



CRACKING THE CODE: WHAT MAKES MALAYSIAN MILLENNIALS EMBRACE MOBILE TECHNOLOGY?

**Vanitamalar Perumal,
Shariffah Haszeqah Bt S. Jainal Abdibin,
Mohanantass Permal,
Kumaran Kanapathipillaiⁱ**

Faculty of Business and Technology,
UNITAR International University,
Tierra Crest, Jalan SS6/3,
Kelana Jaya, 47301 Petaling Jaya,
Selangor, Malaysia

Abstract:

The rapid growth of mobile shopping and the increasing use of smartphones and tablets for e-commerce transactions make understanding consumer acceptance crucial for businesses and app developers. This study investigates the factors influencing mobile technology acceptance among millennials in Malaysia, focusing on security, perceived ease of use, perceived usefulness, and the cost of operations. This research highlights the importance of addressing these dimensions for businesses and application developers to maintain millennials' interest in mobile technologies and remain competitive. A sample size of 384 millennial participants, selected using purposive sampling, contributed to the analysis of this study, which was collected using self-administered questionnaires. The data were analysed using SPSS version 28. The findings reveal that security and perceived usefulness significantly influence millennials' engagement with mobile technology. However, two dimensions, the perceived ease of use and the perceived cost of operations do not significantly impact mobile technology adoption. Therefore, this study offers valuable insights for organisations to develop effective mobile technology strategies and enhance millennial consumers' engagement with mobile technologies.

Keywords: mobile technology acceptance, security, perceived usefulness, perceived ease of use, cost of operations, millennials

1. Introduction

Mobile shopping has become increasingly popular due to advancements in electronic devices and the widespread use of smartphones and tablets. Consumers make more retail

ⁱ Correspondence: kumar.erapintar@gmail.com

purchases through mobile devices, particularly smartphones, which account for over a third of all e-commerce transactions. However, mobile shopping is not equally popular across all goods and service contexts, with higher usage for purchasing tickets and lower usage for financial products.

Mobile shopping also has a lower conversion rate compared to traditional web-based interfaces. Consumers in most nations make mobile retail purchases through smartphones in the business-to-consumer industries, which account for more than a third of all e-commerce transactions (Criteo, 2015). Simultaneously, smartphones are the primary growth engine in mobile e-commerce transactions (Criteo, 2015).

Mobile shopping has significantly impacted customers' lives, enabling them to order, search for, compare, and pay for goods and services online via mobile devices. However, mobile shopping remains unpopular in Malaysia, and people still prefer in-store purchases due to concerns about product quality and lack of security. Mobile shopping applications collect customer information, making them vulnerable to cyber threats. Given these concerns, the study aims to investigate the factors that impact the uptake of mobile shopping.

1.1 Research Problem Statement

Current research on mobile payments mainly focuses on technology and consumer perspectives (Lu et al., 2011; Sulaiman et al., 2017). Mobile payments are commonly used in various scenarios, including digital content, tickets, parking tickets, shipping fees, and electronic payment services for bills or invoices (Lu et al., 2011). Payments for goods can be made through vending machines or points of sale (POS) (Lu et al., 2011). However, there is a need to explore the relationship between mobile payments and traditional methods, examine mobile services for B2B commerce, and conduct more empirical research to understand better mobile payment service markets (Lu et al., 2011). Researchers also suggest that business models shift towards cooperative and standardized solutions for success rather than proprietary ones (Lu et al., 2011).

Lu et al. (2011) developed a model to examine the impact of Chinese consumers' confidence in Internet payment services on their initial trust in outsourced mobile payment services. The model considers the interaction of positive and negative factors affecting adoption. The study found that initial confidence significantly influences consumers' intentions to use mobile payment services directly and indirectly. Cost and risk reduction perceptions also affect these intentions. Notably, the study revealed significant differences in the effects' magnitude between students and workers.

E-commerce significantly influences online shopping, especially for fashion items in Malaysia. E-commerce is well-known, but its implementation is limited in many small enterprises. Large firms have successfully adopted e-commerce, while small businesses remain hesitant (Sulaiman et al., 2017). Understanding factors influencing consumer online buying behaviour and mobile app acceptability is crucial for boosting e-commerce (Sulaiman et al., 2017). Marketers must comprehend consumer behaviour during online purchases to gain a competitive advantage and identify factors encouraging the adoption of mobile apps to meet customer demand.

Despite the widespread use of mobile applications in Malaysia, understanding customer adoption for online shopping still needs to be improved. Identifying variables encouraging mobile app adoption for shopping and factors influencing behavioural intentions is essential (Sulaiman et al., 2017). This study seeks valuable insights for merchants and app developers, enabling them to compete in the market and better align their offerings with consumer needs, especially those of millennials (Sulaiman et al., 2017).

