PREPRINT

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Social Influence, Hand Hygiene Awareness, and E-wallet Continuance Intention

Chin Fei Goh[1], Owee Kowang Tan[1]*, Kim Yew Lim[2], Yee Lin Ting[1], Xiangge Zhao[3], and Sang Long Choi[4]

[1]*Faculty of Management, Universiti Teknologi Malaysia, 81310 Johor, Malaysia*
[2]*INTI International University, 71800 Nilai, Negeri Sembilan, Malaysia*
[3]*Hebei Finance University, Baoding, Hebei, China*
[4]*Faculty of Business, Raffles University, 79250 Iskandar Puteri, Johor, Malaysia*

ABSTRACT

Understanding the adoption of cashless payments through e-wallets requires exploring various perspectives, especially from a health risk standpoint. Previous studies have not sufficiently addressed the role of hand hygiene awareness and its complex relationship with subjective norms (or social influence) and continuance intention. Therefore, the purpose of this study is to examine the continuance intention in e-wallet usage, with a focus on the health perspective, specifically hand hygiene awareness. In this study, we collected data from 320 Touch 'n Go e-wallet users in Malaysia through an online survey and convenience sampling. We used Partial Least Squares (PLS) path modelling to test the research model. Our findings show that subjective norms positively influence both hand hygiene awareness and perceived usefulness. Moreover, hand hygiene awareness significantly affects both perceived usefulness and continuance intention to use e-wallets. Theoretically, these results extend existing technology acceptance literature by integrating a health-oriented perspective, particularly in relation to hand hygiene awareness. From a practical perspective, this study provides valuable insights for practitioners on how to promote hygiene behaviour within platform design to retain e-wallet users.

ARTICLE INFO

Article history:
Received: 26 November 2024
Accepted: 05 January 2025
Published: 28 January 2026

DOI: https://doi.org/10.47836/pjssh.34.1.02

E-mail addresses:
gcfei@utm.my (Chin Fei Goh)
oktan@utm.my (Owee Kowang Tan)
kimyew.lim@newinti.edu.my (Kim Yew Lim)
tingyeelin@graduate.utm.my (Yee Lin Ting)
jessicazxg@gmail.com (Xiangge Zhao)
choisanglong@raffles-university.edu.my (Sang Long Choi)
*Corresponding author

Keywords: e-wallet, hand hygiene, health risk, social influence, subjective norms, technology acceptance

INTRODUCTION

Advancements in mobile payment technology have revolutionised electronic cashless payments, particularly through e-wallets. E-wallets on smartphones enable

e-ISSN: 2231-8534

users to make electronic payments, transfers, and refunds. The use of e-wallets has become increasingly prevalent due to their convenience and ability to facilitate quick, seamless transactions (Fatonah et al., 2018; Nizam et al., 2018). The rapid adoption of e-wallets has also led to higher conversion rates for businesses, as reduced customer waiting times enhance the overall user experience.

In terms of e-wallet adoption, there is a significant disparity across countries due to differences in consumer attitudes, payment infrastructure, and regulatory environments. E-wallets and digital payments serve as tools to increase citizens' access to financial services and boost economic activity, particularly in developing economies (Kasri et al., 2022). China currently exhibits a high adoption rate of e-wallets and is transitioning into a cashless society (Ye & Zhao, 2024). In Malaysia, e-wallets are generally popular among the younger population, but the overall adoption rate of digital payments remains relatively low (Alam et al., 2021; Balakrishnan & Shuib, 2021; Munikrishnan et al., 2024). The Malaysian government has continued to encourage the public to adopt e-wallets as part of its vision to achieve a cashless society (Balakrishnan & Eesan, 2024).

The value and risk barriers influence the use of mobile payment services (Karim et al., 2020). Prior research has extensively applied the Technology Acceptance Model (TAM) to identify the factors driving e-wallet adoption (e.g., Folkinshteyn & Lennon, 2016; Slade et al., 2015; Trivedi, 2016). E-wallets not only enable users to make payments but also allow them to track transactions. On one hand, e-wallet adoption can be attributed to an instrumental or practical perspective, where users find e-wallets or mobile payments easy to use while ensuring security (Amin, 2007; Lew et al., 2020; Pertiwi et al., 2020; Tian et al., 2023). On the other hand, social influence also plays a role, as some consumers feel social pressure to adopt e-wallets due to societal expectations (Rosli et al., 2023; Tian et al., 2023). Additionally, prior studies suggest that individual differences significantly affect the acceptance of e-wallets (Lew et al., 2020; Rosli et al., 2023; Shaikh & Amin, 2025).

In 2018, mobile payments began gaining traction in Malaysia, though e-wallet adoption was still in its infancy (Aji et al., 2020). The COVID-19 pandemic accelerated the adoption of e-wallets, particularly in Malaysia. During the pandemic, many consumers shifted their purchasing habits to online marketplaces and mobile payment (Dinesh & MuniRaju, 2021; Munikrishnan et al., 2024). The World Health Organisation (WHO) also encouraged the public to use cashless payments as a means to promote hand hygiene and help prevent the spread of COVID-19. In line with this, the Malaysian public was reported to have a high level of hand hygiene awareness during the pandemic (Azlan et al., 2020).

To reiterate, the Technology Acceptance Model (TAM) is widely used to examine the factors influencing e-wallet acceptance and continuance intention. However, the existing

literature has largely overlooked the role of health risks, particularly hand hygiene awareness, in conjunction with subjective norms in e-wallet adoption. Specifically, our review indicates that no prior studies have explored the intricate relationships between hand hygiene awareness, subjective norms, and TAM-related variables. To address this knowledge gap, the aim of this research is to examine continuance intention by integrating hand hygiene awareness into TAM, offering a novel perspective in the context of consumer behaviour and consumerism.

