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Adoption of E-Tendering System among Small and Medium Enterprises (SME) Contractors in Malaysian Construction Industry

Siti Hajar Hanisah Rafian[1], Roziha Che Haron[1,*] , Md Asrul Nasid Masrom[2]

[1] *Department of Quantity Surveyor, Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, 53100 MALAYSIA*

[2] *Jabatan Pengurusan Pembinaan, Fakulti Pengurusan Teknologi dan Perniagaan, Universiti Tun Hussein Onn Malaysia, Batu Pahat, Johor, 86400, MALAYSIA.*

*Corresponding Author: roziharon@iium.edu.my
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Abstract

The National Construction Policy 2030 (NCP 2030) was established to improve Malaysia's public procurement system by introducing a centralized e-procurement platform aimed at enhancing efficiency, productivity, innovation, and transparency. A key aspect of this policy is the shift to e-tendering, which streamlines tender submission, contracting, and trading through online platforms. Despite the potential benefits, the adoption of e-tendering remains a challenge, particularly for Small and Medium Enterprises (SMEs), which face barriers such as resistance to technological change and limited understanding of the system. Small and Medium-sized Enterprises (SMEs) play a vital role in the construction sector, especially in Malaysia, where they accounted for more than 90% of the sector's composition and thus provide a greater contribution as a force for economic expansion. This strong implication of overwhelming presence among small and medium enterprises indicates their preeminent role in the construction industry. However, SMEs from the construction industry still lag in terms of adopting web marketing methods, such as e-tendering systems. This study aims to explore the adoption of e-tendering systems among SME contractors in the Malaysian construction industry. The research objective is to analyze the traditional and e-tendering processes, identify challenges, and propose strategies for adoption. A mixed-methods approach was used, combining surveys with contractors in categories G3, G4, and G5, and interviews with industry experts. The research finds that while the e-tendering process shares similarities with traditional methods, its features and activities differ significantly. The main challenges identified include insufficient training and resistance to technological adaptation. To address these issues, the study suggests strategies such as offering training programs for employees and promoting digital knowledge to help SME contractors enhance their capabilities, improve tendering processes, and boost competitiveness.

1. Introduction

The construction industry is a vital contributor to Malaysia's economic growth, significantly impacting the nation's Gross Domestic Product (GDP). According to the Department of Statistics Malaysia (DOSM), the sector recorded a notable increase in GDP from 17.30% to 19.00% in the third quarter of 2024, outperforming other key industries such as manufacturing and services. Small and Medium Enterprises (SMEs) form the backbone of the construction industry, representing approximately 91% of the 135,827 registered contractors (CIDB, 2024). These SMEs play a crucial role in fostering competition, innovation, and employment. However, despite their significance, SMEs face substantial challenges in embracing digital transformation, particularly in adopting electronic tendering (e-tendering).

The National Construction Policy 2030 (NCP 2030) seeks to modernize Malaysia's procurement system through a centralized e-procurement platform aimed at improving efficiency, transparency, and innovation. A key aspect of this policy is e-tendering, which streamlines bid submissions, contract management, and procurement transactions (Sunmola & Shehu, 2020). While e-tendering offers numerous benefits, its adoption among SME contractors remains low due to resistance to change, lack of awareness, and insufficient government support (Hashim *et al.*, 2020). These challenges limit SMEs' ability to compete in the digital procurement landscape, affecting their long-term sustainability (Schoenher *et al.*, 2019).

Traditional tendering methods have long been associated with inefficiencies, including time-consuming documentation, high risks of manipulation, and increased project costs (Ananthajothi *et al.*, 2024). The manual process, which requires physical bid submission and manual evaluation, is prone to errors and delays (Ashaari *et al.*, 2018). In contrast, e-tendering enhances transparency, reduces costs, and improves procurement efficiency (Affendy *et al.*, 2022). However, many construction professionals remain hesitant to transition due to their familiarity with traditional methods, behavioral resistance, and inadequate training in digital procurement (Al-Yahya *et al.*, 2018).

The rise of Industry 4.0 highlights the need for SMEs to adopt modern technologies such as e-tendering to remain competitive. However, research on e-tendering adoption among SMEs in Malaysia remains limited, creating a knowledge gap in understanding the factors influencing its implementation. This study aims to bridge this gap by exploring the barriers to e-tendering adoption and proposing strategic solutions for SME contractors. Using a mixed-method approach, the research will provide valuable insights to enhance digital procurement practices, ultimately supporting SMEs in adapting to the evolving construction landscape.