Additionally, several gaps in the literature need to be bridged to prove the hypothesis developed for this study. There is evidence of significant and insignificant findings regarding the relationship between security, perceived ease of use, perceived usefulness, and cost of operations and mobile technology acceptance, discussed in the literature review.

1.2 Research Questions

RQ1: Is there a statistically significant relationship between security and mobile technology acceptance?

RQ2: Is there a statistically significant relationship between ease of use and mobile technology acceptance?

RQ3: Is there a statistically significant relationship between perceived usefulness and mobile technology acceptance?

RQ4: Is there a statistically significant relationship between the cost of operations and mobile technology acceptance?

1.3 Research Objectives

RO1: To investigate if there is a statistically significant relationship between security and mobile technology acceptance.

RO2: To examine if there is a statistically significant relationship between ease of use and mobile technology acceptance.

RO3: To scrutinize if there is a statistically significant relationship between perceived usefulness and mobile technology acceptance.

RO4: To examine if there is a statistically significant relationship between the cost of operations and mobile technology acceptance.

2. Theoretical Underpinning, Literature Review and Hypothesis Development

The following sub-sections focus on the theoretical underpinning, literature and hypotheses development.

2.1 Theoretical Underpinning – Technology Acceptance Model

This study uses the Technology Acceptance Model (TAM) by Davis (1989) and its application to mobile technology acceptance. As the COVID-19 pandemic accelerated, retailers and consumers adapted to the digital transformation in Malaysia by creating virtual stores to connect producers and consumers (The Straits Times, n.d., 2020). TAM,

which explores human factors affecting technology adoption, is a widely used model that considers perceived usefulness and ease of use as crucial factors influencing intention and use (Dillon & Morris, 1996; Lee et al., 2003; Silva, 2005).

2.2 Literature Review and Hypotheses Development

The following section provides the relevant literature that led to the development of the hypotheses for this study.

2.2.1 Mobile Technology Acceptance

Technology has diffused vastly into all sectors of our economy (Alkafagi et al., 2019). Companies and consumers have been forced to adapt to technological changes as competition for quality and speed has increased. Consumers and telecommunication industries, which form the most prominent market enterprises, have also been impacted by this change. Implementing online forums or mobile applications by companies such as Amazon, PayPal, Apple, and Samsung allow consumers to purchase in the comfort of their homes via mobile technologies.

Moreover, the devastating killer pandemic has impacted all business sectors. Therefore, many ventures need help to sell their merchandise, resulting in online techniques to increase their marketing potential (Benedict et al., 2020). Retailers were trying to provide consumers with the best online shopping experience through mobile technologies during this time. To achieve the intended quality of services, retailers must enhance the security, perceived ease of use, perceived usefulness, and cost of operations of mobile technologies to win their customers.

Additionally, during the coronavirus pandemic, e-commerce retailers in Southeast Asia have seen a significant increase in demand for essential products. These trends have been necessitated by lockdowns and movement control orders, generating multiple operational challenges for consumers, retailers, and last-mile supply chains (Sam, 2020). Such trends have also promoted significant changes in the demand profiles of numerous web-based entrepreneurs (Kanapathipillai, 2020). Then during the post-pandemic era, retailers expanded their operations to Vietnam and Indonesia via mobile technologies (Kanapathipillai, 2020). The retailer aims to maintain its current momentum using mobile technologies in different regional areas to gain a competitive edge.

A recent study on consumer purchase behaviour by (Kanapathipillai & Kumaran, 2022; Benedict, 2020) has revealed that Malaysians are increasingly focused on purchasing essential commodities using mobile technologies. This aspect unveils changes in consumers' expectations of e-commerce, which requires online merchants and logistics service providers to communicate increasingly via mobile technologies (Kanapathipillai & Kumaran, 2022). The survey concluded that mobile payments and transactions were crucial for Malaysian consumers via mobile technologies (Kanapathipillai & Kumaran, 2022; Benedict, 2020). They also indicated that customer loyalty could be promoted through quality mobile technologies (Kanapathipillai & Mahbob, 2021).

Many Malaysians are shifting to online shopping, which has influenced the influx in demand for numerous e-commerce retailers (Kanapathipillai, 2020; Yusheng et al.,

2019). Retailers can maintain their competitive edge and sustainability during challenging times. Therefore, retailers must develop robust and focused strategies to help them capture emerging opportunities through mobile technologies. This approach would help offset the losses and reduce revenues from non-essential product categories that were its primary area of focus.

