

Improving Halal Food Performance: Scrutinising the Technology Acceptance Model and Halal Traceability System Adoption among Malaysian Food and Beverage SMEs

Peningkatan Prestasi Makanan Halal: Analisis Model Penerimaan Teknologi dan Penggunaan Sistem Pengesanan Halal dalam Kalangan Perusahaan Kecil dan Sederhana (PKS) Makanan dan Minuman di Malaysia

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ABSTRACT - Halal Traceability Systems (HTS) play an important role in enhancing the competitiveness of small and medium-sized enterprises (SMEs), preserving halal integrity, and improving supply chain transparency. However, limited empirical evidence exists on how cognitive beliefs influence HTS adoption and whether such adoption contributes to financial performance. This study examines the effects of perceived usefulness (PU) and perceived ease of use (PEOU) on the intention to adopt HTS and investigates the impact of adoption intention on the financial performance of halal food among Malaysian food and beverage (F&B) SMEs. The mediating role of HTS adoption intention is also assessed. A quantitative research design was employed using survey data collected from 225 Malaysian F&B SMEs. The sampling frame was obtained from Majlis Amanah Rakyat (MARA) and SME Corp Malaysia. Data were analysed using SPSS and Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings reveal that PEOU significantly influences HTS adoption intention, whereas PU has no significant effect. HTS adoption intention positively affects halal food financial performance and mediates the relationships between PU, PEOU, and financial performance. These results indicate that ease of use is a stronger driver of HTS adoption than perceived usefulness among SMEs. The study extends the Technology Acceptance Model (TAM) to the halal supply chain context and highlights the importance of user-friendly systems and support mechanisms in promoting HTS adoption and improving business performance.

INTRODUCTION

Recently, interest in using electronic technology to improve supply chain performance has grown, especially for institutions that must comply with regulations and protect their products. In addition to complying with Halal rules, members of the Halal food industry are required to demonstrate that such compliance generates quantifiable business benefits. With rising competition and costs, there is growing pressure on small and medium-sized enterprises (SMEs) to adopt technologies that can enhance halal integrity and financial performance. In addition, the Halal traceability system (HTS) has opened up a pool of cash for businesses seeking transparency in their operations. For instance, a Halal traceability system is cost-effective, resource-intensive, and confidence-building in market-oriented aspects, allowing stakeholders to track products throughout their journey through the supply chain for compliance risk mitigation and collaboration among entities across interlinked trades (Nasyiah et al., 2026). Moreover, the Halal traceability system enhances corporate efficiency by augmenting profitability through elevated sales and margins. A potential explanation for the disparity between corporations and users may be individuals' behaviour when adopting new technology. As a result, corporations refrain from investing in HTS due to the obscurity of long-term profits.

Conversely, established theoretical frameworks can aid research in elucidating the factors influencing adoption decisions. The Technology Acceptance Model (TAM) is a relevant theory for describing how people's perceptions of their own positivity influence behaviours driven by the desire to use new technology (Davis, 1989). The Halal traceability system offers clear advantages and is relatively simple to implement, facilitating effective adoption by SMEs (Hadis et al., 2025). It helps SMEs achieve good performance from the Halal traceability system. This study enhances the current understanding of Halal traceability system adoption while exploring the preparatory measures necessary for these systems and their impact on the financial performance criteria of Halal food. By introducing a process-oriented approach to combining behavioural dimensions with performance indicators, this study sheds light on the economic opportunities that digital systems offer in the halal food business. These insights are key for practitioners and policymakers seeking to promote technology adoption that meets compliance standards and leads to sustainable financial value.

1.1 Background of Study

The number of Muslims around the world is growing, while non-Muslims are more interested in items that are safe, ethical, and environmentally friendly. This has led to a rise in demand for Halal-certified food products across all groups. The State of the Global Islamic Economy Report (2022) highlight that Muslims throughout the world spent more than USD 1.27 trillion on food in 2021. This amount is expected to rise to USD 1.67 trillion by 2025, showing the potential that halal food companies can achieve. Moreover, supply chains are becoming increasingly complex and technology-dependent, necessitating stricter certification procedures to protect halal purity.