2. Literature Review

2.1 Tendering

Tendering serves as the fundamental process linking project clients with contractors in the construction sector (Runeson & Skitmore, 1999). It is a structured procedure that enables the selection of a qualified contractor at an appropriate time based on project circumstances, ensuring the submission of a competitive offer as a basis for awarding a contract (O'Connell, 2010). Finch (2011) further defines tendering as a system used by clients to procure contractors for new construction or renovation projects. Wimalasena and Gunatilake (2018) describe it as the process of soliciting bids from interested contractors to execute specific construction work packages. In essence, tendering is a competitive selection mechanism that allows clients to evaluate bids and appoint the most suitable contractor, ensuring project completion within budget, on time, and in accordance with specified requirements.

2.2 Traditional Tendering Process in the Construction Industry

Tendering serves as the fundamental process linking project clients with contractors in the construction sector (Runeson & Skitmore, 1999). It is a structured procedure that enables the selection of a qualified contractor at an appropriate time based on project circumstances, ensuring the submission of a competitive offer as a basis for awarding a contract (O'Connell, 2010). Finch (2011) further defines tendering as a system used by clients to procure contractors for new construction or renovation projects. Wimalasena and Gunatilake (2018) describe it as the process of soliciting bids from interested contractors to execute specific construction work packages. In essence, tendering is a competitive selection mechanism that allows clients to evaluate bids and appoint the most suitable contractor, ensuring project completion within budget, on time, and in accordance with specified requirements.

Before commencing the tendering process, it is essential to complete the tender preparation phase. The employer needs to confirm the procurement method for the construction project, whether it follows a traditional approach or a non-traditional method like a package deal or design and build. The chosen procurement method significantly influences the preparation of tender documents. Once the procurement method is determined, the consultant quantity surveyor will create a list of qualified contractors who will receive invitations to tender. The content of the tender documentation varies depending on the chosen procurement method. For example, in a traditional procurement approach, the tender document typically

includes bills of quantities (BQ), specifications, schedules of works, schedule of rates, and drawings. Drawings are often distributed electronically through mediums such as CD-ROM or email (Brook, 2004).

The subsequent step involves the issuance of the tender. In private projects, tenderers receive a formal letter of invitation to tender once the tender document is prepared. This letter outlines details such as the project's scope, location, submission deadline, tender deposit, and documentation fee. Conversely, tenders for government projects are advertised through newspapers and various electronic media platforms. Interested tenderers have the option to purchase the tender documents (Cherif, Khalil and Waly, 2014). Upon receipt of the tender documents, tenderers are advised to thoroughly review them to ensure completeness. Typically, tenderers are granted a reasonable period for tendering, often around two weeks, during which they price the bills of quantities (BQ) and prepare their tender submissions.

If an addendum is issued during the tendering period, the duration for tender submission will typically be extended. Addendums usually involve modifications to designs or rectification of errors in the tender document. Additionally, tender meetings are convened to address questions from tenderers and provide explanations on the key components of the tender (Davis and Stafford, 2016). Equal treatment is ensured for all tenderers, and responses to inquiries should be formally communicated to all tenderers, including those who did not attend, along with the questions posed.

Tenderers are required to submit their tenders by the specified date, time, and location outlined in the invitation to tender letter. As a security measure, tenders should be enclosed in sealed envelopes. Prior to opening the tenders, a designated form for the tender opening process will be generated. The tender opening event will be attended by the employer and members of the project team, including the consultant quantity surveyor. Each tender will be opened, and its price recorded on the prepared form. Subsequently, the attendees will review and sign the form.

During the tender evaluation process, the consultant quantity surveyor is responsible for assessing the accuracy of pricing in the bills of quantities (BQ), the Form of Tender, and the Summary of Tender to identify any arithmetic errors. Subsequently, a tender report will be compiled. This report will document and compare each tender price to ascertain the highest and lowest bids. Using the evaluation results, the consultant quantity surveyor will propose a recommendation for the most appropriate tenderer to undertake the project construction (Roy, 2017). Upon completion, the tender report will be presented to the employer for review. Following the employer's approval of the tender report, both successful and unsuccessful tenderers will receive notification via letter. The successful tenderer will be issued a letter of award, which includes details such as the contract price, construction period, commencement date of the contract, and other pertinent information (Davis and Stafford, 2016; RICS, 2014). Figure below illustrates the general process of traditional tendering.