Mobile shopping has become increasingly popular with users and is a significant part of modern customers' lives (Kanapathipillai & Kumaran, 2022). Online purchases of various goods and services are increasingly being made using mobile devices for searching, comparing, ordering, and paying (Hung, 2018). Although mobile shopping is expanding quickly and now accounts for over one-third of all worldwide e-commerce transactions, numerous industry surveys highlight its crucial role as an initiation for switching to other channels (Chopdar et al., 2018).

Retailers strive to increase their online marketing and sales promotion initiatives to help reach more potential consumers, including those in rural regions. In the past survey, consumers stated that such approaches are crucial because they provide them with more significant savings and a good way of acquiring merchandise (Kanapathipillai & Kumaran, 2022; Benedict, 2020).

Several theoretical models have been developed to understand better how people accept and use information technologies. However, the Technology Acceptance Model (TAM), which examines how human factors affect the adoption of new technologies, is one of the most influential and widely used of these theories (Dillon & Morris, 1996; Lee et al., 2003; Silva, 2005). The Technology Acceptance Model (TAM) (Davis, 1989; Legris et al., 2003; Venkatesh et al., 2002) is the foundation for this study.

Mobile technology acceptance among millennials in Malaysia has drastically increased during the pandemic. Mobile shopping has become a more popular and accessible way of purchasing, and the technology movement has gained importance in any business (Kanapathipillai & Kumaran, 2022). The number of online payment agents has also increased, making consumer transactions much more accessible. The banking industry has also adopted an online banking solution for overall dealings.

2.2.2 The Relationship between Security and Mobile Technology Acceptance

Perceived security is critical to the acceptance of mobile technology, as it allows consumers to evaluate a system based on the available information (Khoo, 2021). Technology acceptance, mainly through mobile payment, is vital to generating profits and income in today's business landscape (Raviadaran et al., 2019). Therefore, it is essential to understand the factors that influence mobile payment adoption by users. Despite the growing use of mobile payments, some stakeholders still need to offer m-payment services, suggesting that people are concerned about security and may not trust all service providers (Tandon et al., 2019; Teshome et al., 2020).

Customer skepticism regarding mobile security is justified, as it is difficult to determine how legitimate mobile payment providers may be. Customers and businesses need to secure m-payment services (Khoo, 2021). Customers concerned about their security when making m-payments are less willing to utilize such services. As stated by

(Tandon et al., 2019), m-payments have raised customer security issues, and customers should consider their security before using any mobile payment service.

Despite the widespread adoption of mobile commerce, customers remain concerned about online fraud, which can result in financial loss. While many studies have focused on customers' attitudes toward online security, only some have investigated retailers' perspectives, creating a gap in the literature. Fong et al. (2015) argue that technology should facilitate secure and comfortable business transactions but acknowledge that there are still insecurities associated with new technology.

Cybersecurity challenges are not limited to Malaysia. According to (Kshetri, 2013), cyberattacks originating from China have significantly impacted the economies of the West. Chinese companies have increasingly invested in IT security products, a promising development. However, much empirical research needs to be done in Malaysia to gauge the popularity of Internet banking. Malaysia's slow adoption of Internet banking is due to security and personal preference issues (Suganthi et al., 2001). Malaysian Internet banking faces security challenges, including online identity fraud and phishing. Phishing uses thousands of deceptive emails to lure large audiences into visiting misleading websites, often known as online identity theft. Criminals create websites that appear to be from trustworthy companies to commit online identity fraud or phishing and then send deceptive emails to many random email addresses. A study by Suganthi et al. (2001) found that security issues were one of the critical factors influencing Internet banking in Malaysia. Another study in the country found that most people were reluctant to use Internet banking due to security and privacy concerns, which supports this finding (Ramayah et al., 2002).

Due to the open and global nature of the Internet as a transaction infrastructure, there is ambiguity around online transactions, making trust, credibility, and risk essential components of e-transactions. (Hoffman et al., 1999). (Stewart et al., 2002) Furthermore, (Aladwani, 2003) argues that trust is perhaps the most critical component of consumer–marketer transactions. Therefore, perceptions of trust, credibility, and risk are likely important factors in predicting individual e-transaction acceptance.

Research by (Kim & Park, 2017; Li & Lin; 2019) found that consumers are willing to adopt mobile technology if the service providers have incorporated safety and security features. The study discovered that the level of security offered by telecommunication providers was the main reason to accept mobile technology.

Similarly, a study by (Wang et al., 2020) uncovered that adopting mobile technology was significantly influenced by the security attributes of mobile devices.

According to their analysis, consumers were more willing to adopt mobile devices with security features. This aligns with research conducted by (Al-Harbi & Al-Shehri, 2018), who mentioned that perceived security in mobile technology influences consumers' intention to adopt it. According to their findings, consumers were willing to use mobile technology if they were confident that their personal information was protected.