LITERATURE REVIEW

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a broadly used theory for predicting the adoption of new technology within a group or organisation (Venkatesh & Davis, 1996, 2000). TAM includes several internal variables, such as behavioural intention to use (BI), perceived usefulness (PU), and perceived ease of use (PEOU) (Figure 1). PU and PEOU are conceptualised as factors influencing the intention to use technology. PU reflects a user's subjective perception of whether a technology can enhance job performance, while PEOU reflects a user's perception of whether a technology is easy to use. Additionally, PEOU influences PU—when users perceive a technology as easier to use, they tend to perceive it as useful. External variables are expected to influence both PU and PEOU and subsequently affect the intention to use the technology.

Building on TAM, Venkatesh and Davis (2000) introduced TAM2, which incorporates two key processes: (i) cognitive instrumental and (ii) subjective norms. The aim of TAM2 is to identify external factors that predict perceived usefulness (PU), perceived ease of use (PEOU), and intention to use, with a particular focus on cognitive instrumental and social influence processes. The model is valuable for examining the effect of these determinants on technology acceptance, as users' experiences increase over time with continued use of the technology. Prior research has confirmed

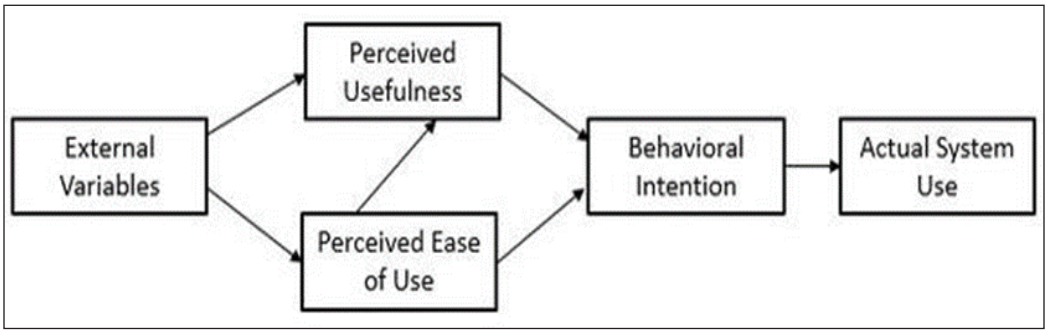

Figure 1. Technology acceptance model
Source: Venkatesh and Davis (1996)

that cognitive instrumental and subjective norms are indispensable external factors influencing technology acceptance within TAM2 (Wu et al., 2011).

Subsequently, Venkatesh et al. (2003) evaluated several variations of the TAM model and unified them into the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT bears strong resemblance to TAM, with the key differences being that it incorporates subjective norms (SN) into social influence, perceived ease of use (PEOU) into effort expectancy, and perceived usefulness (PU) into a performance expectancy construct. UTAUT identifies several key mechanisms: social influence, effort expectancy, performance expectancy, and facilitating conditions. These four mechanisms are moderated by factors such as age, gender, experience, and voluntariness, all of which influence technology adoption and intention to use.

Emerging of Mobile Payment and E-wallet Use

Mobile payments refer to the use of a mobile device to conduct a payment transaction, where money or funds are transferred from the payer to the recipient either through an intermediary or directly, without an intermediary (Mallat, 2007). Mobile payment systems have evolved significantly over the past decade due to technological advancements and innovations.

At present, smartphones enable various mobile payment options through technological capabilities, including e-wallet applications. Karim et al. (2020) define an e-wallet as a digital application that keeps a person's credit (or debit) card information to make electronic transactions. A e-wallet can also be understood as a digital version of a leather wallet in which it can store money, cards, coupons, and receipts digitally.

The use of e-wallets can lead to cost reductions while providing convenience for transactions (Nizam et al., 2018). E-wallets offer benefits such as quicker payouts, better tracking, transparent transactions, lowered time consumption, cost savings, and boosted trust, which are advantageous for both vendors and consumers. Several studies have demonstrated that e-wallets provide both convenience and benefits to users (Al-Saedi et al., 2020; Mallat, 2007; Nizam et al., 2018; Teng & Khong, 2021). This reason is that the cashless payment system, where users do not need to pay for purchases with physical cards or cash. In Malaysia, Touch 'n Go, Boost, BigPay, GrabPay, WeChat Pay, and AEON Wallet are the most popular and commonly used e-wallets (Karim et al., 2020).

It is worth noting that COVID-19 had a significant impact on both social and businesses in human societies (Aji et al., 2020). During the pandemic, many countries, including Malaysia, implemented lockdowns as a preventative measure. The World Health Organisation (WHO) encouraged contactless payments in business activities. There was a notable increase in mobile commerce and e-commerce shopping globally during the pandemic (Pantelimon et al., 2020). Additionally, consumers

began seeking more convenient and secure shopping experiences. As a result, e-wallet usage saw significant growth, particularly in Malaysia.

HYPOTHESES DEVELOPMENT

Subjective Norms (SN)

Subjective norms (social influence) refer to the tendency of individuals to perform behaviours that are endorsed by significant peers within their social environment (Ajzen, 2020; Amin, 2022). Subjective Norms are also understood as societal pressure on a person to adopt a certain behaviour.

