardware to meet the recommended specifications. However, this scenario is very seldom as most of the time the drawings will only be provided in PDF form to allow participants to view its contents easily.
Interview D	Not 100% as not many organizations are willing to take extra money to provide E-tendering platform. They also need to provide higher specifications computer hardware and high-speed internet connection for all staff. Training is important, it can avoid mistakes during tendering processes.

Interview E	In term of the facilities, I think Malaysia is good enough for the implementation of E-tendering. It will just need sufficient computer infrastructure and proper training must be provided before entering the tendering process. E-tendering is only popular in big organizations because they need to be more commercial and increase business opportunities. There will be high initial cost for the small and medium size of organizations to start E-tendering adoption.

5. Discussion

The quantitative and qualitative analyses conducted in this study has provided the fundamental understanding of COVID-19 pandemic's impacts on the Malaysian construction industry. COVID-19 pandemic has caused huge impacts to the construction industry such as suspending the construction activities where only a few projects are allowed to run with strict regulations which are considered as essential for the country. Most of the construction projects are facing contracting, tendering and communication issues in this critical period due to the movement restriction which led to complete suspension of works. This situation brings significant impact to the project progress as the restriction of movement not only apply on the labour but transportation of the construction materials and equipment. Due to the unsafe working environment and the occurrence of health and safety challenges created by COVID-19 virus, the readiness level for the Malaysian construction industry to adopt E-tendering is considered as the utmost importance issue. The Malaysian construction industry can overcome all these problems by using enhanced technologies and communicating with other stakeholders without exposing to the risk of COVID-19 infection. The most important strategy to solve current situation is effective communication as most of the challenges facing by the construction industry can be mitigated through effective communication between stakeholders. As COVID-19 pandemic has changed the norm of construction industry significantly, the conventional approaches for the construction industry which were managed previously must be modified thoroughly to suit the pandemic situations where the modifications should be able to accommodate all the needs to deal with all the sudden crises.

89 respondents and five interviewees gave their perspectives towards the research and the results reflected that the research objectives have been achieved. The results obtained in the questionnaire surveys and interviews were consistent with the literature review. The result showed the majority of the respondents are ready for E-tendering and the interviewees also gave some points on the opposite. The contradiction of the responses can be due to the age and experiences of the respondents and the size of the respondent's organization. As mentioned previously, larger organizations tend to find ways to improve their organization's competitiveness and enhance their business opportunities which will increase their readiness level in the implementation of E-tendering. Moreover, the background of the respondents also affects the readiness level as the younger quantity surveyors are educated in highly technological era, therefore integration of IT in the tendering process is more acceptable. In addition, the government's leadership will likely affect the readiness level. The more E-tendering projects awarded by the government, the contractors will be more familiar with this practice which results in greater adoption and higher readiness level. However, the results obtained were relatively different from the literature reviews. In the view of Yevu *et al.,* [18], good knowledge of IT is the most critical factor of attitudinal readiness in an organization. Furthermore, the introduction of E-tendering does not affect the organization's attitudinal readiness as the organizations are constantly looking for new methods to improve their competitiveness and business possibilities. However, the statement in literature reviews were different with results in questionnaire surveys. According to Yevu *et al.,* [18], investment in IT has been considered the most critical factor of physical readiness in an organization which is aligned with

the results of this study as software facilities readiness is ranked as the most important factor in this study.

Theoretically, this study has identified the organization's attitudinal readiness has several factors such as foresee the construction tendering practice trends, aware if the introduction of E-tendering is by the government, interested in E-tendering, foresee the increasingly importance of E-tendering to company and good knowledge of IT while the organization's physical readiness has factors such as software facilities, network access, investment in IT, computer infrastructure and technical staff. The readiness level to adopt E-tendering must be increased as the adoption of E-tendering in construction industry will be flourished in post COVID-19 era due to its specifications in allowing construction stakeholders to work remotely as majority of the construction companies already used to the remote working environment during COVID-19 pandemic period. Consultants who do not adopt E-tendering will lack of competitive and cause losses of potential construction projects. Practically, E-tendering must be adopted as it is supporting the physical distancing program and allows users to work remotely while ensuring the necessary contract documents and procedures to be followed strictly in this critical time. This is highly appropriate to be implemented within the period of COVID-19 pandemic. Therefore, E-tendering is the best approach to be adopted to enhance the current efficiency and effectiveness of the tendering processes.