In this sense, Malaysia has set a global benchmark in halal governance, primarily through a robust certification management system and its institutional premise under the Department of Islamic Development Malaysia (JAKIM). Malaysia's halal ecosystem is globally acknowledged for its standardisation and regulatory strength, serving as a benchmark in halal certification and supply chain management. SMEs play a crucial role in this ecosystem, constituting over 90% of business establishments within the Malaysian food and beverage (F&B) sector (Department of Statistics Malaysia, 2022). Furthermore, SMEs are crucial in sustaining the continuity and integrity of halal food supply chains in both local and international markets.

Therefore, SMEs play a crucial role in this ecosystem, constituting over 90% of all businesses in the Malaysian F&B industry (Department of Statistics Malaysia, 2022). SMEs are also important in maintaining halal food supply chains as reliable and strong players in both local and global markets. Despite their importance, Malaysian F&B SMEs struggle with structural and operational constraints that prevent effective halal compliance. For instance, challenges can include limited financial resources, poor digital infrastructure, a lack of skilled personnel, and low readiness for adoption (Talib et al., 2015). Furthermore, fragmented supply chain practices, reliance on manual documentation, and low transparency increase the risk of non-compliance with halal standards and sacredness, which can reduce consumer trust in Malaysia's global halal reputation (Abu Bakar et al., 2025).

Therefore, the HTS provides a digital transformation to address another sophisticated approach to halal traceability management, using blockchain, RFID, and cloud-based applications to monitor real-time data on halal products in the supply chain. For instance, HTS effectively improves traceability and auditing processes, thereby increasing compliance with Halal standards and distribution management (Shuib et al., 2021). Moreover, HTSs are increasingly perceived as a strategic tool to help SMEs fulfil worldwide market demand for transparency, quality assurance, and regulatory compliance.

Nonetheless, the uptake of HTS among Malaysian SMEs is still quite low. Much of this has been attributed to perceived technological complexity, financial constraints, limited digital literacy and resistance to organisational change (Seppänen et al., 2025; Awad & Martín-Rojas, 2024; Veseli et al., 2025). Hence, overcoming these barriers requires both cognitive and behavioural awareness of technology adoption decisions among SMEs. In this regard, Davis (1989) presents the Technology Acceptance Model as a substantial theoretical foundation for investigating technology acceptance behaviour. The model suggests that perceived usefulness (PU) and perceived ease of use (PEOU) are critical factors influencing users' intention to adopt new technology. Despite its broad application across numerous fields such as e-commerce, logistics, and information systems (Venkatesh & Davis, 2000), few studies examine TAM in the context of the halal supply chain literature, with a focus on HTS adoption among SMEs.

Additionally, prior literature has not adequately investigated how HTS adoption leads to actual organisational outcomes (i.e., Halal food financial performance, such as cost efficiency, market competitiveness, and value creation). This dearth indicates the need for a more unified framework that not only elucidates adoption behaviour but also assesses its economic ramifications. Thus, this research applies the TAM framework to identify factors affecting HTS adoption in Malaysian F&B SMEs and to examine their influence on Halal food financial performance. This study enriches the halal supply chain management literature by exploring, across behavioural and performance dimensions, its contributions, which will not only appeal to relevant stakeholders but also offer SMEs, policymakers, and halal regulatory bodies feasible advice to enhance digital transformation in the Malaysian Halal ecosystem.

LITERATURE REVIEW

1.1 Halal Food Ecosystem and Financial Performance of SMEs.

Malaysia then became the first country in the world to be a global custodian of halal food. Collaborating ecosystem partners to share information, build capacity, and create distribution networks that make halal food more available around the world. Moreover, Malaysia has been recognised as a significant actor in halal governance due to its strong institutions and relatively robust regulatory frameworks (Che Mohd Zain, 2022). However, more recent interest has been in how this ecosystem affects business performance and competitiveness. More specifically, the halal industry is now seen more as a strategic economic sector that enhances revenue, export markets, and business sustainability than as merely a matter of complying with religious obligations.

