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ABSTRACT

With the spread of m-commerce usage around the globe, mobile commerce can become the primary approach for many users in transactions. Such a method is considered an innovative way for the financial wallet but with some encumbrances. Trust in mobile commerce is one of the challenges yet to receive in-depth studies regarding linear and non-compensatory relationships. This study aims to evaluate the determinants of trust in mobile commerce using hybrid three-stage Fuzzy Delphi-Structural Equation Modeling (SEM)-Artificial Neural Network (ANN) approach. A hybrid approach was performed on 344 users mobile-commerce activities. The results of this study provide valuable insights for mobile commerce firms to come up with effective plans that increase customer trust in mobile commerce. Practically, the relative importance of specific determinants of trust in mobile commerce contributes to providing deep insight into the factors of customer trust in mobile commerce. The proposed model predicts 94.80% trust in mobile commerce with social presence and social support theories. A novel perspective was provided in this study to encourage e-marketing among consumers to persuade customers to trust mobile commerce.

1. Introduction

The world has witnessed a change in the business mechanisms with the development of electronic commerce known as mobile commerce. Doing business on the internet is becoming a common activity nowadays (Ngai & Gunasekaran, 2007). The rapid exchange of information among consumers has changed the e-business environment and enhanced the formation of a social and reliable transaction environment. Moreover, mobile phone production technology growth has paved the way for the formation and development of mobile commerce (m-commerce) (Sarkar et al., 2020). Although an increasing number of retailers and wholesalers are flourishing from the growing trend of internet shopping worldwide, the highest rate of online trading through mobile phones is in the Middle East (Jaffar et al., 2016). With the growth of the digital economy, m-commerce has become a needed element in business strategy (Sahi, 2019). According to Chong et al. (2012), software companies may decide not to manufacture m-commerce applications due to a lack of users.

Similarly, users may be hesitant to utilize m-commerce because of its service shortage. However, m-commerce is increasing and is reaching a value of more than 3 billion US dollars. Hence, IT companies invest close to 50 billion US dollars annually in electronic commerce. M-commerce is projected to grow to 80 billion US dollars in 2020 (Leong et al., 2020a). In the last few years, there has been a significant increase in research on trust in e-commerce (e.g., Attar et al., 2021; Hallikainen & Laukkanen, 2018; Lin et al., 2019). Such an increase in the literature was due to the sheer volume of user-created content and lack of physical confrontation, unlike conventional trading (Li & Yeh, 2010). In other words, since the authenticity of the content is not verified due to a lack of verbal, non-verbal expressions and body language, obtaining the trust of m-commerce users is likely to be complicated (J. Lin et al., 2011). Previous studies focused on the importance of trust in the growth of product loyalty (Zhang & Benyoucef, 2016), social participation, social shopping, and buying in m-commerce (J. Chen & Shen, 2015).

Literature concentrated on analyzing customer satisfaction and loyalty using SEM with ANN. However, the fuzzy theory was neglected. In addition, there is minimal adoption of evaluating trust in mobile commerce using presence and social theories through mobile-wallet and innovation resistance theory. Moreover, the literature analysis confirmed the modelling and evaluating trust in mobile commerce needs to be investigated. This study bridges such challenges in the current literature by modelling and evaluating trust in m-commerce using a linear and non-compensatory approach. M-commerce can be one of the most attractive areas for study because the subject matter is yet to be fully explored and provides possible chances for future study and applications (Attar et al., 2021; Calzetta, 2012; Ngai &

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Gunasekaran, 2007). Therefore, using the structural equation modelling technique and neural networks addresses the shortcomings of previous studies in terms of the multivariate assumptions. Besides, explore linear and non-compensatory relationships may help the m-commerce firms to improve the social commerce construct.

The concept of mobile wallet adoption has become common in both developed and developing countries to improve the scale, productivity, and superior of banking services (Sharma et al., 2018). Due to the pro-innovation bias, a focus has been on adopting technology, and little attention has been given to the resistance of innovation, especially in the m-wallet context (Leong et al., 2020a). Moreover, the determinants of trust in m-commerce and the application of dual theory from SEM and ANN have been rarely investigated (Li, 2019). The ANN is a computational structure designed to emulate the accumulation of information in the organic central nervous system (Tkáč & Verner, 2016). The practice of current ANN mechanisms for analyzing customer attitudes can be helpful for startup firms (Ansari & Riasi, 2016). The benefits of applying the ANN method with PLS-SEM techniques enable further confirmation of the SEM analysis's findings. Additionally, such a method captures linear interactions between antecedents and dependent variables and dynamic, nonlinear interactions and a perfect measure of each predictor's relative strength (Albahri et al., 2021). This study addresses the existing gap by examining the curbs of m-wallet innovation adoption through the vision of innovation resistance theory (IRT) and applying a sophisticated hybrid three-staged Fuzzy-SEM-ANN approach.

2. Literature review

This section presented and discussed the theories adopted in this study. Besides, the development of hypotheses was discussed based on previous studies, as shown in the following subsections.

3. Social presence theory

It is believed that social presence theory (SPT) first appeared in social psychology and communication (Cui et al., 2013; Al-Abrrow et al., 2019). Short, Williams discussed the social presence theory, and Christie, in the mid-seventies, compared physical interactions with diverse communication media (Bulu, 2012). The main argument in the traditional SPT is that several types of communication media with diversified abilities can influence people's social presence perception. Previous studies emphasized that perceived social presence varies from person to person and across time regardless of whether people use the exact communication mechanism (Mallmann & Maçada, 2021; So & Brush, 2008). Social presence as a medium can transmit information about makeover expressions, position, dress, and non-verbal signals. SPT is adopted in this paper as a theoretical image to understand the impacts of social shopping structures on m-commerce (Lu, Zeng, et al., 2016; AL-Abrrow et al., 2021). Sensitization of a communicator to the presence of an interaction partner. Therefore, social presence is the emotional state in virtual interactions (Leong et al., 2020a). Social presence consists of the three dimensions: the social presence of the web, the social presence of others, and the social presence of interacting with vendors (Lu, Zeng, et al., 2016). The social presence of the web is the ability of the m-commerce application to convey warmth during social communication. Physical agents and 3D images enhance the perceived social presence of the Web. Customer reviews and ratings can increase the perceived social presence of the web (Kumar & Benbasat, 2002). Social interaction with sellers is a fantastic marketing tool for many social commerce businesses. In m-commerce, chat and messaging are essential factors for increasing interaction between customers and sellers (Lu, Zeng, et al., 2016). Interaction with others is how others respond to members of social commerce. Through discussions, reviews and recommendations, social presence can be strengthened to interact with others. Hence, word-of-mouth promoting interaction with others in social commerce activities (Kumar & Benbasat, 2002). Social presence is the most critical construct in the context of social commerce. Thus, such a concept is considered suitable in the context of m-commerce (Leong et al., 2020a).

4. Social support theory

Social support at first was discussed during the seventies and early eighties. Social support perception theory has been investigated from different points of view (Hupcey, 1998). It is used to describe various sets of activities. For instance, an expression of positive effect among people, social reinforcement, symbolic assistance of various types, and offering information (Abdulaali et al., 2019; Scharer, 2005). Social support makes a person feel valued, respected, appreciated, and motivated (Ballantine & Stephenson, 2011; Fadhil et al., 2021). Social support is the experience of obtaining assistance and responding to individuals in the context of social commerce (Tan, 2019). Social support provides information and business recommendations to enhance trust and friendship among members and increase the desire for commerce exchanges (Liang et al., 2011). Virtual social support increases intentions to engage in social commerce. Sharing information via m-commerce enhances trust in m-commerce (Hajli & Sims, 2015). Social support depends on personal, cultural, and environmental (Gottlieb & Bergen, 2010). Furthermore, information sharing and emotional interactions are vital concepts for providing social support to m-commerce users (Arora et al., 2007; Ballantine & Stephenson, 2011; Langford et al., 1997; McKinley & Wright, 2014; Scharer, 2005; Wright, 2000). Online recommendations and reviews are necessary for m-commerce users due to the difficulty of perceiving the product's features through the human senses (Leong et al., 2020a). This study focuses on two frequently used types, informational and emotional support because content and social relations are intrinsic properties of social commerce (Lin et al., 2016). Emotional support is the process of providing kindness, compassion, attending to a person's needs, and being attainable to other people (McKinley & Wright, 2014). Emotional support is the process of knowledge transmission to assist other people in gaining the needed information (Tan, 2019).