6. Conclusion

The purpose of this study is to examine the readiness level of the Malaysian construction industry in implementing E-tendering. The organization's attitudinal, physical readiness and the factors that contribute to the readiness level to participate in E-tendering have been identified in the study. The results shows that most of the organizations are physically equipped with software facilities and IT knowledge but not attitudinal equipped. Low organization's attitudinal readiness level can be due to the unforeseen perception of importance and tendering practices trend. Besides, the results also show that the organizations are primarily concerned with profit and potential benefits from making these changes. Malaysia is ready for the E-tendering because the organizations are constantly looking for innovative ways to improve their competitiveness and opportunities to maximize their profit. The main contributory factor that affects the readiness level in participating in E-tendering is the reluctance to change. The organization must be willing to change to improve the readiness level in the adoption of E-tendering. By then, the adoption of E-tendering will increase.

In Malaysia, technology is no longer a stumbling block, and the people remain as the most important aspect of E-tendering deployment. Employee's motivation, interest in IT, attitude, and prior experience in collaborative environments are all the potential essential success elements in implementing E-tendering. The government should act as the largest construction client to establish a more capable platform and make E-tendering mandatory for the construction projects. Moreover, the government shall allow the E-tendering services available on the rental basis, so the small and medium organizations can access and reduce the burden of high initial cost. In addition, the government shall incorporate this new technical knowledge into the syllabus of tertiary education to raise awareness and interest in the E-tendering. Moreover, top-level management support is crucial in boosting the confidence to use E-tendering for the employees. Employees must also be given adequate training and resources in order to integrate IT into the tendering practice effectively and efficiently. Besides, findings of this study can be useful in evaluating the main factors hindering the adoption of E-tendering and it is expected these findings will increase the popularity of the E-tendering usage in the Malaysian construction industry. There are limitations in this study such as the findings may not be able to generalise all the construction players in the whole Malaysia as the

respondents are from Klang Valley area only. This is because the views and opinions of construction companies in other states may be different. Furthermore, this study included respondents who were unfamiliar with E-tendering. This will lead to the findings being dependent on the respondents' interpretation and assumptions as E-tendering is not widely understood and adopted by all respondents.

Acknowledgement
This study was supported by the Faculty of Built Environment, Tunku Abdul Rahman University of Management and Technology under the Centre for BIM research.

References

[1] Wimalasena, Nipuni Nilakshini, and Sachie Gunatilake. "The readiness of construction contractors and consultants to adopt e-tendering: The case of Sri Lanka." *Construction Innovation* 18, no. 3 (2018): 350-370. https://doi.org/10.1108/CI-03-2017-0025

[2] Adedokun, Olaide A., Oladinrin T. Ibironke, and S. O. Babatunde. "Assessment of competitive tendering methods of procuring educational building projects in Nigeria." *Journal of Facilities Management* 11, no. 1 (2013): 81-94. https://doi.org/10.1108/14725961311301484

[3] Rosli, S. A., and A. R. Songip. "Effectiveness of E-procurement in Malaysia." *International Journal of Academic Research in Business and Social Sciences* 7, no. 2 (2017): 870-875.

[4] Kaliannan, Maniam, Halimah Awang, and Murali Raman. "Electronic procurement: a case study of Malaysia's e-Perolehan (e-procurement) initiative." *International Journal of Electronic Governance* 2, no. 2-3 (2009): 103-117. https://doi.org/10.1504/IJEG.2009.029124

[5] Lavelle, Derek, and Andrew Bardon. "E-tendering in construction: time for a change?." *Northumbria Working Paper Series: Interdisciplinary Studies in the Built and Virtual Environment* 2, no. 2 (2009): 104-112.