Fig. 1 General Process of Tendering *(Rosida, 2021)*

2.3 E-Tendering System

According to Sunmola & Shehu (2020), e-tendering is an internet-based procurement method that enhances the efficiency, transparency, and accessibility of tender processes. It eliminates paperwork and digitizes the entire workflow, from tender advertisement to award.

2.3.1 E-Tendering Process

The e-tendering process closely mirrors traditional tendering, consisting of six stages (Tan, 2022):

- Tender Invitation: Tender documents are uploaded online for interested contractors.
- Registration & Purchase: Tenderers register, purchase, and download tender documents digitally.
- Pricing & Submission: Tenderers review, price, and submit the Bill of Quantities (BQ) electronically.
- Tender Opening: Submitted documents are securely stored and opened post-deadline.
- Tender Evaluation: Software tools, such as CubiCost, automate price comparison and tender assessment.
- Tender Award: Results are announced online, and contracts are signed digitally.

2.4 Background of SME Corporation Malaysia

Malaysia established the Small and Medium Industries Development Corporation (SMIDEC) in 1996 to support SME growth. In 2004, the National SME Development Council (NSDC) was formed to develop SME strategies, leading to SMIDEC's transformation into SME Corp. Malaysia in 2009. SME Corp. Malaysia is now the central agency for SME development, providing financial support, market access, and advisory services. SMEs in Malaysia are categorized as (SME Corp. Malaysia, 2020):

- **Manufacturing sector:** Sales turnover ≤ RM50 million or ≤ 200 employees.
- **Services & other sectors:** Sales turnover ≤ RM20 million or ≤ 75 employees.

2.4.1 Overview of SMEs in Malaysia

According to a report from the Department of Statistics Malaysia (DOSM), SMEs are vital to Malaysia's economy, contributing significantly to employment, GDP, and innovation. As of 2020, SMEs made up 97.2% of total businesses, with 1,151,339 establishments across services, manufacturing, construction, agriculture, and mining. The services sector dominates, comprising 85.52% of SMEs. SMEs play a crucial role in regional economic development, fostering entrepreneurship and social mobility.

2.4.2 SMEs in the Construction Industry

Unlike other sectors, construction SMEs operate on a project-based model, with most work subcontracted. The Construction Industry Development Board (CIDB) classifies SMEs based on paid-up capital and tendering capacity:

- **Small-sized contractors:** G1–G3 (tendering capacity ≤ RM1 million).
- **Medium-sized contractors:** G4–G5 (tendering capacity ≤ RM5 million).
- **Large contractors:** G6–G7 (tendering capacity > RM10 million).

As of 2024, Malaysia has 135,827 registered contractors, with SMEs (G1–G5) accounting for 91% of the total. These SMEs are crucial for digital transformation, particularly in e-tendering, to enhance efficiency and competitiveness (CIDB, 2024).

2.5 Challenges of Adopting E-Tendering Systems among SME Contractors

The adoption of e-tendering systems among SME contractors presents significant advantages but also comes with notable challenges. Overcoming these barriers is crucial to facilitating a smooth transition to digital procurement and maximizing the benefits of e-tendering in the construction industry.

2.5.1 Security and Policy Concerns

One of the primary challenges to e-tendering adoption is the concern over data security and confidentiality. The e-tendering system handles highly sensitive information, including bid prices and contract details, making it vulnerable to cyber threats such as data breaches and unauthorized access (Lin *et al.*, 2024). A lack of robust cybersecurity measures and uncertainties regarding data integrity further erode stakeholders' trust in the system (Yutia, 2024). In addition to security concerns, inconsistencies in government policies create further resistance to adoption. Frequent policy changes, unclear regulatory frameworks, and the absence of a standardized approach to e-tendering implementation lead to uncertainty among industry players (Hossain, 2024). In Malaysia, the lack of a centralized notification mechanism for private e-tendering projects further

complicates the process, limiting stakeholders' access to critical updates and tendering opportunities (Lin *et al.*, 2024).