5. Perceived novelty

An essential attribute of any innovation is the uniqueness and brilliance of the innovation from the viewpoint of the innovator and user (Wells et al., 2010). Innovation has been examined as a source of desire and hedonic experience for buyers' actions and alternatives. To satisfy customers' needs, firms of social commerce should frequently innovate and present new products for customers (Dang, 2020). Perceived novelty is users' perception of innovation and the brilliance of technology. According to Jeno et al. (2019), the perceived novelty of a product is positively connected to a positive attitude and perceived rewards while negatively connected to perceived product risk. Perceived novelty defines customers' reactions to social commerce innovations. Realizing innovations in social commerce activities, such as m-commerce, increases intent to use m-commerce and reduces resistance to using such commerce (Leong et al., 2020b). Previous literature has provided much evidence that perceived novelty is linked with the adoption of new technology (e.g., Mani & Chouk, 2017; Tokunaga, 2013; Yang & Lin, 2017). M-commerce is innovation has faced many reactions. Therefore, perceived novelty is correlated with the resistance of customers to the use of m-commerce.

6. Mobile wallet

The continuous development of technology, such as Automated Teller Machine (ATM) to modern electronic banking, has reduced costs and provided banks with the core competencies needed to compete (Abbas et al., 2021; Arif et al., 2016). Scholars have excessively utilized the concept and discovered different forms of mobile payment services to evaluate the behavioral intention of such technology (Eneizan et al., 2019; Hadi et al., 2018; Hamid et al., 2021; Singh & Sinha, 2020; Singh et al., 2020). A mobile wallet is a payment method that enables users to make payments electronically by using a mobile device to complete payment transactions (Shaw, 2014). The mobile wallet is one of the modern forms of internet payment via mobile that assists customers to share content and access services, including payment for ticketing businesses (Shin, 2009). There are several benefits of adopting such a method. The benefits of using a mobile wallet are saving time, fraud mitigation, speedy payment, and less cash (Sharma et al., 2018; B. Shaw & Kesharwani, 2019). An emerging trend shows m-wallet has been substituted for debit and credit cards (Alnoor, 2020; Leong et al., 2020a). Mobile wallet allows customers to store information in an intelligent chip and can be used without the need for credit cards (Leong et al., 2020b). However, there is a lack of evidence regarding the impact of the presence and social support theories on the mobile wallet. In order to address the challenges in the literature, it is necessary to conduct a study on the mobile wallet to broaden the understanding of mobile wallet resistance.

7. Innovation resistance theory

The innovation resistance theory provides a theoretical context for customer resistance and assists in understanding the resistance-oriented behavior of users (Kaur et al., 2020). Innovation resistance is described as a behavior emanating from sound thinking and decision-making concerning the utilization of innovation (Leong et al., 2020b). Therefore, contradictory beliefs lead to customers' opposition to innovation (P. T. Chen & Kuo, 2017). Many new technologies are characterized by a rejection of innovation due to customer reactions to innovation that conflict with their values and beliefs (Ma & Lee, 2019). The tendency of customers to maintain the status quo leads to an increase in customers' behavior toward resistance to innovation (Abdullah et al., 2021; Jabbar et al., 2020; Kaur et al., 2020). Passive and active innovation resistance are the two types of consumer resistance to innovation (Heidenreich & Kraemer, 2015; Van Tonder, 2017). Several barriers affect customers' acceptance of innovation, such as functional and psychological barriers (P. T. Chen & Kuo, 2017). It is assumed innovation generates positive and vital results. However, many practitioners and academics neglect the customer resistance that hinders innovation adoption in social commerce (Leong et al., 2020b). Understanding the reasons behind customer reactions to innovation helps social commerce firms design and develop new products and reduce risk and failure rates (Mani & Chouk, 2017). Innovation resistance includes the rejection of innovation, the postponement of acceptance of the innovation, and opposition in which customers try the innovation before final rejection because there is no distinct advantage of used innovation (Szmigin & Foxall, 1998). According to El Mhamdi et al. (2011), innovation resistance theory (IRT) assumes that customer resistance includes functional and psychological barriers. Psychological barriers include the conflict of innovation with beliefs, while functional barriers include the changes that cause innovation, such as use, risk, and value barriers (Joachim et al., 2018).

8. Trust in mobile commerce

One of the critical predictors of m-commerce adoption is consumer trust. The lack of trust is one of the main reasons for customers' reluctance to practice social commerce (Zhou, 2011). Thus, the phenomenon of trust in m-commerce is a complex issue. However, little literature has investigated such an issue (Leong et al., 2020a; Manchanda et al., 2021). Trust in social commerce is crucial for success in an online environment (Blaise et al., 2018). Trust in m-commerce increases customer engagement in e-commerce. Therefore, applications must contain guidelines to create a complete image of the firms (Leong et al., 2020b). Trust in m-commerce should be identified by m-commerce shareholders to be able to design appropriate marketing approaches (Alhamdi et al., 2019; Sarkar et al., 2020). In the context of m-commerce, perceived risk and trust are critical factors that can enhance customer privacy. Trust is the expectations of customers based on the word, promise, and oral or written statement (Eastin et al., 2016). Interface design and network capabilities are critical challenges in gaining trust in m-commerce. In other words, such factors hinder customers when conducting business transactions via the internet (Li & Yeh, 2010). Hence, trust is one of the main concepts of m-commerce studies (Hillman & Neustaedter, 2017).

9. Hypothesis development

Online consumers' perception of social presence has a positive influence on trust. Hence, social presence encourages consumers to engage in m-commerce business (Hassanein & Head, 2007). Trust in m-commerce is built through web interactions with customers (Leong et al., 2020a). Web interactions are socially effective and increase consumer trust in m-commerce (Lu, Zeng, et al., 2016). Moreover, convenience, system quality, and facilitating conditions are critical factors to improve trust in m-commerce (Li et al., 2012). As a result, such interactions make information about m-commerce products more transparent. Subsequently, suspicious behaviors are hidden and motivate customers to purchase (Ogonowski et al., 2014). According to (Leong et al., 2020a), there is a linear relationship between social presence and trust in online commerce. Such interactions make information about m-commerce products more transparent. Subsequently, suspicious behaviors are hidden and motivate customers to purchase (Ogonowski et al., 2014). Social presence develops favorable attitudes toward online stores by reducing social distance (Leong et al., 2020a). Firms of m-commerce with less social presence reduce trust. Customer interaction with websites and applications with low social presence increases negative beliefs about electronic sellers (Gefen & Straub, 2004). M-commerce companies with high social connections increase customers' positive perceptions of trust in m-commerce websites (Liew et al., 2017). Consequently, the hypothesis would be:

Hypothesis 1: Social presence will be positively related to trust in m-commerce.

Informational and emotional support are categories of social support to provide customers with recommendations, information, and helpful advice for making a purchase decision. Customers receiving information and advice about m-commerce products contributes to increasing integrity. Moreover, customers' sharing their opinions regarding product purchase and delivery increases trust in m-commerce (Lal, 2017). Relying on previous customers' opinions and experiences is necessary for potential customers rather than relying on manufacturers' information. Therefore, such information enhances trust in m-commerce (Lu, Zeng, et al., 2016).