Subjective norms have been shown to enhance perceived usefulness through the processes of internalisation and identification (Venkatesh & Davis, 2000). Even if individuals do not personally favour a behaviour, they may choose to engage in it due to social pressure. Therefore, we expect that e-wallet users experience social pressure from important individuals within their social circle, influencing their perception of the usefulness of e-wallet usage. Thus:

> H1: Subjective norms exhibit a positive effect on perceived usefulness.

Subjective norms are a powerful element in the social influence process, meaning that the behaviour of e-wallet users can be significantly affected by their colleagues and peers. Studies in healthcare settings have suggested that subjective norms can increase the intention to practice hand hygiene among healthcare professionals (Heydarizadeh et al., 2021; Pessoa-Silva et al., 2005). In Malaysia, the public perceived hygiene as an important protective measure against COVID-19 during the pandemic (Azlan et al., 2020). During this period, we expect that improper hand hygiene practices among e-wallet users would likely be disapproved of by their significant peers. Thus:

> H2: Subjective norms exhibit a positive effect on hand hygiene awareness.

Hand Hygiene Awareness (HHA)

Hand hygiene is a crucial preventive measure against infectious diseases, including COVID-19 (Thomas et al., 2021). However, adherence to hand hygiene practices remains a challenge for the public. A recent study found that only about 40% of healthcare professionals followed proper hand hygiene protocols (Heydarizadeh et al., 2021). This phenomenon can be attributed to factors such as inadequate education, insufficient training, and heavy workloads.

The Malaysian public has been reported to maintain a high level of hand hygiene during the pandemic (Azlan et al., 2020). Increased fear and panic may lead individuals to overinflate their risk perceptions regarding COVID-19 transmission (Pratiwi et al., 2022; Salih et al., 2023). As a result, it is expected that individuals will be more self-regulated in practicing disease preventive behaviours, including wearing masks, practicing social

distancing, and maintaining hand hygiene (Lee et al., 2020).

Contactless payment methods, such as e-wallets, offer consumers a way to enhance hand hygiene and reduce the spread of COVID-19. It is likely that e-wallet users exhibited a heightened level of hand hygiene awareness during this period, as they perceived the use of e-wallets to provide instrumental benefits in preventing the transmission of viruses. Therefore, the following hypotheses are proposed:

H3: Hand hygiene awareness exhibits a positive effect on perceived usefulness.

H4: Hand hygiene awareness exhibits a positive effect on continuance intention.

Based on the hypotheses outlined above, a research framework is proposed (Figure 2).

METHODS

Sample and Data Collection

In this study, data were collected through an online questionnaire conducted in 2022, prior to the declaration of the end of the public health emergency during the COVID-19 pandemic. The aim of this research was to assess the continuance intention of using e-wallets in Malaysia. In 2022, there were approximately 17.8 million e-wallet users in Malaysia (IDC, 2023). We used a-priori sample size calculator (for structural equation models) to calculate the minimum sample size based on the number of latent variables and indicators (Soper, 2025). The resulting minimum sample size for the model was 173. Due to social distancing measures and movement restrictions during the COVID-19 pandemic, convenience sampling was employed. Questionnaires were distributed via Facebook, Telegram, and WhatsApp. The researchers also encouraged family, friends, and peers who had used the Touch 'n Go (TnG) e-wallet

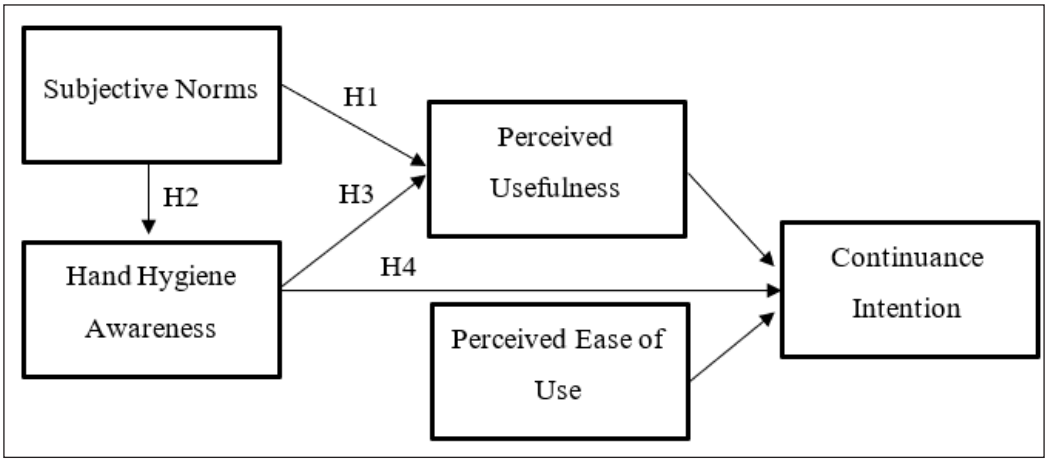

Figure 2. Research model

to participate in the survey anonymously. Ultimately, 320 usable responses were obtained from consumers who had used the TnG e-wallet in Malaysia, exceeding the minimum required sample size.

Research Instruments

The questionnaire was divided into two sections. The first section collected demographic data from respondents, while the second section assessed their perceptions regarding perceived usefulness, perceived ease of use, subjective norms, hand hygiene awareness, and continuance intention to use the TnG e-wallet.

Perceived usefulness measures the extent to which a consumer believes that using the TnG e-wallet can enhance the efficiency and effectiveness of completing transactions. Perceived usefulness (3 items) was adapted from Ramos-de-Luna et al. (2016).