2.5.2 Cost Implications

The high initial cost of setting up an e-tendering system is a significant deterrent, particularly for small and medium-sized enterprises (SMEs) (Kajendran, 2022). The transition from traditional procurement methods to digital platforms requires substantial investment in IT infrastructure, software, and training. Organizations with limited financial resources may struggle to justify the cost of adopting a new system, especially when the return on investment is not immediately visible (Mehdipoor *et al.*, 2022). Beyond initial implementation, maintenance costs present an ongoing financial challenge. E-tendering platforms require regular software updates, cybersecurity enhancements, and technical support, all of which add to operational expenses (Mehdipoor *et al.*, 2022). SMEs face financial constraints that limit their ability to sustain these recurring costs, potentially rendering their systems outdated and less secure over time (Izzati, Suhaida & Kam, 2018).

2.5.3 Limited Knowledge and Skills

A lack of training and technical expertise significantly hinders e-tendering adoption. Many construction professionals, particularly in SMEs, lack the necessary IT skills to effectively navigate digital procurement platforms (Lin *et al.,* 2024). Without proper training, employees may struggle to utilize the system efficiently, leading to errors, inefficiencies, and reluctance to transition from traditional methods (Nassir *et al.*, 2023). Additionally, a general lack of knowledge about the benefits and functionalities of e-tendering further slows its adoption (Mehdipoor *et al.*, 2022). Many organizations, especially smaller contractors, remain unaware of how e-tendering can enhance their operations, resulting in hesitancy to invest in digital procurement solutions (Wimalasena & Gunatilake, 2018).

2.5.4 Resistance to Change

Resistance to technological change is another major challenge in e-tendering adoption. Employees and contractors who are accustomed to traditional tendering processes often prefer conventional methods due to familiarity and perceived reliability (Nassir *et al.*, 2023). The long-standing practice of paper-based tendering in Malaysia contributes to a cultural reluctance to embrace digital alternatives (Sydorenko, 2017). Furthermore, lack of awareness and engagement among employees exacerbates the problem (Lin *et al.*, 2024). Without targeted efforts to educate and promote the advantages of e-tendering, many organizations remain resistant to its adoption, resulting in lower participation rates and missed opportunities for efficiency improvements (Kajendran, 2022).

2.6 Strategies of Adopting E-Tendering System among SME Contractors

The challenges discussed earlier can be mitigated by adopting several key strategies to ensure the successful adoption of an e-tendering system within the construction industry, particularly among SME contractors.

2.6.1 Providing Software Training for Employees

Comprehensive training is essential for successful e-tendering adoption, as it equips employees with the technical skills and knowledge required to navigate the system effectively (Chan *et al.*, 2019). Proper training minimizes errors, enhances efficiency, and increases user confidence in digital procurement processes (Lin *et al.*, 2024). Structured programs not only boost motivation (Lou & Alshawi, 2009) but also foster adaptability, ensuring employees can keep up with system updates and evolving industry requirements (Ashaari *et al.*, 2018). Continuous learning opportunities, workshops, and hands-on practice further reinforce understanding and improve long-term adoption success.

2.6.2 Government Financial Support

Financial assistance plays a crucial role in helping SMEs overcome cost barriers in e-tendering adoption, making the transition more feasible (Ashaari *et al.*, 2018). Grants, subsidies, and low-interest loans enable SMEs to invest in essential software, infrastructure, and comprehensive training programs, ensuring a seamless integration process (Akinshipe *et al.*, 2022). This financial support not only alleviates the burden of initial expenses but also enhances competitiveness, encourages technological innovation, and facilitates smoother adoption across the construction sector.

2.6.3 Providing References and Guidelines

Guidelines and reference materials play a vital role in facilitating the structured adoption of e-tendering by providing clear instructions, best practices, and troubleshooting support (Ashaari *et al.*, 2018). These resources help organizations implement e-tendering efficiently while ensuring consistency in tendering practices. Additionally, government-issued guidelines offer a standardized framework, enabling organizations to align with technological, security, and regulatory compliance requirements, thereby reducing risks and enhancing system reliability (Seah, 2021).