On the other hand, providing care and encouragement increases customers' feelings of appreciation and respect. Feeling emotional support improves trust in m-commerce (J. Chen & Shen, 2015). Through emotional exchange between customers, trust in m-commerce increases (Leong et al., 2020a). Thus, we proposed that:

Hypothesis 2: Social support will be positively related to trust in m-commerce.

10. Moderating roles

As mentioned earlier, perceptions of innovation influence social support and social presence for m-commerce (Wells et al., 2010). Thus, the perceived novelty will be positive when innovation is considered simple and less complicated (N. Shaw & Sergueeva, 2019). The literature has argued that perceived novelty depends on the perception of innovation in m-commerce (Zhang & Benyoucef, 2016). Perceived novelty stimulates positive emotional reactions, leading to increased recommendations and positive information about m-commerce products (Tokunaga, 2013). Positive feedback on innovations for m-commerce is increasing because customers are looking at innovations as incentives they haven't tried before.

Furthermore, perceived novelty increases the provision of positive information, review, and recommendations for m-commerce products. The relationship between social presence support and mobile wallet resistance is weak when perceived novelty is high (Aransyah et al., 2020). Perceived novelty determines customers' reactions to the adoption of the electronic wallet. Awareness of customers of new recommendations and superior advantages of the e-wallet increases the continuity of using such a method in social commerce services (Yang & Lin, 2017). Perceived novelty is a vital issue and is negatively related to innovation resistance. Realizing the e-wallet is an innovation reduces the resistance to adopting the e-wallet in e-commerce (Aransyah et al., 2020). Thus, we assume that:

Hypothesis 3: The relationship between social presence, social support and mobile-wallet resistance will be weak when perceived novelty is high.

Many customers suffer from keypads and small screens to use a mobile wallet, which makes it challenging to use a mobile wallet in banking services (Bruner & Kumar, 2005). Such operations increase the resistance to the use of internet banking. The incompatibility of mobile wallets with customs and traditions increases resistance to innovation among customers (Leong et al., 2020b). Likewise, the failure of the mobile wallet to provide a reasonable performance rate compared to the available alternatives increases the resistance of customers to using such a method of payment, which in turn reduces trust in m-commerce (Laukkanen, 2016). Not discovering the value of using a mobile wallet leads to poor trust in social commerce. Resistance to innovation is likely to increase reluctance to adopt mobile wallets in m-commerce transactions (Antioco & Kleijnen, 2010). Increasing the risks of innovation discourages customers from using electronic commerce.

Consequently, the physical and economic risks lead to a decrease in the trust of customers in m-commerce (Lian & Yen, 2013). Security threats and illegal money transfers are causing increased resistance to using the mobile wallet in m-commerce. Many customers are afraid to use mobile wallets in m-commerce when the perceived risk of innovation increases (Leong et al., 2020a). The strength of norms, values and traditions increases resistance to m-commerce. In the context of social commerce, many customers resist m-commerce when it does not correspond to values and customs (Kaur et al., 2020). Traditional barriers increase the intent to use e-commerce services. Therefore, innovation barriers increase customers' resistance to mobile wallets in m-commerce (Aransyah et al., 2020). Customers realizing the difficulty of using the mobile wallet

in m-commerce increases negative attitudes toward adopting social commerce services (Cheng et al., 2018). Adverse reactions increase resistance to the use of the mobile wallet, which reduces trust in m-commerce (Singh et al., 2020). Consumers' awareness of the new value-added from the adoption of mobile wallets in m-commerce is a critical determinant of intent to continue purchasing with m-commerce (Shaw, 2014). Resistance to innovation reduces mobile wallets in m-commerce because customers prefer to pay with cash (Muna et al., 2020). Hence, we theorize that:

Hypothesis 4: The relationship between mobile wallets and trust in m-commerce will be weak when innovation resistance is high.

11. Mediating role

Globally, the mobile wallet has been accepted as a tool for formal banking transactions. Mobile wallet services include payment, bill settlement, money transfer (Sharma et al., 2018). Use and trust in m-commerce are linked to readiness to pay by mobile wallet in m-commerce. Hence, mobile wallet services will increase the intentions of online purchases (Lew et al., 2020). However, there is a negative relationship between mobile wallets and trust in m-commerce toward mobile banking software (Arif et al., 2016). The mobile wallet is linked to business intelligence to motivate purchases from online stores (Ooi & Tan, 2016).

On the other hand, Sharma et al. (2018) examined mobile wallet inhibitors, including trust in mobile commerce, using an integrated model. They found the intricacy of new mobile banking technology and distrust toward new technology are the significant barriers to mobile wallet acceptance. As mentioned previously, significant progress in mobile technology has enabled the application of the mobile wallet to replace the traditional roles of the traditional wallet (Liébana-Cabanillas et al., 2018). However, the effect of social present and support was identified as a challenge toward adopting mobile wallets in m-commerce (Aransyah et al., 2020; Leong et al., 2020b). Furthermore, numerous factors led customers to mobile-wallet resistance (Swilley, 2010). According to Chung and Liang (2020), negative recommendations and comments about mobile wallets on websites of social commerce firms increase negative intentions for online purchases.

Moreover, there is an integration between the mobile wallet and the intentions of using m-commerce. The literature confirms that customers' increased use of mobile wallets enhances the use of m-commerce (Tun, 2020). Therefore, firms should reduce the resistance to using a mobile wallet in m-commerce to increase online trade exchanges (Sharma et al., 2018). Mobile wallet and perceived usefulness were significantly influenced behavior intention to use m-commerce (Shin, 2009). The resistance of potential consumers to mobile payments is related to the emotional and informational support provided by previous customers (Kaur et al., 2020). Therefore, a mobile wallet mediates the relationship between social support, presence and trust in m-commerce. Therefore, we proposed that:

Hypothesis 5: Mobile-wallet will mediate the relationship between social presence, support, and trust in m-commerce.

12. Control variables

The ability of m-commerce to customize services to users increases the benefits of such commerce. Consequently, age and gender affect trust in m-commerce. However, Leong et al. (2020a) found that education and gender influence customers' awareness of information processing, leading to increased trust in m-commerce. Education can increase trust in m-commerce by 4.6%. Therefore, educational level, gender and age of users play a control variable in m-commerce (Charron & Rothstein, 2016). Henceforth, we suggested the following conceptual framework (Figure 1).

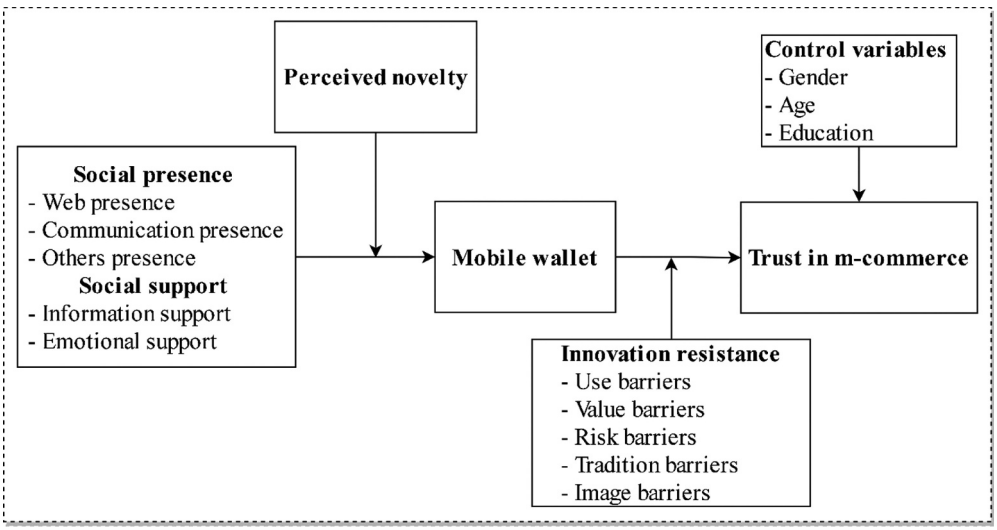

Figure 1. Conceptual framework of the study.