Perceived ease of use measures the degree to which a consumer believes that using the TnG e-wallet would be free of effort. Perceived ease of use (4 items) was adapted from Ramos-de-Luna et al. (2016).

Subjective norms measure the perceived social pressure to use the TnG e-wallet. Subjective norms (3 items) were adapted from Ramos-de-Luna et al. (2016).

Continuance intention measures a consumer's intention to continue using the TnG e-wallet. Continuance intention (3 items) was adapted from Zhao et al. (2016).

Hand hygiene awareness measures the recognition of the importance of proper hand hygiene practices to prevent the spread of infectious diseases. Hand hygiene awareness (3 items) was adapted from van de Mortel (2009).

All measurement items for multi-item variables were assessed using a five-point Likert scale: strongly disagree (=1), disagree (=2), slightly agree (=3), agree (=4), and strongly agree (=5) (Amin, 2022).

RESULTS

Demographic Profile of Respondents

A total of 320 respondents participated in this study (Table 1). Of these, 65.9% were male and 34.1% were female. Most respondents (69.1%) were aged between 21 and 24 years, followed by 22.5% in the 17 to 20 age group, and 8.4% in the 25 to 30 age group. The questionnaire also revealed that 95.6% of respondents had attained a university education. In terms of occupation, 88.8% of respondents were students, 6.6% were employed in non-governmental companies, and the remaining participants had various other occupations.

Measurement Model

In this study, we used Partial Least Squares-Structural Equation Modelling (PLS-SEM) to assess the measurement models (Table 2). The measurement models were evaluated based on outer loadings, internal consistency, and convergent validity to ensure they met the required criteria for reliability and validity (Hair et al., 2019). First, the outer loadings for each construct exceeded 0.7, indicating that indicator reliability was achieved for all reflective

Table 1
Demographic profile

Demographic	Characteristics	Frequency	Percentage (%)
Gender	Male	211	65.9
	Female	109	34.1
Age	17-20 years old	72	22.5
	21-24 years old	221	69.1
	25-30 years old	27	8.4
Education level	Senior high school	14	4.4
	College / University	288	90
	Graduate school and above	18	5.6
Occupation	Student	284	88.8
	Employee of a non-government company	21	6.6
	Self-employed	4	1.3
	Public institutions	1	0.3
	Others	10	3.1
Monthly income	No income	266	83.1
	RM1000 – RM3000	40	12.5
	RM3001 – RM6000	9	2.8
	RM6001 – RM9000	2	0.6
	More than RM9000	3	0.9

constructs (Hair et al., 2019). Second, internal consistency of the constructs was assessed using two measures: Cronbach's alpha (CA) and composite reliability (CR). Internal consistency evaluates the reliability of a set of indicators within reflective constructs. The results showed that the values for Cronbach's alpha and composite reliability for all constructs surpassed the minimum threshold of 0.7, confirming the internal consistency of the reflective constructs.

Finally, convergent validity was assessed to determine whether an item is positively correlated with other items in the same reflective construct (Hair et al., 2019). This validity was measured using the Average Variance Extracted (AVE), where values are expected to exceed 0.50 (Hair et al., 2019). The results indicate that

all AVE values are greater than 0.50 (Table 2), confirming that convergent validity has been achieved for all constructs.

On the other hand, discriminant validity was evaluated to ensure that each construct is distinct from others within the path model. The Fornell-Larcker criterion was applied, demonstrating that the square root of the AVE for each construct is larger than its correlations with other constructs (Table 3) (Fornell & Larcker, 1981). Additionally, the Heterotrait-Monotrait (HTMT) ratio was examined, with all values falling below the recommended threshold of 0.85, thereby

Table 2
Measurement model

Construct	Item	Outer Loadings	CA	CR	AVE
Subjective Norm (SN)	SN1	0.91	0.91	0.94	0.85
	SN2	0.93			
	SN3	0.93			
Hand Hygiene Awareness (HHA)	HHA1	0.85	0.81	0.89	0.72
	HHA2	0.86			
	HHA3	0.84			
Perceived Usefulness (PU)	PU1	0.92	0.85	0.91	0.77
	PU2	0.92			
	PU3	0.79			
Perceived Ease of Use (PEOU)	PEOU1	0.87	0.91	0.94	0.80
	PEOU2	0.90			
	PEOU3	0.91			
	PEOU4	0.89			
Continuance Intention (CI)	CI1	0.91	0.88	0.93	0.81
	CI2	0.88			
	CI3	0.91			

*Notes: Cronbach's Alpha (CA); Composite Reliability (CR); Average Variance Extracted (AVE)

Table 3
Fornell and Lacker's Criterion

	1	2	3	4	5
1. SN	0.921				
2. HHA	0.267	0.851			
3. PU	0.560	0.343	0.878		
4. PEOU	0.418	0.392	0.607	0.892	
5. CI	0.615	0.363	0.641	0.539	0.901

confirming discriminant validity (Table 4) (Hair et al., 2019). These results indicate that the path model exhibits adequate discriminant validity.

Analysis of Structural Model

We used a bootstrapping procedure (5,000 resamples) to estimate the path coefficients, explained variance (R-Square), and predictive relevance (Q-Square) (Hair et al., 2019). The results of the path analysis are shown in Table 5 and illustrated in Figure 3. The overall explanatory power (R-Square) of the structural model indicates that it accounts for 10.6% of the variance in hand hygiene awareness, 37.4% in perceived usefulness, and 46.8% in continuance intention. Additionally, the (unreported) Q-Square values for all constructs are greater than 0, confirming that the model has sufficient predictive relevance for the endogenous constructs (Hair et al., 2019).