[6] Yevu, Sitsofe Kwame, Ann Tit Wan Yu, and Amos Darko. "Barriers to electronic procurement adoption in the construction industry: a systematic review and interrelationships." *International Journal of Construction Management* 23, no. 6 (2023): 964-978. https://doi.org/10.1080/15623599.2021.1946900

[7] Bakeri, Iffah Sahira, Siti Rashidah Hanum Abd Wahab, and Adi Irfan Che Ani. "The Technology Adaptation Measures to Reduce Impacts of Covid-19 Pandemic on the Construction Industry." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 31, no. 1 (2023): 34-52. https://doi.org/10.37934/araset.31.1.3452

[8] Lou, Eric Choen Weng, and Mustafa Alshawi. "Critical success factors for e-tendering implementation in construction collaborative environments: People and process issues." *J. Inf. Technol. Constr.* 14 (2009): 98-109.

[9] Hendrickson, Chris, and Laurence R. Rilett. "The COVID-19 pandemic and transportation engineering." *Journal of Transportation Engineering, Part A: Systems* 146, no. 7 (2020): 01820001. https://doi.org/10.1061/JTEPBS.0000418

[10] Choudhury, Pranab, Ranjan Kumar Ghosh, and Sumita Sindhi. "Covid-19 crisis, pandemic resilience and linkages to land: An exposition." (2020). https://doi.org/10.2139/ssrn.3625042

[11] Pamidimukkala, Apurva, and Sharareh Kermanshachi. "Impact of Covid-19 on field and office workforce in construction industry." *Project Leadership and Society* 2 (2021): 100018. https://doi.org/10.1016/j.plas.2021.100018

[12] Hansen, Seng, Susy F. Rostiyanti, Rizaldi Rizaldi, and Clara Andjarwati. "Quantity Surveyors' Response to the COVID-19 Outbreak: A Mixed Method Approach." In *Journal of the Civil Engineering Forum*, vol. 7, no. 2, pp. 177-186. Petra Christian University, 2021. https://doi.org/10.22146/jcef.60715

[13] Gamil, Yaser, and Abdulsalam Alhagar. "The impact of pandemic crisis on the survival of construction industry: a case of COVID-19." *Mediterranean Journal of Social Sciences* 11, no. 4 (2020): 122-122. https://doi.org/10.36941/mjss-2020-0047

[14] Elias, Ezanee Mohamed, Norlila Mahidin, and Nurshuhada Shiratuddin. "E-tendering system for construction projects." In *Proceedings of Internatioal Conference on E-Commerce*. 2005.

[15] Otundo Richard, Martin. "Automating Procurement (E-Procurement) and Its Benefits during the COVID-19 Pandemic." *Available at SSRN 3870248* (2021). https://doi.org/10.2139/ssrn.3870248

[16] Hashim, Nurulhuda, Michelle Yee Seen Man, Myzatul Aishah Hj Kamarazaly, Sr Loo Seong King, S. S. C. A. Ling, and Sr Azrina Md Yaakob. "Application of paperless concept in Malaysian construction e-tendering system, from QS consultants' perspective." *Journal of Built Environment, Technology and Engineering* 8 (2020): 101-110.

[17] Lou, Eric Choen Weng. "Ready? Go The National E-Tendering Initiative–A Malaysian Experience." In *CIB World Building Congress: Construction for Development*, pp. 1442-1455. 2007.

[18] Yevu, Sitsofe Kwame, Ann Tit Wan Yu, Gabriel Nani, Amos Darko, and Mershack Opoku Tetteh. "Electronic procurement systems adoption in construction procurement: A global survey on the barriers and strategies from the developed and developing economies." *Journal of Construction Engineering and Management* 148, no. 1 (2022): 04021186. https://doi.org/10.1061/(ASCE)CO.1943-7862.0002213

[19] Tan, Jeffrey Jia Ren, and Kamarudin Suhana. "Application of e-tendering in Malaysian construction industry." *INTI Journal Special Edition–Built Environment* (2016): 94-101.

[20] Betts, Martin, Peter Black, Sharon Christensen, Edward Dawson, Rong Du, Bill Duncan, Ernest Foo, and Juan Gonzalez Nieto. "Towards secure and legal e-tendering." *Journal of Information Technology in Construction* 11, no. e-Commerce in Construction (2006): 89-102.

[21] Quinn, Anthony. "Vehicle crime, CPTED, and offending under the influence: a qualitative investigation of offender perceptions." *Social Sciences* 8, no. 3 (2019): 88. https://doi.org/10.3390/socsci8030088