13. Research method

This section describes the data collection process, sample size, and measurements designed based on the previous literature. In addition, the statistical methods used in this study are described as shown in the following sections.

14. Data gathering process

This study was collect data by surveying users of m-commerce in Malaysia. The study's target population was m-commerce customers with experience in purchasing online via social media, including Instagram, Facebook, and Twitter in Malaysia. The samples were collected from four selected cities with the highest rate of internet use according to global reports (i.e., Kuala Lumpur, Penang, Langkawi, and Genting Highlands) because these cities have a high rate of visitors and tourism. The chosen cities contribute to above 50% of the total internet usage rate in Malaysia (Leong et al., 2020a). Three hundred forty-four questionnaires were answered completely by the female and male respondents from various education levels and age groups. In the pretest, the preliminary survey tool was appraised by eight persons who have worked as managers for more than ten years in m-commerce to verify the authenticity of the content, and some minor adjustments were made in line with their comments. Hence, the last survey was distributed to the respondents in two weeks in the selected locations shopping centers in Malaysia. The shopping interception technique was used through the following question, "have you participated in electronic commerce before?" The intention was to target m-commerce users, and the online survey was used because of the inability to reach the users due to COVID-19 and prevention measures. A total of 344 questionnaires administered were returned and accepted because they were correctly filled. Hair et al. (2011) affirmed the sample size of a study should be equal to or greater than ten times the formative indicators used in construction or greater than the number of structural paths directed in the structural model. The demographics profile of respondents were 41% male and 59% females, 43% of the respondents were between the ages 15 and 24, 36% between 25 to 34, 9% between 35 to 44, 7% between 45 to 54, and 5% between 55 and 64 years old, respectively. Regarding education, 15% obtained a secondary degree, 23% obtained a diploma, 36% obtained a bachelor, 25% obtained a postgraduate, and 1% have other qualifications. Concerning the m-commerce platform, 51% of the respondents used Facebook, 38% used Instagram, 1% used WhatsApp, 1% used Google and YouTube, and 9% used Twitter.

15. Data analysis in fuzzy

The Delphi method is a combination of the Delphi technique and fuzzy theory. Such a method was used to investigate experts' opinions who know the study sample's users' needs. Rowe and Wright (1999) affirmed this approach has been used to achieve "controlled feedback," "statistical group response," "anonymity," and "iteration." The number of experts in this method ranged from five to nine. Hence,15 experts have targeted their experience from 10 years or more and highly educated backgrounds. They have high-level management positions in electronic shopping centers by sending the questionnaire to experts to determine the most critical dimensions of innovation resistance theory. The questionnaires included all dimensions for innovation resistance theory, and the experts should determine the importance of each dimension based on the Likert scale. The scale started from 1 (not necessary at all) to 5 (very important). The following discussion explains the steps for data analysis in fuzzy (Krishnan et al., 2021).

Step 1: Assume that K experts are invited to determine the importance of the evaluation criteria and the ratings of alternatives concerning various criteria using linguistic variables. In this step, the linguistic options represent the expert feedback.

Step 2: Convert linguistic variables to triangular-fuzzy numbers.

Step 3: For each expert, use the vertex method to compute the distance between the average $\widetilde{r}_{ij}$ and $\widetilde{r}_{ij}^{k}$ and the distance between the average $\widetilde{w}_j$ and $\widetilde{w_j^k}$, where k = 1,.,k. The distance between two fuzzy numbers $\tilde{m}$ = ($m1$, $m2$, $m3$) and $\tilde{n}$ = ($n1$, $n2$, $n3$) is computed by:

$$d(\tilde{m},\ \tilde{n}) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]} \tag{1}$$

Step 4: According to (Chang & Hsu, 2011), if the distance between average and expert's evaluation data is equal to or low compared to a threshold of 0.2, it indicates that consensus is achieved. Also, in between m X n score of alternative and n criteria weight, if the per cent of consensus is more than 75%, jump to step 5; otherwise, repeat the steps (Chang & Hsu, 2011).

Step 5: Aggregate the fuzzy evaluations by:

$$\begin{aligned}\tilde{A} &= \begin{bmatrix} A_1 \\ \vdots \\ A_m \end{bmatrix} \text{ where } \widetilde{A}_i \\ &= \widetilde{r}_{i1} \otimes \widetilde{W}_1 \oplus \widetilde{r}_{i2} \otimes \widetilde{W}_2 \oplus \ldots \oplus \widetilde{r}_{in} \otimes \widetilde{W}_n\end{aligned} \tag{2}$$

I = 1, …, m

Step 6: For each alternative option, the fuzzy evaluation $\widetilde{A}_i = (a_{i1}, a_{i2}, a_{i3})$ is defuzzified by

$$a_i = \frac{1}{4}\left(a_{i1} + 2a_{i2} + a_{i3}\right) \tag{3}$$

The ranking order of alternative options can be determined according to the values of a_i.

16. Operationalization of measurements

The 5-point Likert scale was used, ranging from "strongly agree (5)" to "strongly disagree (1)." This scale was adopted because the rest of the scales have more options which may confuse the respondents filling out the questionnaire (Dawes,

2008). Social presence theory and social support theory were measured from Leong et al. (2020a) as a second order. Mobile-wallet resistance was measured using (Leong et al., 2020b). The perceived novelty was measured by adapting Wells et al. (2010) scale. Innovation resistance theory was measured by adapting five dimensions based on Hyunwoo (2009) as a second-order construct. Finally, trust in m-commerce was measured by adapting Ng (2013) scale.

This study adopted PLS-SEM to measure linear relationships between variables and used the ANN method to measure nonlinear relationships between constructs because of the inability of PLS-SEM to address nonlinear issues between variables. For PLS-SEM, the study has assessed the measurement model to confirm convergent and discriminate validity. Convergent validity involves Cronbach's alpha (CA), loading factors, average variance extracted (AVE), and composite reliability (CR), while discriminate validity includes Fornell–Larcker, HTMT, and cross-loadings. AVE value must be more than 0.7. CR value is 0.7 or above, and CA and loading factors should be more than 0.7. According to the loading factors value, we have excluded items for the social presence of the web (items 2 and 3), the social presence (item 2), mobile-wallet resistance (item 4), the usage barrier (1), value barrier (items 3 and 5), the risk barrier (items 4 and 5), and the traditional barrier (item 1).

The appendix shows all CR results were acceptable, indicating the validity of the measurement model (Hair et al., 2014). For assessing discriminative validity, the square roots of the AVE were all above the correlations between the latent combinations, proving adequate discriminatory validity (Hair et al., 2014). The correlation between the study variables indicates a positive relationship the variables. Besides, the relationships between all construct less than 0.9. Hence, there is no issue related to multicollinearity.

The results of testing the linear relationships between variables using PLS-SEM are presented in the analysis. Then, the ANN technique is adopted to validate the SEM results and capture the nonlinear interactions between the antecedents and the dependent variables. The ANN approach provides validation of essential parameters of the model. The sigmoid functions were utilized as activation functions. The neural network algorithm was conducted using a ten-fold ANN analysis to avoid the possible issue of over-fitting with ten per cent of the data utilized for testing and the residual data utilized for training procedures. The mean root square of the error (RMSE) was used to measure the predictive accuracy of the ANN model in line with Leong et al. (2020b).