2.6.4 Top Management Support

Strong leadership commitment is crucial for the successful adoption of e-tendering, as it fosters a supportive organizational culture and ensures smooth implementation (Lin *et al.*, 2024). When management actively participates, allocates resources, and removes barriers, employee confidence and acceptance increase (Affendy *et al.*, 2022). Collaboration at the leadership level facilitates seamless integration, enhances operational efficiency, and reinforces a long-term commitment to digital transformation (Ashaari *et al.*, 2018).

3. Research Methodology

This research adopted a mixed-methods approach to investigate e-tendering adoption among SME contractors in the Malaysian construction industry. A questionnaire survey was conducted with 30 SME contractors from categories G3, G4, and G5 to gather quantitative data, which was analyzed using descriptive statistics. This study focuses on G3, G4, and G5 contractors, as they are actively involved in tendering processes for projects exceeding RM500,000. Additionally, qualitative insights were obtained through semi-structured interviews with three industry experts in e-tendering. These interviews explored their experiences, challenges, and strategies for implementation. By combining both methods, the study provided a comprehensive understanding of the barriers faced by SMEs and potential solutions to enhance e-tendering adoption in the industry.

The questionnaire consisted of five sections: A, B, C, D, and E, with data from sections C and D analyzed using the Statistical Package for Social Sciences (SPSS). Mean values were organized in descending order to identify key impacts. The study utilized a Likert scale for data collection and analysis, categorizing responses into three groups: low (≤2.50), medium (2.51–3.50), and high (≥3.51) (Evren *et al.*, 2020). This approach provided a clear framework for evaluating SME contractors' perspectives on e-tendering adoption, enabling a structured analysis of the challenges and factors influencing their adoption decisions.

The data from the Interview was analysed by Thematic Analysis. Thematic Analysis is particularly for analyzing data that is rich in description, such as interviews and focus group responses (Naeem *et al.*, 2023). Although it is commonly applied to interview data, thematic analysis can also be used to analyze a variety of data types, including photographs, videos, and other visual materials (Braun & Clarke, 2019).

4. Result

4.1 Comparison Between the Traditional System and the E-Tendering System

This section provides a detailed analysis of the e-tendering processes adopted by two different developers, namely the Jabatan Kerja Raya (JKR) and GAMUDA, highlighting their approaches, features, and activities.

4.1.1 JKR E-Tender (JET) used by JKR

The key processes involved stated by Respondents 1 and 2:

"The process of the JET E-Tender System begins with the Pegawai Menyedia Tender (PMT) creating a tender advertisement and uploading the relevant tender documents to the system. On the contractor's side, they can view the tender notices and register an account to access the platform. Once registered, contractors can view the tender advertisement, which includes details such as tender information, briefing schedules, tender purchase instructions, and the required Tender Submission Document (TTD). A tender briefing is then conducted for all interested contractors. Following the briefing, contractors can proceed to purchase the tender documents online. The Pegawai Menyedia Tender (PMT) will verify the contractors' attendance at the briefing session and confirm their purchase receipts. Upon verification, the system activates the download link for the tender documents."

"After registering, contractors can log in to the system to download the tender documents. Once all required documents are completed, contractors can upload the necessary tender documents through the system to submit their tenders.

The Cawangan Pengurusan dan Perolehan Harga (CPPH) will then appoint the Tender Opening Committee (Jawatankuasa Buka Tender, JBT). JBT is responsible for opening the submitted tender documents, reviewing the mandatory documents, and verifying the Tender Schedule Form (JKR28) submitted by contractors. Notably, the JKR28 form is automatically generated on the system's main page. Next, Pegawai Menyedia Tender (PMT) will update the system with the details of the successful tenderer. The final stage involves the Data Officer downloading the cost data from the system for record-keeping and analysis."

4.1.2 SAP Ariba and Build Space are used by GAMUDA

The key processes involved were stated by Respondent 3:

"The first step in the e-tendering process with GAMUDA is the contractor registration through the SAP Ariba system. Contractors must create a profile and provide key information, such as company details, certifications, financial status, and other relevant data."

"To be eligible for selection, the contractor's registration status must be marked as 'Registered'. If the status remains 'Pending', the contractor may not receive an invitation to participate in the tender process."

"GAMUDA identifies contractors from the list of those successfully registered in their system. Invitations to tender are then sent to the selected contractors. The published tender documents include scope of work, technical specifications, terms and conditions, and submission deadlines."