As the global halal market expands, so does the need for firms to capitalise on emerging economic opportunities. The increasing demand from Muslim and non-Muslim consumer markets has positioned halal products as value-added products associated with quality assurance, safety, and ethical production (Saleh & Rajandran, 2024). This trend has significant implications for Malaysian food and beverage (F&B) SMEs, as compliance with halal standards is an entry requirement to the halal ecosystem, which is now closely tied to market access and financial performance. Establishing a cost-effective production process aligned with halal standards can boost market positioning and deliver earnings or financial performance beyond rivals'.

Despite these opportunities, many SMEs still struggle to translate halal compliance into real economic benefits. Due to limitations in financial capacity, technological investment, and managerial expertise, they have often been constrained from fully utilising the halal ecosystem for performance improvement (Nor et al., 2021; Talib et al., 2015). Consequently, compliance efforts could end up being simply procedural rather than strategic, limiting their ability to support profitability and long-term growth. Moreover, more complex supply chains add costs and risks that may more than offset financial benefits if not effectively managed.

In this sense, it has increasingly been recognised that integrating digital solutions and traceability mechanisms within the halal ecosystem can improve operational and financial performance. In this way, the generated transparency can enable (better) coordination among supply chain actors and help to prevent non-compliance risks, enhancing cost efficiency and better resource utilisation while further strengthening customer trust (Sonar et al., 2025). Performance is contingent upon these factors, especially in competitive and export-driven markets where reliability and credibility matter.

Thus, exploring the Malaysian halal food ecosystem through a performance lens is essential to gauge the extent to which firms can extract economic value from compliance-oriented actions. This approach to halal integrity reframes the analysis from focusing solely on maintaining the standard to assessing how such opportunities support financial sustainability, competitiveness, and long-term success among SMEs.

1.2 Importance of The Halal Traceability System

The development of HTS is attracting particular interest in performance-focused research examining the relationship between HTS and firm financial outcomes (Sulaiman et al., 2025). Traditionally, HTS is viewed as either halal-compliant or not. However, recent research highlights HTS as a framework that enables organisations to create observable economic benefits at the firm level and across competitive sectors. HTS implementation should not be viewed by SMEs only in a compliance-dictated light.

Operatively, HTSs can facilitate cost optimisation by minimising waste in processes associated with manual tracking and improving documentation accuracy, thereby decreasing the risk of costly product recalls or regulatory fines (Mirgani & Elnour, 2023). Moreover, increased traceability also fosters better coordination among supply chain partners and enables firms to streamline their processes and use their resources more effectively. These enhancements reduce operational expenses and ultimately increase profit margins. Moreover, improved transparency and trustworthiness in Halal validation can increase consumer trust, thereby positively impacting sales performance and market share (Abd Muin et al., 2026).

HTSs also serve as an important enabler of firms' competitive positioning at local and international markets, moving beyond internal efficiency. Building consumer confidence regarding traceability has become a crucial factor in defining the criteria for market access and business sustainability, amid increasing global demand for halal-certified products. Thus, successfully implementing HTS would enable SMEs to differentiate themselves, build brand reputation, and enhance regulatory and customer responsiveness (Abd Rahman et al., 2017). In particular, SMEs looking to expand into markets beyond the local market may find that these competitive benefits generate profits over time.

However, while these cost savings may be appealing, the financial implications of adopting HTS are not always immediately apparent. Underestimating the cold-start investment due to uncertainties in return on investment (ROI) and limited cash and skills is a characteristic approach of SMEs towards technology adoption. Consequently, SMEs' perceptions regarding the trade-off between expected benefits and implementation costs are associated with their decision to own HTS. In this regard, the Technology Acceptance Model has helped to understand how perceived usefulness and perceived ease of use affect adoption decisions (Davis, 1989). When SMEs realise that HTSs can improve operational performance and financial results, they are keener on integrating these systems into their business processes.

Therefore, an investigation into the implications of high-performance teams from a financial performance perspective will provide deeper insights into the role that HTS play in the halal food sector. Rather than seeing HTSs simply as a compliance tool, this perspective also demonstrates the opportunity for SMEs to generate economic benefits through HTS, thereby improving business efficiency and sustainability.