In this study, the multi-layer perceptron with the Feedforward-Back Propagation algorithm was used. The error signals are represented in the reverse direction, this includes three layers (Input Layer, Hidden Layer, and Output Layer) whilst the inward signals are fed in the forward direction. Each layer consists of neurons interconnected with the neurons of the other layers. The signal is nourished onward through the concealed layer from input to output. Each neuron computes its output from an input vector. The balances are represented by input component-i, and Wji denotes the hidden neuron-j, the weights linking the concealed neuron-j to the output neuron-k are denoted by V_{kj}. More specifically, for the j-th hidden neuron,

$$net_j^h = \sum_{i=1}^{N} Wji\, x_i \text{ and } Y_i = f\left(net_j^h\right) \tag{4}$$

For the k-th output neuron,

$$net_k^0 = \sum_{j=1}^{J+1} V_{kj} y_j \text{ and } o_k = f\left(net_k^0\right) \tag{5}$$

A practical x-function (Eq. 3) is used with a parameter to process the color gamut for a function that ranges from 0 to 1, a monotonic and differentiable increment. The weight modification formula will be utilized for the output layer weights V using Eq. (4), where the concealed layer weights will be extracted using Eq. (5). The d_{pk} represents the desired output from neuron-k, while o_{pk} represents the true output of neuron-k of the input type. Weights are reduced in this way to reduce the square of the sum of the SSE Equations (6, 7, 8, and 9) across training modes for some of the pre-defined tolerance levels.

$$f(net) = \frac{1}{1+e^{-\lambda net}} \tag{6}$$

$$V_{kj}(t+1) = v_{kj}(t) + c\lambda(d_k - o_k)o_k(1-o_k)y_i(t) \tag{7}$$

$$W_{ji}(t+1) = W_{ji}(t) + c\lambda^2 y_j\left(1-y_j\right)x_i(t) \left(\sum_{k=1}^{k}(d_k - o_k)o_k(1-o_k)V_{kj}\right) \tag{8}$$

$$SSE = \frac{1}{2P}\sum_{p=1}^{p}\sum_{k=1}^{k}(d_{pk} - o_{pk})^2 \tag{9}$$

17. Findings

This section explains data analysis and includes three steps. The first step involved the application of Fizzy Delphi to determine the dimensions of resistance to innovation. The second step involved applying the PLS-SEM method. The third step included the results of the ANN analysis.

18. Fuzzy analysis

The Delphi method combines the Delphi technique and fuzzy theory. The Fuzzy Delphi method is used to investigate the opinions of experts who know the users' needs. It seeks expert consensus using a Likert scale questionnaire format. The linguistic variables were converted into a fuzzy scale. The analysis result showed the overall average group consensus was 79%, which makes this iteration accepted. If the average group consensus is greater than 75%, then a consensus was achieved. Suppose less than 75%, and another survey iteration is required since the consensus was not achieved (Chang & Hsu, 2011). The scores were converted into fuzzy numbers derived from a mathematical fuzzy Delphi formula. The following figure was reached based on fuzzy results, which indicates the most critical acceptable and rejected dimensions.

Figure 2 shows the proposed conceptual framework of this paper. Figure 2 shows that the threshold (d) value equals the distance between the average fuzzy evaluation and the expert's evaluation. Decisions are made based on the value of if d is lesser than the threshold of 0.2, then this parameter will be accepted. Finally, Fuzzy includes stabilizing expert opinions, which

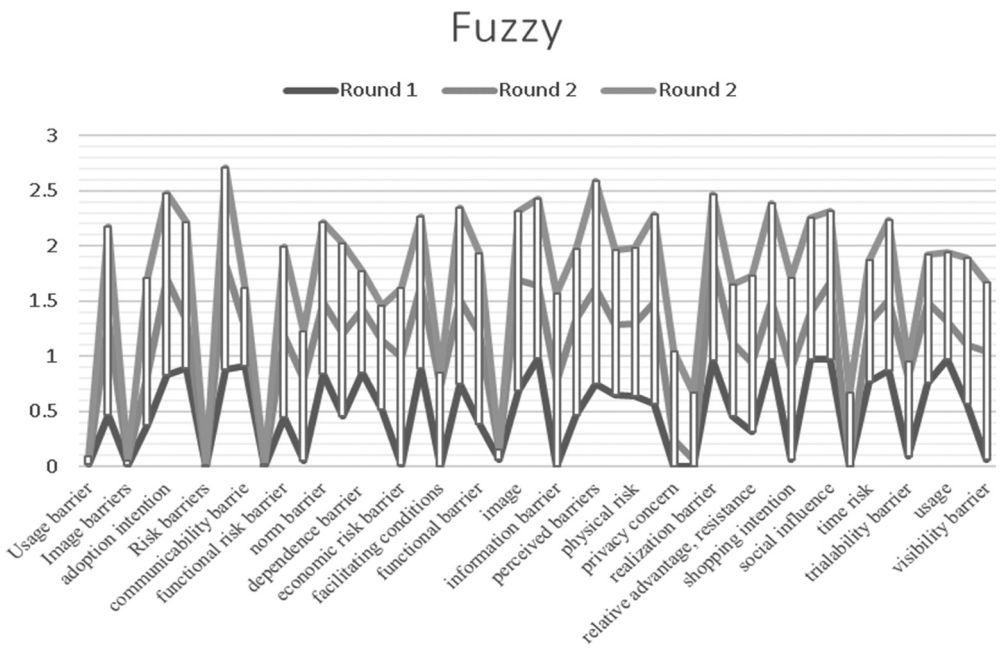

Figure 2. Rejected and accepted parameters based on a threshold value (d).

prepared Fuzzy's three rounds to reach stability (Dawood et al., 2021).

19. PLS path analysis

This study examined the structural model through the SmartPLS utilizing 5,000 introductory samples. Based on previous studies, the second-order method was used in the analysis because the previous studies indicated the study variables are in second order (Leong et al., 2020a, 2020b). The results presented in Table 1. indicates social presence (β = 0.248, p = .000), social support (β = 0.192, p = .000), and Mobile-wallet resistance (β = −0.232, p = .000), significant impacts on trust in m-commerce. In addition, the relationship between social presence, support would be stronger when perceived novelty was high (β = −0.139, 0.123, p = .009, 0.019). The innovation resistance did not moderate the relationship between mobile wallet and trust in m-commerce (β = 0.015, p = . 253). Likewise, the control variables, gender (β = 0.137, p = .240), age (β = 0.040, p = .285), and education (β = 0.238, p = .102) have no impact on trust in m-commerce as presented in Table 1. Besides, the result shown the innovation resistance mediate the relationship between social present, support and trust in m-commerce (β = 0.248, p = .072; β = 0.192, p = .063) respectively. Findings show the coefficient of determination (R^2). This study contains only one internal variable, which is "trust in mobile commerce" as shown in Table 1, the value of R^2 is 0.798. This result shows the exogenous constructs explain about 79.8% of the dependent variable.

20. Artificial neural network (ANN)

To analyze the neural network, SEM was combined with ANN by hypothesis testing with PLS-SEM. The sigmoid functions were used for activation functions and outcome layers. Through many phases of the learning procedure, faults can be reduced and prediction accuracy improved. We determined 90% to training operations, and the rest of the samples were used for testing. The mean root square of the error RMSE was used to measure the predictive precision of the ANN model (Leong et al., 2020b). Table 2. shown 0.8703 and 0.8199 are the RMSE values for training and testing, respectively. There is a slight difference between the training and testing values for the study variables. At the same time, the sensitivity analysis represents an assessment of each predictor's contribution to trust in m-commerce. The relative importance was calculated regarding the percentage, based on the relative importance of each inserted neuron divided by the most significant relative importance. The results indicate that social support, the most important predictor of trust in m-commerce, is social presence, mobile-wallet resistance, and perceived novelty. The mobile-wallet resistance is one of the main contributing predictors, following by perceived novelty, social presence, and social support. The concealed neurons of H (1:3) are the primary contributing cells, while those of H (1:2) are the most inhibitive neurons, and next is H (1:1). Lastly, the goodness-of-fit index Eq. (10) was calculated. This is similar to R2 in SEM.

$$R^2 = 1 - \frac{RMSE}{S_y^2} \tag{10}$$

Where S_y^2 is the variance favored outcome in line with the average of SSE, and the finding indicates that the ANN model predicts 94.80% trust in m-commerce.