"Contractors who accept the invitation and agree to participate in the tender must attend a mandatory training session on using the system, regardless of their prior experience with the system. GAMUDA provides step-by-step guidelines to ensure all contractors are familiar with the process."

"Once trained, contractors must submit the required tender documents within the specific deadlines. The E-Auction process follows, where GAMUDA sets a ceiling price and evaluates the prices offered by the contractor. The tender is then awarded to the successful contractor, who receives a notification and a letter of award from the client."

"After both parties sign the contract electronically, the contractor can begin the work. Post-award activities are also managed through the SAP Ariba system. These include tracking project progress, submitting payment claims, certifying payment claims by the client, and processing final payments."

"The SAP Ariba system streamlines the entire process, from tender advertisement to project completion."

4.2 Challenges of Adopting the E-Tendering System Among SME Contractors

4.2.1 Questionnaire Survey

Table 1 below shows the challenges compiled according to the ranking. The average score for all e-tendering system challenges rated by respondents is a moderate average index. The limited training provided related to the e-tendering system is rated as the most challenging aspect to adopt e-tendering systems among SME contractors. Moreover, the lowest-rated challenge is a high initial cost.

Table 1 *Summary of all challenges of adopting e-tendering systems among SME contractors*

Challenges	Ranking	Mean
Limited training was provided related to E-tendering	1	3.43
Lack of knowledge of E-tendering	2	3.27
Employees are comfortable with the traditional tendering	3	3.13
Lack of awareness of employees	4	3.00
Lack of security in sensitive data	5	2.83
High maintenance cost	6	2.63

Inconsistency of government policy	7	2.63
High initial cost	8	2.60

4.2.2 Interview

Based on the results in Table 2, the biggest challenges mentioned by all respondents are resistance to adapting to new technology, a lack of employee awareness about e-tendering, and a preference for traditional tendering methods. The least challenging challenges mentioned by the respondents are insufficient knowledge about the e-tendering process, perceived complexity of the e-tendering system, and language barriers. These interviews were conducted to validate the findings from the questionnaire.

Table 2 *Summary of all challenges of adopting e-tendering systems among SME contractors*

Challenges	Ranking	Respondent
Resistance to adapting to new technology	1	R1, R2, R3
Lack of employee awareness about E-tendering	2	R1, R2, R3
Preference for traditional tendering methods	3	R2, R3
Limited digital literacy	4	R1, R2
Insufficient knowledge about the e-tendering process	5	R1
Perceived complexity of the e-tendering system	6	R3
Language barriers	7	R3

4.3 Strategies Adopting E-Tendering System Among SME Contractors

4.3.1 Questionnaire Survey

Table 3 below presents the compiled strategies ranked according to their respective scores. The overall average score for all e-tendering system strategies, as rated by respondents, falls within a high average index. Among these strategies, providing software training for employees is identified as the most effective approach for encouraging the adoption of e-tendering systems among SME contractors. Conversely, the strategy receiving the lowest rating is government-provided financial support.

Table 3 *Summary of all strategies of adopting e-tendering systems among SME contractors*

Strategies	Ranking	Mean
Provide software training for employees	1	4.13
Provide reference and guideline notes	2	4.07
Support from top management	3	3.97
The government provides financial support	4	3.80

4.3.2 Interview

Based on the results in Table 4, the most frequently mentioned strategy by respondents is conducting training sessions. In contrast, the least mentioned strategy is the continuous improvement of the system. These interview findings were gathered to validate the results obtained from the questionnaire.

Table 4 *Summary of all strategies for adopting e-tendering systems among SME contractors*

Strategies	Ranking	Respondent
Conduct training sessions	1	R1, R2, R3
Promote digitalization knowledge	2	R1, R3
Hire experts	3	R2, R3
Continuously improve the system	4	R3

4.4 Discussions

4.4.1 Comparison Between the Traditional Tendering System and the E-Tendering System

The tendering process plays a critical role in the construction industry, ensuring the selection of the right contractor for a project. Traditional tendering and e-tendering are two primary methods employed in this process. While both methods follow the same basic steps, the features and activities involved differ significantly, as highlighted by Tan (2022) in subheading 2.7. Thus, comparing the two ways reveals the advantages and limitations of each method, as well as a clearer understanding of how technology is influencing the procurement landscape in the construction sector. Table 5 shows the differences between these two methods.