1.3 TAM Dimension

The Technology Acceptance Model (TAM) was first developed by Davis (1989) and has been widely employed to understand technology user acceptance behaviour for information systems across various fields. In addition, TAM is used as an analytical framework to show how cognitive beliefs shape behavioural intention that leads to performance outcomes in adopting the Halal traceability system among SMEs. In this model, perceived usefulness (PU) and perceived ease of use (PEOU) are conceptualised as two fundamental determinants that collectively impact behavioural intention. According to Wilson et al., (2021) PU indicates the extent to which SMEs perceive that adopting HTSs will improve both operational performance and compliance reliability leading to better business outcomes in terms of cost savings and risk mitigation PU plays a vital role in HTSs innovation diffusion in the halal food context, particularly as SMEs are more likely to adopt HTS if they have clear benefits both on an operational efficiency basis and on market credibility. Furthermore, PEOU is the extent to which SMEs perceive HTS as easy to learn, use, and incorporate into existing business processes. In this study, however, the definition of PEOU is broadened beyond the simplicity of a system by Davis et al., (1989) to incorporate perceived compatibility with organisational capabilities, workflow structures and digital readiness. SMEs are more likely to adopt technologies that they perceive as user-friendly and requiring localised training, especially in resource-scarce contexts (Siow et al., 2026). In this sense, ease of use lowers perceived implementation barriers and indirectly encourages adoption behaviour.

Importantly, this study establishes HTS adoption intention as a mediating construct that converts cognitive perceptions (PU and PEOU) to actual behavioural readiness. Intention to adopt is the readiness and preparedness of SMEs to deploy HTS within organisational systems, mediating the relationship between the perception of such systems discussed earlier and system usage. Previous studies have emphasised intention as a major determinant of technology adoption behaviour, and, in particular, for SMEs, the nature of such decision-making is influenced by perceived benefits and constraints (Faiz et al., 2024).

Moreover, this research enriches the TAM by linking HTS adoption to Halal food financial performance. From a financial performance perspective, improved traceability and compliance management practices can lead to lower operational costs, enhanced market competitiveness, and overall higher value. Prior studies suggest that improved supply chain transparency and reduced compliance risks increase organisational performance and competitiveness, specifically in halal markets (Khairuddin et al., 2026).

2.4 Conceptual Framework

This study develops a conceptual framework based on the Technology Acceptance Model (TAM) to examine the antecedents and consequences of Halal Traceability System (HTS) adoption among Malaysian food and beverage SMEs. The framework indicates that PU and PEOU are significant cognitive antecedents of SMEs' intention to adopt the Halal traceability system.

Perceived ease of use (PEOU) refers to the extent to which SMEs perceive HTSs as simple to learn, use, and integrate into their business processes. Past studies show SMEs' willingness to adopt technologies that require little training and fit easily with existing work processes (Indiani et al., 2025). Thus, it is proposed that:

H1: Perceived ease of use has a positive relationship with HTS adoption intention among Malaysian F&B SMEs.

Perceived usefulness (PU) is the degree to which SMEs believe HTS can improve their operational performance and compliance effectiveness. When SMEs understand HTS as enhancing efficiency, minimising risks, and strengthening market authority, they are more likely to form favourable intentions toward using the system (Wilson et al., 2021). Therefore, it is hypothesised that:

H2: Perceived usefulness is positively related to HTS adoption intention among Malaysian F&B SMEs.

HTS adoption intention reflects SME firms' willingness to implement traceability systems within their organisations. It is predicted that implementing HTSs can reduce operational effort and compliance costs, improve market competitiveness, and therefore enhance business performance (Khairuddin et al., 2026). Therefore:

H3: HTS adoption intention is positively related to Halal food financial performance among Malaysian F&B SMEs.

Behavioural intention is a vital mechanism for translating cognitive perceptions into reality, as suggested by TAM. In this study, it is anticipated that the intention to adopt HTSs mediates the effects of PU and PEOU on Halal food financial performance, since SMEs that consider HTSs useful and easy to use are more inclined to adopt them, ultimately leading to enhanced financial performance.