Tables 3 and 4. indicated social support. Social presence, mobile-wallet resistance, and perceived novelty are the most crucial predictor of trust in mobile commerce.

Table 1. Hypotheses results.

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values	Result
SPT -> MWR	0.248	0.25	0.066	3.774	0.000	Supported
SST -> MWR	0.192	0.193	0.05	3.849	0.000	Supported
MWR -> TMC	−0.232	−0.23	0.026	8.84	0.000	Supported
Moderating effect						
PN * SPT -> MWR	−0.139	−0.139	0.053	2.614	0.009	Supported
PN * SST -> MWR	0.123	0.122	0.052	2.357	0.019	Supported
IRT * MWR -> TMC	0.015	0.016	0.013	1.145	0.253	**Unsupported**
Control variables						
Gender -> TMC	0.137	0.051	0.069	1.901	0.240	**Unsupported**
Age -> TMC	0.040	0.045	0.047	1.364	0.285	**Unsupported**
Education -> TMC	0.238	0.044	0.061	0.913	0.102	**Unsupported**

Mediating effect	**Path a**	**Path b**	**Indirect Effect**	**SE**	**t-value**	**95% LL**	**95% UL**	**Result**
SST -> MWR-> MWR	0.248	−0.232	−0.058	0.066	3.774	−0.187	0.072	Supported
SPT -> MWR-> MWR	0.192	−0.232	−0.045	0.055	3.849	−0.152	0.063	Supported

IV	**R^2**	**R^2 Adjusted**
Trust in mobile commerce	0.798	0.796

SPW = Social presence of Web; SPI = Social presence of Interaction; SPO = Social presence of Others; SPT = Social presence Theory; IS = Information Support; ES = Emotional Support; SST = Social Support Theory; MWR = Mobile-wallet resistance; PN = Perceived Novelty; UB = Usage Barrier; VB = Value Barriers; RB = Risk Barrier; TB = Tradition Barrier; IB = Image Barrier; TMC = Trust in mobile commerce.

Table 2. The RMSE for training and testing processes in a ten-fold ANN.

	Input neurons: SPT, SST, NP						Input neurons: MWR						
	Output nodes: MWR						Output nodes: TMC						
	Training			Testing			Training			Testing			
Neural Network	N	SSE	RMSE	N	SSE	RMSE	N	SSE	RMSE	N	SSE	RMSE	Total
1	321	140.756	0.8130	23	10.404	0.8695	308	142.926	0.8701	36	16.836	0.9166	344
2	313	127.620	0.6357	31	12.742	0.8064	309	141.577	0.8538	35	15.930	0.8285	344
3	311	116.184	0.5787	33	12.852	0.6363	313	145.272	0.8690	31	14.436	0.9354	344
4	305	112.030	0.5540	39	15.568	0.6410	316	147.248	0.8860	28	12.916	0.7500	344
5	321	118.505	0.5295	23	7.223	0.3913	316	147.472	0.8797	28	13.123	0.8214	344
6	312	122.496	0.6153	32	13.155	0.7812	305	141.910	0.8786	39	18.196	0.8461	344
7	299	125.560	0.7023	45	18.999	0.7111	314	146.217	0.8853	30	13.852	0.7666	344
8	314	138.764	0.7643	30	13.577	0.7333	315	145.096	0.8503	29	13.211	0.6896	344
9	308	129.715	0.6623	36	15.325	0.7500	306	141.650	0.8725	38	17.333	0.8157	344
10	310	136.044	0.7967	34	14.944	0.7647	297	137.531	0.8585	47	21.706	0.8297	344
Mean		126.767	0.6651		13.478	0.7084		143.689	0.8703		15.753	0.8199	
SD		9.2316	0.0958		3.0005	0.1251		3.1294	0.0126		2.8261	0.0732	

SPT = Social presence Theory; SST = Social Support Theory; MWR = Mobile-wallet resistance; PN = Perceived Novelty; TMC = Trust in mobile commerce; N = number of data; SSE = sum square of error, RMSE = Root Mean Square of Error.

21. Discussion

This study aims to model and evaluate trust in mobile commerce by adopting a hybrid three-station Fuzzy Delphi, structural equation modeling, and neural network approach. The results of Fuzzy Delphi validated usage barrier, value barrier, risk barrier, tradition barrier, and image barriers as the essential dimension of resistance to innovation. However, the findings of the PLS-SEM method confirmed the relationship between the social present, support and trust in m-commerce. The relationship between the social present, support and trust in m-commerce was strong when perceived novelty was high. In addition, there is a relationship between mobile wallets and trust in m-commerce. The mobile wallet mediates the relationship between the social present, support and trust in m-commerce. Finally, innovation resistance did not moderate the relationship between wallet mediates and trust in m-commerce. On the other hand, the ANN method showed social support, the most important predictor of trust in m-commerce, social presence, mobile-wallet resistance, and perceived novelty.

Findings show social presence and social support have a non-linear relationship with trust in m-commerce. This finding is consistent with the previous studies(Leong et al., 2020a, 2020b). The findings indicate that perceived novelty's interaction with social presence theory and social support influence mobile wallets. Consumers' perceptions of social presence and social support interacting with a perceived novelty. Thus, when consumers realize the mobile wallet is innovative and unique, they will become interested in adopting such a technique in the payment process. Hence, Positive customer recommendations and reviews will make potential customers who use a mobile wallet in m-commerce less hesitant. The findings are in line with previous studies from European and Asian studies (Leong et al., 2020b; Mani & Chouk, 2017). There is a similarity between the results achieved in Malaysia and France, though with different cultural backgrounds. Surprisingly, there is little interaction between innovation resistance theory and mobile-wallet resistance in influencing trust in mobile commerce. This result was interesting since mobile wallet users in Malaysia have positive reactions toward adopting electronic payment services in m-commerce operations.

There is a noticeable increase in m-commerce firms in Malaysia, such as grab, food panda, and others. Moreover,

Table 3. Sensitivity analysis.

	Relative importance			
Neural Network	SPT	SST	PN	MWR
1	0.2815	0.3151	0.2019	0.2014
2	0.3517	0.3294	0.1427	0.1762
3	0.3135	0.3400	0.1592	0.1872
4	0.3168	0.3877	0.1318	0.1637
5	0.3263	0.2452	0.1989	0.2295
6	0.2353	0.2529	0.2551	0.2566
7	0.1594	0.3459	0.1702	0.3245
8	0.2928	0.2712	0.2325	0.2035
9	0.2617	0.2955	0.2164	0.2264
10	0.3069	0.3493	0.2047	0.1391
Mean relative importance	0.2845	0.3132	0.1913	0.2108
Normalized importance (%)	87.9%	100.0%	58.6%	39.8%

Notes: SPT = Social presence Theory; SST = Social Support Theory; PN = Perceived Novelty; MWR = Mobile-wallet resistance

Table 4. Average weights of the input and hidden neurons in the ten-fold ANN.