The results indicate that hypotheses H1, H2, H3, and H4 are supported (Table 5). The significant pathways demonstrate that hand hygiene awareness positively influences both perceived usefulness and continuance intention. Additionally, subjective norms have a positive impact on both perceived usefulness and hand hygiene awareness.

Table 4
Heterotrait-monotrait (HTMT) ratio

	1	2	3	4	5
1. SN					
2. HHA	0.311				
3. PU	0.633	0.412			
4. PEOU	0.458	0.456	0.685		
5. CI	0.686	0.428	0.736	0.600	

Table 5
Structural model analysis

Relation (Hypothesis)	Path Coefficient	P-value	Conclusion
SN → PU (H1)	0.494	<0.01	H1 Supported
SN → HHA (H2)	0.326	<0.01	H2 Supported
HHA → PU (H3)	0.235	<0.01	H3 Supported
HHA → CI (H4)	0.135	<0.01	H4 Supported
PU → CI	0.456	<0.01	
PEOU → CI	0.220	<0.01	

*Note: Subjective Norm (SN); Hand Hygiene Awareness (HHA); Perceived Usefulness (PU); Perceived Ease of Use (PEOU); Continuance Intention (CI)

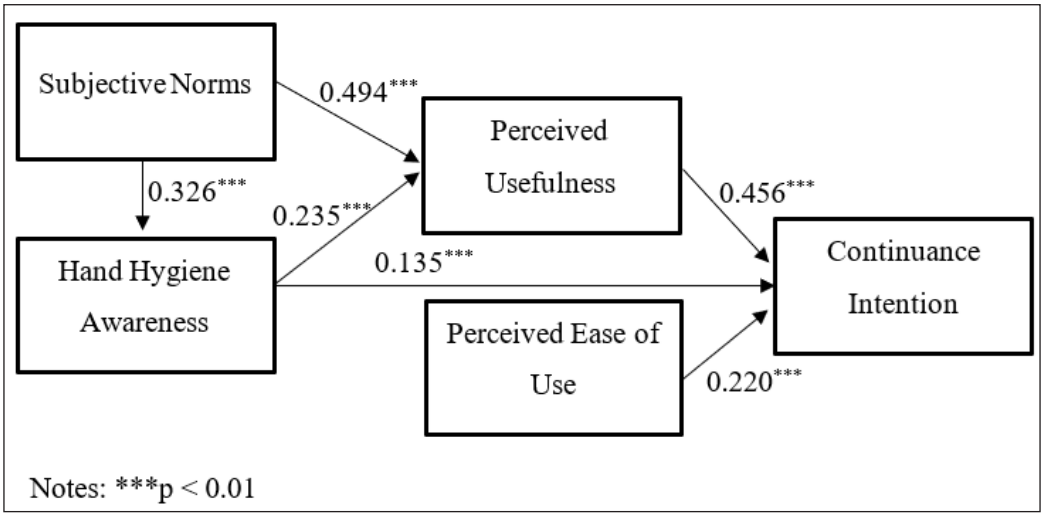

Figure 3. The results of research model

DISCUSSION

The adoption of e-wallets in Malaysia accelerated during the COVID-19 pandemic, a period when health risks became a significant social concern. This study investigates the role of health and social perspectives in shaping consumer behaviour, specifically focusing on the continuance intention to use e-wallets.

Our first hypothesis (H1) posited that subjective norms have a positive effect on perceived usefulness among e-wallet users. Our findings reveal a positive relationship between subjective norms and perceived usefulness, consistent with prior research in technology acceptance (Izuagbe et al., 2019; Kumar et al., 2020). Subjective norms influence individuals to adopt a behaviour when they perceive it positively and believe that important others expect them to engage in it. The COVID-19 pandemic accelerated e-wallet adoption in Malaysia, and as a collectivist society, social influence through subjective norms appears to shape individuals' perceptions of e-wallet usefulness.

The second hypothesis (H2) proposed that subjective norms positively impact hand hygiene awareness during the COVID-19 pandemic. Our findings suggest that subjective norms positively influence hand hygiene awareness. E-wallet users may acquire strong knowledge about hand hygiene through informal learning processes from their peers. Subjective norms further strengthen hand hygiene awareness among Malaysians e-wallet users. These findings provide preliminary evidence that hand hygiene awareness may play a role like social factors, which are known antecedents of technology acceptance.

The third hypothesis (H3) proposed that hand hygiene awareness has a positive impact on perceived usefulness in the

context of e-wallet continuance intention. Hand hygiene awareness is positively linked to perceived usefulness, consistent with previous findings that consumers prefer contactless payment methods for hygiene reasons (Beretta & Neuberger, 2021). Czeisler et al. (2020) argue that individuals adopt hand hygiene practices as preventive measures to reduce the transmission of COVID-19. Our study confirms that the Malaysian public perceives electronic payments to achieve instrumental benefits, particularly maintaining good hygiene to prevent the spread of the virus. As consumers perceive e-wallet usage as beneficial for achieving this instrumental goal, hand hygiene awareness appears to be an antecedent of e-wallet (or technology) acceptance.