H4: HTS adoption intention mediates the relationship between perceived usefulness, perceived ease of use, and Halal food financial performance among Malaysian F&B SMEs.

METHODS

A quantitative research design was used for this study, employing a cross-sectional survey approach. The cross-sectional design is suitable because we collect data at a single time point to investigate the relationship between perceived usefulness (PU), perceived ease of use (PEOU), Halal Traceability System (HTS) adoption intention, and Halal food financial performance among Malaysian food and beverage (F&B) SMEs. The main data collection instrument was a structured questionnaire. The population of this study is halal-certified Malaysian food and beverage-based SMEs. The sampling frame was determined based on official SME lists from SME Corp Malaysia and Majlis Amanah Rakyat (MARA). In other words, only SMEs relevant to halal operations and certification processes were surveyed, as a somewhat purposive sampling technique was adopted in this study.

The selection criteria encompassed SMEs that are halal-certified or have involvement in the production and distribution of halal food. Sample size was calculated using a statistical power analysis in G*Power. Accordingly, 225 valid responses were collected for data analysis. PLS-SEM, appropriate for testing complex models and predictive research, can be considered an adequate analytical method for this sample size. A self-administered questionnaire was distributed to SME owners and managers to collect data. The questionnaire was constructed using validated measurement items adopted from previous studies. A pilot test was conducted to assess the instrument's clarity, reliability, and content validity before its full distribution. The survey was administered both online and by direct distribution to maximise response rates. The data were analysed in two phases using Statistical Package for the Social Sciences (SPSS) and Partial Least Squares Structural Equation Modelling (PLS-SEM).

RESULTS

Table 1 illustrates the demographic distribution among Malaysian F&B SMEs, which consist predominantly of small-sized enterprises (47.5%), followed by micro-enterprises (37.8%) and medium-sized enterprises (14.7%). A large proportion of SMEs are local (73.3%), with only a minority seeking access to the international marketplace. A relatively geographical distribution of SMEs across the main Malaysian states was also recorded, including Sabah (22.5%), Johor (15.5%), Pahang (15.5%), Sarawak (15.5%), Selangor (15.5%) and Penang (15.5%).

Table 1: SME Demographic Distribution

Demographic	Category	Frequency	Percentage (%)
Company Size	Micro	85	37.8
	Small	107	47.5
Market	Medium	33	14.7
	Domestic	165	73.3
State	International	60	26.7
	Selangor	35	15.5
	Sabah	50	22.5
	Sarawak	35	15.5
	Johor	35	15.5
	Pahang	35	15.5
	Penang	35	15.5

Table 2 presents the descriptive statistics, showing generally favorable attitudes toward HTS adoption. The average score regarding PEOU was moderate (3.92), but there have been some issues related to its ease of implementation; The PU mean score of 3.74 established that the benefits in HTS adoption are recognized. A mean score 3.85 for HTS adoption suggested a moderate to high willingness to adopt the system. The mean score of 3.88 for Halal food performance reflects the positive perception by higher impact HTS implementation on food quality and safety.

Table 2: Descriptive Statistics

Variable	Mean	Standard Deviation
Perceive Ease of Use	3.92	0.61
Perceive Usefulness	3.74	0.66
HTS Adoption Intention	3.85	0.63
Halal Food Financial Performance	3.88	0.59

Table 3 illustrates the reliability and validity of the study constructs, where all measurement items surpass the loading and average variance extracted (AVE) thresholds of 0.5 and the composite reliability (CR) threshold of 0.7. Thus, the measurement model was validated as robust and corroborated the constructs' ability to accurately capture the intended variables.