Parameter Estimates						
		Predicted				
		Hidden Layer 1			Output Layer	Total contribution
Predictor		H (1:1)	H (1:2)	H (1:3)	TMC	
Input Layer	(Bias)	1.487	−1.029	−1.056		0.201
	SPT	0.050	0.740	0.308		0.107
	SST	−0.307	0.131	0.606		0.091
	PN	−0.933	−0.630	0.777		0.245
	MWR	−0.801	−1.790	0.758		0.342
Hidden Layer 1	(Bias)				−0.523	
	H (1:1)				−1.675	
	H (1:2)				1.647	
	H (1:3)				2.018	

SPT = Social presence theory; SST = Social support theory; MWR = Mobile-wallet resistance; PN = Perceived novelty; TMC = Trust in mobile commerce.

the findings of the study indicate emotional support has little impact on trust in mobile commerce. The users have emotional stability and are not easily affected by emotional support from others. Regarding education, gender, and age as controlling variables, the results of the study show there is no effect of these variables on trust in mobile commerce. The effect of such variables on the trust in mobile commerce was due to of growth and development of social media (Charron & Rothstein, 2016). Therefore, trust in mobile commerce is not affected by demographic variables in the context of this study. The spread of social media has led to an increase in customers' trust in m-commerce, regardless of age and gender. This argument is consistent with the previous literature (e.g., Charron & Rothstein, 2016; Leong et al., 2020a).

However, more communication increases trust in m-commerce amongst users. Users make emotional decisions in the e-purchase process. Meeting the needs of customers in m-commerce platforms reduces the costs of using a mobile wallet. Such results show customer resistance is low. Therefore, customers' reactions to m-commerce in Malaysia are positive. There is an increase in the purchase of goods and services without concern. This will reduce their resistance due to a lack of monetary risks. Therefore, mobile wallet resistance plays a vital role between social presence and social support in influencing trust in m-commerce.

Moreover, it was proved the moderator role of perceived novelty has a significant impact on trust in m-commerce to increase positive perceptions of positive attitudes and perceived rewards associated with the products perceived by users. The relationship between customers' perceptions of trust in m-commerce is a complex process that linear relationships cannot explain. Nonlinear relationships presented insights to practitioners and academics about the determinants of trust in m-commerce. The nonlinear relationships confirmed the increase in scams, and the suspension of social networking sites increases the negative perceptions of customers to create a state of mistrust in m-commerce. In addition, providing more information by customers increases the trust of potential customers in m-commerce. Customers' realization m-commerce is unique and superior, and high social support increases trust in social commerce. The construct of m-commerce firms must be compatible with the habits and values of customers. In addition, m-commerce operations must be simplified and perceived risks reduced. Finally, social commerce firms should provide offers in m-commerce that are less expensive compared to traditional commerce. Such factors are vital to increasing the positive intentions of customers in using m-commerce.

22. Theoretical and practical implications

In terms of theoretical contribution, the model of the current study provides a new dimension to the studies on trust in m-commerce, unlike previous studies that focused on a single theory such as social presence theory (Leong et al., 2020a; Lu, Fan et al., 2016; Alnoor et al., 2020), or social support theory (Shanmugam et al., 2016). A theoretical contribution to this study was the use of several social commerce sites. Therefore, the results can be generalized by providing an in-depth view of the academics for modeling and evaluating trust in mobile commerce. Moreover, the demographic variables (education, age, and gender) used have proved through empirical evidence that these variables have a limited role in increasing trust in m-commerce. The results could provide a new understanding regarding the precedents of trust in m-commerce by wholesalers or retailers. Hence, this study identified the most important dimensions of resistance to innovation. Academics can adopt such dimensions and investigate the impact of resistance to innovation factors on trust in m-commerce. By adopting a hybrid model of deep learning, we verify the results of PLS-SEM and identify the contribution of each construct to trust in m-commerce. We conduct a hybrid three stages Fuzzy Delphi, SEM, and ANN approach. Moreover, this study contributed to the literature by identifying the most influential precedents in m-commerce.

We provide many practical and managerial contributions related to trust in m-commerce. First, mobile wallet is the most critical factor in predicting trust in m-commerce. More focus should be given to it. Managers should pay attention to this payment method, which will enable users to make payments electronically using a mobile. The new method of payment can replace the traditional methods of electronic business transactions. Second, the mobile wallet is a critical factor in shaping the policies of building trust in m-commerce by giving users rewards represented by a set of points credited to the mobile wallet user account. Such rewards enable users to get a discount depending

on the amount of wallet usage. Third, managers may consider mobile wallets as a critical factor in making decisions related to social commerce innovation. Fourth, this study encourages managers and academics to investigate the use of an electronic control panel that includes information about customer problems. Such innovative options help social commerce firms improve trust in m-commerce and get first-hand information to solve users' problems.

Managers of social commerce firms should create forums and form chat groups over the internet that allow users to post questions, answer, and get advice, recommendations, and answers to their issues. The marketers and advertisers in m-commerce should develop more support for users in their strategies by introducing the product, functions, features, a statement of advice and other information that clarifies the solution to the problems of using the product or service. Managers and marketers should provide sufficient information and support to users regarding products and services. They may add information regarding the number of purchasers who have purchased a specific brand and the number of online operators who have indicated an interest in the brand. The previous buyers can share their experiences of the product on a social commerce platform. Finally, managers of m-commerce should offer moral care as one of their social responsibilities to the company. Such support allows building trust in m-commerce because contributing to society has an essential role in building the company's value more significant than achieving profitability and revenue goals.

23. Claim points of research limitation and future directions

As a cross-sectional study, the results of the study were limited. Future studies should focus on applying a longitudinal approach to explore temporal effects. The context of the study was also in one country (Malaysia) due to the global COVID-19 crisis, which affects the process of generalizing the results. It is necessary to conduct comparative studies across different cultures to examine the impact of demographic variables based on different cultures. We have considered three theories that are related to customer attitudes. Future literature could adopt such factors with technology acceptance models to investigate nonlinear relationships in the context of an extended technology acceptance model. Therefore, future studies should explore trust in m-commerce from a different approach using social bond theory and social network theories. This study adopted PLS-SEM with ANN approach to explore causal and nonlinear relationships. Future studies may adopt multi-PLS-SEM in terms of the ANN model to discover the differences and similarities between different groups or countries in the context of m-commerce.

24. Conclusion

This study uses a hybrid three-stage Fuzzy Delphi, structural equation modelling, and neural network method to model and evaluates trust in m-commerce. A survey was conducted for several customers of m-commerce in Malaysia. The study population was m-commerce customers with experience purchasing online via social media, including Instagram, Facebook, and Twitter in Malaysia. The samples size was collected from four selected cities (i.e., Kuala Lumpur, Penang, Langkawi, and Genting Highlands) because these cities have a high rate of visitors and tourism. The Fuzzy Delphi findings confirmed the most significant dimensions of resistance to innovation are use barriers, value barriers, risk barriers, tradition barriers, and image barriers. The PLS-SEM technique validated the relationship between social presence, support, and trust in m-commerce. When perceived novelty was high, the relationship between social presence, support, and trust in m-commerce was significant.

Additionally, there is a relationship between mobile wallets and m-commerce trust. The mobile wallet mediates the relationship between social presence, support, and trust. Finally, resistance to innovation did not affect the link between mobile wallets and m-commerce trust. On the other hand, the ANN approach revealed that social support is the most significant predictor of m-commerce trust, social presence, resistance to mobile wallets, and perceived novelty.