The fourth hypothesis (H4) proposed that hand hygiene awareness positively influences consumers' continuance intention to use e-wallets during the COVID-19 pandemic. This study confirms that hand hygiene awareness positively influences the continuance intention of e-wallet usage. During the pandemic, the Malaysian public became more cautious and adhered to strict hand hygiene practices to prevent virus transmission. Previous research has demonstrated that users' attitudes and health awareness significantly impact mobile application usage (Francioni et al., 2022). Similarly, hospital nurses in Hong Kong exhibited heightened hand hygiene awareness during the COVID-19 outbreak (Sin & Rochelle, 2022). Our findings suggest that greater self-hygiene awareness strengthens the intention to continue using e-wallets in Malaysia. This highlights that individual health awareness can be as important as established technology acceptance model (TAM) variables, such as perceived usefulness (PU) and perceived ease of use (PEOU), in exerting a direct causal role on continuance intention.

CONCLUSION

This study aimed to address a knowledge gap in technology acceptance by incorporating a health perspective into e-wallet adoption research. Specifically, it examined the continuance intention to use e-wallets, with a focus on hand hygiene awareness. Our findings indicate that subjective norms positively influence both hand hygiene awareness and perceived usefulness among e-wallet users. Additionally, hand hygiene awareness has a positive impact on both perceived usefulness and the continuance intention of using e-wallets. Overall, this study underlines the importance of both health risk and social factors in sustaining e-wallet adoption.

Theoretical Contributions

Our study offers several significant theoretical contributions to the Technology Acceptance Model (TAM) literature by integrating underexplored perspectives on health risks and social influences. First, while individual risk has become a prominent perspective in technology

acceptance, health risk remains largely understudied. This research addresses this gap by proposing and confirming that hand hygiene awareness is a crucial individual risk factor that influences e-wallet adoption. We provide empirical evidence that consumers' hand hygiene awareness was a major determinant of mobile payment adoption during the COVID-19 pandemic. In doing so, our study is among the first to integrate a health risk perspective—specifically, hand hygiene awareness—into the technology acceptance framework, thereby broadening the scope of factors considered in technology adoption research.

Second, this study provides novel insights into the role of social processes, particularly subjective norms, in influencing both hand hygiene awareness and mobile payment adoption. While existing TAM literature recognises the role of subjective norms in explaining technology acceptance, its link with health risk factors has been missing. Our findings demonstrate that subjective norms, as a form of social influence, enhance hand hygiene awareness, which in turn increases the continuance intention to use e-wallets. This suggests that leveraging subjective norms can be an effective social strategy to promote both public health behaviours and the adoption of contactless payment technologies.

Finally, our research provides empirical evidence for the causal effects of subjective norms and hand hygiene awareness on perceived usefulness. We show that consumers are aware of the instrumental logic behind the common value of society (i.e., subjective norms) when it comes to e-wallet adoption. Furthermore, higher hand hygiene awareness also translates into an enhanced perceived usefulness of e-wallets. These results suggest that consumers are capable of cognitively assessing the effort and potential rewards associated with a technology, which is ultimately reflected in their perception of its usefulness.

Limitations and Recommendation For Future Research

This study has several key limitations. First, it relied solely on an online questionnaire and convenience sampling, thus limit the generalisability of the findings to the broader population. Second, the study was conducted during the COVID-19 pandemic, a time of heightened public health awareness. As a result, health awareness levels may differ in a post-pandemic context, potentially affecting e-wallet adoption patterns. Third, our findings are specific to the Malaysian population, which may have a relatively high level of hygiene awareness compared to other regions. Future research could address these limitations by examining sociocultural differences in other countries (Siame et al., 2024). Additionally, it would be interesting to explore other health perceptions could provide deeper insights into users' attitudes toward e-wallet adoption beyond hygiene awareness.

ACKNOWLEDGEMENT

This work was supported/funded by the Ministry of Higher Education under

Fundamental Research Grant Scheme (FRGS/1/2022/SS10/UTM/02/10). We also would like to thank the Editor-in-Chief and reviewers for the time and their comments on our manuscript.

REFERENCES

Aji, H. M., Berakon, I., & Md Husin, M. (2020). COVID-19 and e-wallet usage intention: A multigroup analysis between Indonesia and Malaysia. *Cogent Business & Management*, *7*(1), Article 1804181. https://doi.org/10.1080/23311975.2020.1804181

Ajzen, I. (2020). The theory of planned behaviour: Frequently asked questions. *Human Behaviour and Emerging Technologies*, *2*(4), 314-324. https://doi.org/10.1002/hbe2.195

Al-Saedi, K., Al-Emran, M., Ramayah, T., & Abusham, E. (2020). Developing a general extended UTAUT model for m-payment adoption. *Technology in Society*, *62*, Article 101293. https://doi.org/10.1016/j.techsoc.2020.101293

Alam, M. M., Awawdeh, A. E., & Muhamad, A. I. B. (2021). Using e-wallets for business process development: Challenges and prospects in Malaysia. *Business Process Management Journal*, *27*(4), 1142-1162. https://doi.org/10.1108/BPMJ-11-2020-0528

Amin, H. (2007). An analysis of mobile credit card usage intentions. *Information Management & Computer Security*, *15*(4), 260-269. https://doi.org/10.1108/09685220710817789

Amin, H. (2022). An analysis of online sadaqah acceptance among university graduates in Malaysia. *International Journal of Islamic and Middle Eastern Finance and Management*, *15*(6), 1019-1034. https://doi.org/10.1108/IMEFM-01-2019-0020

Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H., & Mohamad, E. (2020). Public knowledge, attitudes, and practices towards COVID-19: A cross-sectional study in Malaysia. *PLOS ONE*, *15*(5), Article e0233668. https://doi.org/10.1371/journal.pone.0233668

Balakrishnan, V., & Eesan, M. L. (2024). Enablers and disablers for contactless payment acceptance among Malaysian adults. *Humanities and Social Sciences Communications*, *11*(1), Article 534. https://doi.org/10.1057/s41599-024-03057-7

Balakrishnan, V., & Shuib, N. L. M. (2021). Drivers and inhibitors for digital payment adoption using the cashless society readiness-adoption model in Malaysia. *Technology in Society*, *65*, Article 101554. https://doi.org/10.1016/j.techsoc.2021.101554

Beretta, E., & Neuberger, D. (2021). The war on cash: Institutional hostility and COVID-19. *Cato Journal*, *41*, 593-620.