Table 5 *Comparison between the traditional system and the e-tendering system*

Component	Traditional Tendering	E-Tendering System	
		JKR E-Tender (JET)	SAP Ariba
Tender Invitation	Open tenders are advertised in newspapers; selective tenders are sent via email/fax	Publicly advertised in the system	Invitation-only for registered contractors under GAMUDA
Purchase Tender Document	Hard copy purchased from the person in charge	Purchased and paid via system (JOMPAY)	Purchased and paid via the system
Tender Meetings	Conducted face-to-face	Online registration, followed by a meeting for all tenderers	No briefing session
Tender Addendum	Delivered by hand or email	Provided and notified via the system	Provided and notified via the system
Tender Submission	Sealed documents submitted at a specified location	Submitted electronically through the system	Submitted electronically through the system
Tender Evaluation	Manually evaluated by consultant quantity surveyors	Evaluated by Tender Opening Committee (JBT)	Evaluated using the E-Auction process

Tender Evaluation	Notices sent via letter to all tenderers	Announced in the system	Announced in the system

4.4.2 Challenges of Adopting the E-Tendering System Among SME Contractors

The findings from both the survey and questionnaire highlight significant challenges in the adoption of e-tendering systems among SME contractors. The questionnaire results indicate that the most critical barrier to adoption is inadequate training, which received the highest ranking among the identified challenges. This underscores the urgent need for structured training programs to equip employees with the necessary skills to navigate e-tendering platforms effectively. Studies by Mohungoo *et al.* (2020), Nassir *et al.* (2023), and Lin *et al.* (2024) emphasize that insufficient training significantly hinders adoption, making it a crucial issue that must be addressed to facilitate a smoother transition to digital tendering.

The interview findings further reinforce these challenges, particularly the strong resistance to adopting new technology. Many SME contractors continue to rely on traditional tendering methods, which they find more familiar and reliable, making them hesitant to embrace e-tendering. This reluctance stems from a long-standing dependence on paper-based processes and a lack of confidence in digital alternatives. Studies by Sunmola and Shehu (2021) and Nassir *et al.* (2023) support this observation, highlighting how deep-rooted familiarity with conventional methods creates both psychological and operational barriers to change. Without targeted efforts to address these concerns, the transition to e-tendering among SME contractors will likely remain slow and challenging.

4.4.3 Strategies Adopting E-Tendering System Among SME Contractors

The findings from both the questionnaire and interview emphasize that training and education are the most effective strategies for increasing the adoption of e-tendering among SME contractors. The questionnaire results highlight that providing software training for employees is the most impactful strategy, as it equips them with the necessary skills to navigate and maximize the system's capabilities. This aligns with Lin *et al.* (2024), who stress that adequate training is essential for ensuring the successful implementation of e-tendering, ultimately enhancing productivity and streamlining processes.

Similarly, the interview findings reinforce the importance of raising awareness through training. Respondents emphasized that training should not only cover technical aspects but also highlight the benefits of e-tendering, such as increased transparency, reduced errors, and improved workflow efficiency. This perspective supports Lin *et al.* (2024), who argue that training fosters awareness, encourages acceptance of new technology, and empowers employees to adopt innovative practices effectively.

5. Conclusion

In conclusion, while e-tendering offers significant benefits such as improved transparency, reduced errors, and streamlined processes, its adoption among SME contractors remains limited due to challenges like inadequate training, resistance to change, and lack of awareness. Overcoming these barriers through structured training, increased stakeholder engagement, and supportive policies is essential for ensuring a smooth transition and maximizing the benefits of e-tendering. As the construction industry continues to digitalize, embracing e-tendering is crucial for SME contractors to enhance operational efficiency, remain competitive, and contribute to a more transparent and efficient procurement landscape in Malaysia.

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Conflict of Interest

There is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm their contribution to the paper as follows: ***study conception and design****: Siti Hajar Hanisah Binti Rafian, Roziha Che Haron;* ***data collection****: Siti Hajar Hanisah Binti Rafian;* ***analysis and interpretation of results****: Siti Hajar Hanisah Binti Rafian;* ***draft manuscript preparation****: Siti Hajar Hanisah Binti Rafian, Roziha Che Haron. All authors reviewed the results and approved the final version of the manuscript.*

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