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Appendix A. Collinearity statistics

	Tolerance	VIF
Social presence Theory	.543	1.263
Social Support Theory	.207	1.274
Mobile-wallet resistance	.328	1.216
Perceived Novelty	.625	1.201
Innovation resistance theory	.104	1.200
Trust in mobile commerce	.395	1.593

Appendix B. Results of measurement model

No.	Items	Loading	Cronbach's Alpha	CR	AVE
	Social presence Theory		0.853	0.736	0.748
	Social presence of Web		0.770	0.745	0.528
1	Human interaction in the web of the s-commerce seller	0.736			
2	Personalness in the web of the s-commerce seller	0.164			
3	Sociability in the web of s-commerce seller	0.176			
4	Human warmth in the web of the s-commerce seller	0.717			
5	Human sensitivity in the web of the s-commerce seller	0.880			
	Social presence of Communication		0.711	0.767	0.555
1	Character of sellers by interacting with them via s-commerce	0.712			
2	Networking via s-commerce makes me evaluate them	0.462			
3	Human touch to communicate with sellers via s- commerce	0.724			
4	Interaction via s-commerce was sincere	0.779			
	Social presence of Others		0.791	0.786	0.551
1	Many other buyers feel interested in the brand in s-commerce	0.796			
2	Many other buyers sharing information regarding the brand in s-commerce	0.777			
3	Many others who bought the brand through s-commerce	0.750			
	Social Support Theory		0.783	0.836	0.682
	Information Support		0.762	0.766	0.528
1	Some people would offer recommendations when I needed help	0.754			
2	Some people on the s-commerce site would give information to help me overcome any issue	0.886			
3	Some people on the s-commerce site would help me find the cause and offer me with suggestions, if necessary	0.711			
	Emotional Support		0.790	0.751	0.521
1	Some people on the s-commerce site are on my side with me if any issue	0.703			
2	Some people on the s-commerce site comforted and encouraged me if any issue	0.759			
3	Some people on the s-commerce site expressed interest and concern in my well-being if any issue	0.938			
	Mobile-wallet resistance		0.716	0.797	0.588
1	I am afraid of wasting my time using m-wallet services	0.746			
2	It is doubtful that I use m-wallet services soon	0.726			
3	M-wallet services are not for me	0.729			
4	I do not need m-wallet services	0.273			
	Perceived Novelty		0.775	0.869	0.689
1	I find using m-wallet services to be an innovative experience	0.834			
2	Using m-wallet services is new and inspirational	0.854			
3	M-wallet services represent a fast and novel way of making payment	0.802			
	Innovation resistance theory		0.763	0.780	0.692
	Usage Barrier		0.767	0.720	0.509
1	M-wallet services are difficult to use	0.438			
2	The use of m-wallet services is problematic	0.774			
3	M-wallet services are slow to use	0.784			
4	The process in m-wallet services is uncertain	0.869			
	Value Barriers		0.719	0.814	0.570
1	The use of m-wallet services is inefficient	0.761			
2	M-wallet services do not offer any rewards compared to cash payments	0.764			

(*Continued*)

(Continued).

No.	Items	Loading	Cronbach's Alpha	CR	AVE
3	The use of m-wallet services does not increase capability to control financial matters	0.493			
4	M-wallet services are not a good substitute for traditional cash payment	0.705			
5	M-wallet services do not remove the constraint of time when conducting the transactions	0.481			
	Risk Barrier		0.728	0.757	0.522
1	I fear making any mistakes in the process of using m-wallet services	0.793			
2	I fear entering the wrong information when using m-wallet services to make payment	0.796			
3	I fear the battery of the electronic devices will run out or the connection will otherwise be lost when using m-wallet services	0.800			
4	I fear the exposure of privacy to the third party when using m-wallet services	0.414			
5	I fear unreasonable or fraudulent charges if using m-wallet services	0.196			
	Tradition Barrier		0.722	0.783	0.502
1	I feel impatient with m-wallet services	0.284			
2	I prefer engaging in physical interaction when purchasing goods and services	0.773			
3	I prefer face-to-face forms of payment	0.780			
4	I prefer buying things online	0.848			
	Image Barrier		0.757	0.854	0.662
1	I have a negative image of m-wallet services	0.750			
2	New technology is too complex to be useful	0.894			
3	I have such an image that m-wallet services are problematic to use	0.790			
	Trust in mobile commerce		0.749	0.834	0.504
1	The seller in s-commerce is dependable	0.763			
2	I trust that the s-commerce seller keeps my best interests in mind	0.768			
3	This s-commerce seller will keep its promises	0.754			
4	I believe in the data that this s-commerce seller offers	0.544			
5	This s-commerce seller desires to be known as an officer that keeps his promises	0.696			

Appendix C. Discriminant validity of constructs

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SPW	0.649												
2. SPI	0.221	0.813											
3. SPO	0.551	0.097	0.727										
4. IS	0.464	0.501	0.166	0.623									
5. ES	0.163	0.653	0.204	0.510	0.830								
6. MWR	0.242	0.263	0.196	0.343	0.206	0.650							
7. PN	0.300	0.074	0.259	0.293	−0.120	0.234	0.674						
8. UB	0.272	−0.013	0.329	0.270	−0.045	0.195	0.403	0.743					
9. VB	0.394	0.080	0.351	0.242	−0.031	0.183	0.534	0.362	0.573				
10. RB	0.216	0.676	0.259	0.556	0.966	0.24	−0.047	0.018	0.047	0.708			
11. TB	0.279	0.273	0.307	0.264	0.292	0.535	0.109	0.301	0.071	0.331	0.710		
12. IB	0.269	0.679	0.237	0.385	0.473	0.418	0.048	0.113	0.056	0.513	0.314	0.639	
13. TMC	0.272	0.279	0.285	0.293	0.315	0.562	0.127	0.302	0.079	0.355	0.455	0.573	0.685

SPW = Social presence of Web; SPI = Social presence of Interaction; SPO = Social presence of Others; SPT = Social presence Theory; IS = Information Support; ES = Emotional Support; SST = Social Support Theory; MWR = Mobile-wallet resistance; PN = Perceived Novelty; UB = Usage Barrier; VB = Value Barriers; RB = Risk Barrier; TB = Tradition Barrier; IB = Image Barrier; TMC = Trust in mobile commerce.

Appendix D. Descriptive Statistics and Correlation

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SPW	3.342	1.322	1.000												
2. SPI	3.426	1.345	0.421	1.000											
3. SPO	3.232	1.375	0.321	0.313	1.000										
4. IS	3.224	1.477	0.097	0.567	0.646	1.000									
5. ES	3.542	1.245	0.647	0.766	0.345	0.235	1.000								
6. MWR	3.754	1.388	0.327	0.645	0.643	0.274	0.646	1.000							
7. PN	3.484	1.597	0.121	0.332	0.232	0.364	0.245	0.236	1.000						
8. UB	3.745	1.376	0.223	0.123	0.334	0.475	0.522	0.633	0.452	1.000					
9. VB	3.234	1.243	−0.537	0.320	0.557	0.368	0.573	0.632	0.236	0.120	1.000				
10. RB	3.752	1.352	0.964	0.234	0.864	0.864	0.442	0.097	0.532	0.542	0.236	1.000			
11. TB	3.452	1.350	0.672	0.532	0.246	0.335	0.064	0.357	0.247	0.230	0.670	0.052	1.000		
12. IB	3.220	1.336	0.315	0.346	0.436	0.664	0.127	0.853	0.363	0.357	0.128	0.127	0.106	1.000	
13. TMC	3.557	1.293	−0.009	0.119	0.653	0.356	0.753	0.247	0.247	0.095	0.094	0.052	0.412	0.368	1.000

$P < .05$ (2-tailed).

Notes: SPW = Social presence of Web; SPI = Social presence of Interaction; SPO = Social presence of Others; SPT = Social presence Theory; IS = Information Support; ES = Emotional Support; SST = Social Support Theory; MWR = Mobile-wallet resistance; PN = Perceived Novelty; UB = Usage Barrier; VB = Value Barriers; RB = Risk Barrier; TB = Tradition Barrier; IB = Image Barrier; TMC = Trust in mobile commerce

Appendix E. Relevance of predictor variables based on at least one non-zero synaptic weight with hidden neurons

	Neural networks									
Input Variables	NN1	NN2	NN3	NN4	NN5	NN6	NN7	NN8	NN9	NN10
SPT	X	X	X	X	X	X	X	X	X	X
SST	X	X	X	X	X	X	X	X	X	X
PN	X	X	X	X	X	X	X	X	X	X
MWR	X	X	X	X	X	X	X	X	X	X

Notes: SPT = Social presence Theory; SST = Social Support Theory; PN = Perceived Novelty; MWR = Mobile-wallet resistance