Czeisler, M. É., Garcia-Williams, A. G., Molinari, N. A., Gharpure, R., Li, Y., Barrett, C. E., Robbins, R., Facer-Childs, E. R., Barger, L. K., & Czeisler, C. A. (2020). Demographic characteristics, experiences, and beliefs associated with hand hygiene among adults during the COVID-19 pandemic—United States, June 24-30, 2020. *Morbidity and Mortality Weekly Report*, *69*(41), 1485-1491. https://doi.org/10.15585/mmwr.mm6941a3

Soper, D. S. (2025). *A-priori sample size calculator for structural equation models* [Software]. https://www.danielsoper.com/statcalc

Fatonah, S., Yulandari, A., & Wibowo, F. W. (2018). A review of e-payment systems in e-commerce. *Journal of Physics: Conference Series*, *1140*(1), Article 012033. https://doi.org/10.1088/1742-6596/1140/1/012033

Folkinshteyn, D., & Lennon, M. (2016). Braving Bitcoin: A technology acceptance model (TAM) analysis. *Journal of Information Technology Case and Application Research*, *18*(4), 220-249. https://doi.org/10.1080/15228053.2016.1275242

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39-50. https://doi.org/10.2307/3151312

Francioni, B., Curina, I., Hegner, S. M., & Cioppi, M. (2022). Predictors of continuance intention of online food delivery services: Gender as moderator. *International Journal of Retail & Distribution Management*, *50*(12), 1437-1457. https://doi.org/10.1108/IJRDM-11-2021-0537

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2-24. https://doi.org/10.1108/EBR-11-2018-0203

Heydarizadeh, M., Birjandi, M., Heydari, H., & Ashtaria, H. (2021). The effect of educational interventions based on the theory of planned behaviour on nurses' intention to perform hand hygiene. *Interdisciplinary Journal of Acute Care*, *2*(1), 12-20. https://doi.org/10.22087/ijac.2021.146337

Izuagbe, R., Ifijeh, G., Izuagbe-Roland, E. I., Olawoyin, O. R., & Ogiamien, L. O. (2019). Determinants of perceived usefulness of social media in university libraries: Subjective norm, image, and voluntariness as indicators. *Journal of Academic Librarianship*, *45*(4), 394-405. https://doi.org/10.1016/j.acalib.2019.03.006

Karim, M. W., Haque, A., Ulfy, M. A., Hossain, M. A., & Anis, M. Z. (2020). Factors influencing the use of e-wallets as a payment method among Malaysian young adults. *Journal of International Business and Management*, *3*(2), 1-12.

Kasri, R. A., Indrastomo, B. S., Hendranastiti, N. D., & Prasetyo, M. B. (2022). Digital payment and banking stability in an emerging economy with a dual banking system. *Heliyon*, *8*(11), Article e11198. https://doi.org/10.1016/j.heliyon.2022.e11198

Kumar, J. A., Bervell, B., Annamalai, N., & Osman, S. (2020). Behavioural intention to use mobile learning: Evaluating the role of self-efficacy, subjective norm, and WhatsApp use habit. *IEEE Access*, *8*, 208058-208074. https://doi.org/10.1109/ACCESS.2020.3037925

Lee, M., Kang, B. A., & You, M. (2020). Association between knowledge, attitudes and practices (KAP) towards COVID-19: A cross-sectional study in South Korea [Preprint]. *Research Square*. https://doi.org/10.21203/rs.3.rs-73653/v1

Lew, S., Tan, G. W. H., Loh, X. M., Hew, J. J., & Ooi, K. B. (2020). The disruptive mobile wallet in the hospitality industry: An extended mobile technology acceptance model. *Technology in Society*, *63*, Article 101430. https://doi.org/10.1016/j.techsoc.2020.101430

Mallat, N. (2007). Exploring consumer adoption of mobile payments: A qualitative study. *Journal of Strategic Information Systems*, *16*(4), 413-432. https://doi.org/10.1016/j.jsis.2007.08.001

Munikrishnan, U. T., Mamun, A. A., Xin, N. K. S., Chian, H. S., & Naznen, F. (2024). Modelling the intention and adoption of cashless payment methods among young adults in Malaysia. *Journal of Science and Technology Policy Management*, *15*(2), 374-395. https://doi.org/10.1108/JSTPM-04-2022-0077

Nizam, F., Hwang, H. J., & Valaei, N. (2018). Measuring the effectiveness of e-wallets in Malaysia. In R. Lee (Ed.) *Big data, cloud computing, data science & engineering* (pp. 59-69). Springer. https://doi.org/10.1007/978-3-319-96803-2_5

Pantelimon, F. V., Georgescu, T. M., & Posedaru, B. Ş. (2020). The impact of mobile e-commerce on GDP: A comparative analysis between Romania and Germany and how COVID-19 influences e-commerce activity worldwide. *Informatica Economica*, *24*(2), 27-41. https://doi.org/10.24818/issn14531305/24.2.2020.03