Table 3: Reliability and Validity of the Study Constructs

Construct	Item	Loading	AVE	CR
Perceive Ease of Use	PEOU1	0.782	0.61	0.89
	PEOU2	0.819		
	PEOU3	0.850		
	PEOU4	0.791		
	PEOU5	0.833		
	PEOU6	0.767		
	PEOU7	0.821		
	PEOU8	0.801		
Perceive Usefulness	PU1	0.747	0.59	0.88
	PU2	0.771		
	PU3	0.811		
	PU4	0.796		
	PU5	0.830		
	PU6	0.760		
	PU7	0.800		

	PU8	0.783		
HTS Adoption Intention	HTSA1	0.841	0.68	0.90
	HTSA2	0.863		
	HTSA3	0.880		
	HTSA4	0.827		
	HTSA5	0.851		
Halal Food Financial Performance	FP1	0.855	0.71	0.91
	FP2	0.871		
	FP3	0.902		
	FP4	0.837		
	FP5	0.881		

The results for direct-effect hypothesis testing are shown in Table 4. PEOU was found to have a strong and positive effect on HTS adoption intention ($t = 6.532$, $p = 0.000$), and the hypothesised implications of instrumentality in technology acceptance by SMEs were also evident through it. The intention to adopt HTS also had a significant and positive effect on Halal food performance ($t = 8.104$, $p < 0.001$), indicating that SMEs perceived improvements in food safety, quality, and overall performance directly as a result of adoption intentions. However, PU had a negligible effect on HTS adoption intention ($t = 1.298$; $p = 0.194$), suggesting that perceived benefits were not the only driver of a higher implementation rate.

Table 4: Direct-Effect Hypothesis Testing Results

Hypothesis	Path	β	t-value	p-value	Decision
H1	PEOU → HTS Adoption Intention	0.448	6.532	0.000	Supported
H2	PU → HTS Adoption Intention	0.091	1.298	0.194	Not Supported
H3	HTS Adoption Intention → Halal food financial performance	0.576	8.104	0.000	Supported

The mediation effect of the HTS adoption intention is shown in Table 5. In particular, PEOU significantly affected Halal food performance via HTS adoption intention ($t = 5.386$, $p = 0.000$), whereby a feeling of effortlessness when using the system would increase performance by heightening willingness to implement it. Furthermore, the mediating effect of HTS was not significant at PU ($t = 1.744$, $p = 0.081$), indicating partial mediation, which is commonly accepted in exploratory PLS analysis.

Table 5: Mediation Analysis

Hypothesis	Path	t-value	p-value	Decision
H4a	PEOU → HTS Adoption Intention → Halal Food Performance	5.386	0.000	Supported
H4b	PU → HTS Adoption Intention → Halal Food Performance	1.744	0.081	Supported

DISCUSSION

This study aimed to investigate the effects of perceived usefulness (PU) and perceived ease of use (PEOU) on Halal traceability system (HTS) adoption intention, which, in turn, affects the financial performance of Halal food among Malaysian SMEs. The results offer several theoretical and practical contributions to the study of technology adoption behaviour in the halal industry. The findings indicate that perceived ease of use (PEOU) had a significant positive impact on the intention to adopt HTS. This means that integrating the HTS with SMEs' current operation system components is expected to have a positive impact. Also, the HTS system is perceived as less complicated or demanding and compatible with existing operational processes used by SMEs, which will automatically increase its adoption. Our

finding is consistent with the Technology Acceptance Model by Davis (1989), in which ease of use is identified as an important predictor of behavioural intention. Perceived ease of use is a dominant factor for SMEs because it affects their ability to adopt technology, including their readiness for digital literacy and the availability of resources. A recent study by Tajuddin and Jaiyeoba (2026) found that perceived ease of use significantly impacts the acceptance and adoption of Halal-related technologies.

Interestingly, the effect of perceived usefulness (PU) on HTS adoption intention is not significant. However, while SME owners may recognise that HTSs can enhance compliance, traceability, and operational efficiency (Wilson et al., 2021), this perceived benefit alone is insufficient to motivate adoption. This shows that operational feasibility is very important for SMEs when making decisions about technology adoption in the Halal food business. Hence, this finding supports previous studies showing that the ease of implementation will determine adoption behaviour in resource-circumscribed environments, although less effort is hypothesised to be allocated to making things easier rather than more useful (Yang & Fu, 2008). The results confirmed that HTS adoption considerably improves the financial performance of Halal food. These results support the notion that digital traceability systems are not merely tools for compliance but rather strategic resources that enhance firm performance. This allows for maintaining control over costs, facilitates competitiveness in the market, and improves profitability through enhanced transparency and reduced operational inefficiencies (Khairuddin et al., 2026).