Pertiwi, D., Suprapto, W., & Pratama, E. (2020). Perceived usage of e-wallets among Generation Y in Surabaya based on the technology acceptance model. *Jurnal Teknik Industri: Jurnal Keilmuan dan Aplikasi Teknik Industri*, *22*(1), 17-24. https://doi.org/10.9744/jti.22.1.17-24

Pessoa-Silva, C. L., Posfay-Barbe, K., Pfister, R., Touveneau, S., Perneger, T. V., & Pittet, D. (2005). Attitudes and perceptions towards hand hygiene among healthcare workers caring for critically ill neonates. *Infection Control & Hospital Epidemiology*, *26*(3), 305-311. https://doi.org/10.1086/502544

Pratiwi, I. C., Novani, S., & Suryana, L. A. (2022). Tourists' intentions during COVID-19: Push and pull factors in the extended theory of planned behaviour. *Pertanika Journal of Social Sciences & Humanities*, *30*(2), 699-721. https://doi.org/10.47836/pjssh.30.2.15

Ramos-de-Luna, I., Montoro-Ríos, F., & Liébana-Cabanillas, F. (2016). Determinants of the intention to use NFC technology as a payment system: An acceptance model approach. *Information Systems and E-Business Management*, *14*(2), 293-314. https://doi.org/10.1007/s10257-015-0284-5

Rosli, M. S., Saleh, N. S., Md. Ali, A., & Abu Bakar, S. (2023). Factors determining the acceptance of e-wallets among Generation Z from the lens of the extended technology acceptance model. *Sustainability*, *15*(7), Article 5752. https://doi.org/10.3390/su15075752

Salih, S. A., Ismail, S., Najm, A., & Ismail, N. (2023). Effect of the COVID-19 pandemic and subsequent social distancing on individuals' mental health. *Pertanika Journal of Social Sciences & Humanities*, *31*(3), 1057-1077. https://doi.org/10.47836/pjssh.31.3.08

Shaikh, I. M., & Amin, H. (2025). Technology acceptance determinants and consumer innovativeness influencing ASNAFs' acceptance of e-wallet usage. *International Journal of Ethics and Systems*, *41*(1), 238-257. https://doi.org/10.1108/IJOES-06-2023-0126

Siame, J. N., Libonda, L., & Kanyata, K. (2024). Physical and sociocultural factors influencing hand hygiene behaviour during the COVID-19 pandemic: A cross-sectional study among traders in Lusaka District, Zambia *(Preprint). medRxiv*. https://doi.org/10.1101/2024.03.06.24303900

IDC. (2023, October 28). *Number of mobile wallet users in Malaysia from 2021 to 2022 (in millions)* [Statista statistic]. *Statista*. https://www.statista.com/statistics/1367899/malaysia-mobile-wallet-users/

Sin, C., & Rochelle, T. L. (2022). Using the theory of planned behaviour to explain hand hygiene among nurses in Hong Kong during COVID-19. *Journal of Hospital Infection*, *123*, 119-125. https://doi.org/10.1016/j.jhin.2022.01.018

Slade, E. L., Dwivedi, Y. K., Piercy, N. C., & Williams, M. D. (2015). Modelling consumers' adoption intentions of remote mobile payments in the United Kingdom: Extending UTAUT with innovativeness, risk, and trust. *Psychology & Marketing*, *32*(8), 860-873. https://doi.org/10.1002/mar.20823

Teng, S., & Khong, K. W. (2021). Examining actual consumer usage of e-wallets: A case study using big data analytics. *Computers in Human Behavior*, *121*, Article 106778. https://doi.org/10.1016/j.chb.2021.106778

Thomas, R., Greenwood, H., Michaleff, Z. A., Abukmail, E., Hoffmann, T. C., McCaffery, K., Hardiman, L., & Glasziou, P. (2021). Examining Australians' beliefs, misconceptions and sources of information for COVID-19: A national online survey. *BMJ Open*, *11*(2), Article e043421. https://doi.org/10.1136/bmjopen-2020-043421

Tian, Y., Chan, T. J., Suki, N. M., & Kasim, M. A. (2023). Moderating role of perceived trust and perceived service quality on consumers' use

behaviour of Alipay e-wallet system: Perspectives of the technology acceptance model and theory of planned behaviour. *Human Behavior and Emerging Technologies*, *2023*(1), Article 5276406. https://doi.org/10.1155/2023/5276406

Trivedi, J. (2016). Factors determining the acceptance of e-wallets. *International Journal of Applied Marketing and Management*, *1*(2), 42-53.

van de Mortel, T. (2009). Development of a questionnaire to assess health care students' hand hygiene knowledge, beliefs and practices. *Australian Journal of Advanced Nursing*, *26*(3), 9-16.

Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, *27*(3), 451-481. https://doi.org/10.1111/j.1540-5915.1996.tb00860.x

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Towards a unified view. *MIS quarterly*, 425-478. https://doi.org/10.2307/30036540

Wu, M. Y., Chou, H. P., Weng, Y. C., & Huang, Y. H. (2011). TAM-2 based study of website user behavior-using web 2.0 websites as an example. *WSEAS Transactions on Business and Economics, 4*(8), 133-151.

Ye, N., & Zhao, Z. (2024). The reform of consumer protection in mobile payment services in China: Legislation, regulation, and dispute resolution. *Computer Law & Security Review, 54*, 106007. https://doi.org/10.1016/j.clsr.2024.106007

Zhao, Q., Chen, C. D., & Wang, J. L. (2016). The effects of psychological ownership and TAM on social media loyalty: An integrated model. *Telematics and Informatics, 33*(4), 959-972. https://doi.org/10.1016/j.tele.2016.02.007