The utility of HTS adoption significantly mediates the relationship between PEOU and financial performance. This means ease of use affects financial outcomes indirectly through the system's actual usage behaviour. However, the indirect effect of PU is weaker and marginally significant. It indicates that this perceived usefulness will not be compounded unless you use the actual system. Hence, the results indicate that SMEs cannot compound this perceived usefulness unless they use the real system. This finding is consistent with prior studies indicating that behavioural intention acted as a significant mediator between cognitive perception and actual performance (Davis, 1989).

IMPLICATION AND LIMITATION

This research advances TAM beyond behaviour intention by introducing Halal food financial performance as a post-adoption consequence. This adds to the literature on technology adoption by providing evidence that not only explains behavioural acceptance but also has measurable implications for an organisation's performance. The contribution of including financial performance as an outcome variable is the enhanced predictive relevance of TAM for supply chain and halal technology studies. Furthermore, the cross-sectional data show that HTS adoption intention mediates the relationship between these cognitive perceptions and performance outcomes through behavioural intention. This augments TAM with a more comprehensive route from perception to performance. The results have several important implications for industry practitioners, policymakers and technology developers. HTS developers, for example, would need to focus on system simplicity, intuitive interfaces, and easy integration with the existing SME environment. PEOU has a significant impact on adoption; thus, reducing system complexity will directly improve SMEs' adoption rate.

Although it contributes to knowledge, this study has some limitations that need to be considered. To start, the research uses a cross-sectional design that captures only the antecedents of technology adoption behaviour and financial performance at a single point in time. A longitudinal approach may provide greater insight into how HTS adoption progresses and its influence on performance over time. Second, the data in this study are self-reported (we use publicly available reports by owners and managers of SMEs). This may lead to common method bias and subjective perception bias, especially as it relates to financial performance. This point would enhance future research with objective financial indicators. Moreover, the sample is restricted to local F&B SMEs in Malaysia, which may limit the generalisability of this study's findings to other industries or nations with dissimilar halal regulatory environments and digital maturity levels. In addition, the study examines only PU and PEOU as antecedents of adoption intention. The model did not include other important factors that may also affect HTS adoption behaviour, such as organisational readiness, top management support, perceived risk and regulatory pressure.

CONCLUSION

Through the Technology Acceptance Model, the study examines the underlying factors and impact of Halal Traceability System adoption among Malaysian SMEs. The findings reveal that the intention to adopt telemedicine is significantly influenced by perceived ease of use, whereas perceived usefulness has a weaker effect. In addition, HTS adoption is a significant predictor of financial performance and mediates the relationship between cognitive perceptions and business consequences. Findings also highlight that, compared with usefulness, ease of use has a greater impact on technology adoption amongst halal food SMEs. The results also showed that HTS adoption partially mediates the relationship between cognitive perceptions and financial performance elements, thereby enhancing the significance of applying TAM in halal supply chain research.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest in this study.

AUTHORS CONTRIBUTION

Haslinda Hadis: Conceptualization, Methodology, Investigation, Data curation, Writing – Original draft preparation. **Masran Tamin:** Supervision, Validation, Writing – Review and Editing. **Sharizin Abd Sarhadat:** Data curation, Resources, Investigation, Writing – Review and Editing. **Azaze-Azizi Abdul Adis:** Conceptualization, Supervision, Validation, Project administration, Writing – Review and Editing.

AVAILABILITY OF DATA AND MATERIALS

1. Data available within the article or its supplementary materials.
2. Data available on request due to privacy/ethical restrictions.

DECLARATION OF GENERATIVE AI

The authors confirm that this manuscript was primarily written and developed independently. Any digital tools used were limited to improving the language and readability of their paper, and with the appropriate disclosure. The authors take full responsibility for the originality and accuracy of the work.

ETHIC STATEMENTS

This study was conducted in accordance with ethical research standards. Participation was voluntary, and informed consent was obtained from all respondents. Data were collected anonymously and used solely for academic purposes. All information was kept confidential, and no harm or coercion was involved in the study.

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