On the other hand, data breaches were found to harm the acceptance of mobile technology (Woon et al., 2018). They found that security breaches might diminish

consumers' trust in mobile technology. Additionally, (Ondrus & Pigneur, 2018) study also found that security was insignificant to the adoption of mobile technology. Their research discovered that other factors, such as convenience and ease of use, are more significant to consumers.

Moreover, a study conducted by (Wang & Liang, 2019) was parallel to (Woon et al., 2018; Ondrus & Pigneur, 2018), which revealed that security was not the primary concern for the consumer using mobile technology.

Additionally, several studies have discovered that the behavioural intentions of young people to use technology-related items like e-wallet apps are significantly influenced by security (Wasiul Karim et al., 2020). If the customer's activity related to the transaction is appropriately protected, they will be more likely to trust the new service (Wasiul Karim et al., 2020). Although trust has been extensively studied in information technology, it has yet to be studied concerning mobile banking applications. One of the main obstacles to individuals using internet banking technologies is the perception of trust (Teoh & Md Nor, 2007). Lack of trust negatively affects one's propensity to use internet banking. As personal information and valuable funds are sent across the Internet in electronic transactions, trust will be positively impacted by raised privacy and security standards among online banking consumers, leading to a stronger intention to use internet banking (Akhlag et al., 2013).

Security has always been a concern for consumers in online transactions, and it has been a significant barrier to the growth of online technologies since their inception. Security has been critical in any online activity in the current technology landscape. It is always considered for improvement since online businesses and activities are concerned. However, despite these efforts, some people still misuse technology to engage in illegal activities when making business or transactional decisions. The number of scammers in the online space has increased dramatically, which makes online users more cautious and vigilant. Based on the literature above, there are gaps. Therefore, the following hypothesis was developed to bridge the gaps in the literature:

H1: There is a statistically significant relationship between security and mobile technology acceptance.

2.2.3 The Relationship between Ease of Use and Mobile Technology Acceptance

Many people adopt technology because it is helpful and easy to use. The Technology Acceptance Model (TAM) suggests that perceived ease of use is closely related to perceived usefulness. The same holds for mobile technology, which has revolutionized how people view and use technology (YuSheng et al., 2019). Using mobile devices for shopping has become increasingly popular due to their user-friendly interface, allowing people to shop from the comfort of their homes.

Mobile payment services are quickly adopted for convenience and accessibility, reducing the need for dealing with human resources and speeding up payment processes (Yu Sheng et al., 2019). In contrast, regarding online financial services, ease of use and compatibility with customers' lifestyles greatly influence adoption. However, a small

group of customers, representing about 42% of users, show interest in online financial services due to privacy and safety concerns (Wu et al., 2017). To ensure the long-term adoption of mobile payment services, it is crucial to prioritize customers' security and privacy concerns by implementing strong security measures and transparent privacy policies. This way, customers will be more likely to trust the service and continue to use it in the future (Wu et al., 2017).

The usefulness of technology to retailers revolves around the trust that adopting a particular technology will be very useful in business and yield profits. Willman (2015) states that the perceived ease of use greatly influences the decision to use a particular technology. Like perceived usefulness, the ability to utilize technology encourages even the most ignorant to adopt it, thereby reaping the maximum benefits. It is imperative to note that people or retailers can be hindered from adopting a technology due to its features. Thus, when they find the features manageable, adopting them in business becomes easy, improving productivity. While this has been focused on various businesses, it is clear from the literature review that more focus should be placed on technology adoption in business. The focus on businesses in the literature review suggests a gap in the study that this research aims to fill, giving it prominence. With technology being easy to use, the decision-making process on which technology to adopt becomes simple, as opposed to when it is unclear which technology to adopt due to the complex nature of the operation. Additionally, the increased availability of technology models makes learning simple because many people are already familiar with them.

It has been discovered that perceived usefulness significantly impacts user acceptance, behaviour, and attitude (Kim et al., 2009). It has also been shown that perceived usefulness and willingness to use positively correlate with modern innovations such as the mobile internet (Kim et al., 2007). According to (Liu & Li, 2018; Venkatesh et al., 2003), a significant positive relationship exists between perceived ease of use and mobile technology adoption. They discovered that consumers perceive that easy to use influences consumers to adopt mobile technologies and continue to use them because of their simplified features. Additionally, (Wu & Chen, 2019; Park et al., 2019) mentioned that consumers would significantly adopt mobile technology when they perceive a mobile payment method or mobile health application provided by the service provider as user-friendly. Moreover, a survey conducted by (Alalwan et al., 2017) discovered that bank customers would continue to adopt mobile technology if they found that mobile banking applications are comprehensible.

Contrarily, previous studies (Chong & Chan, 2012; Venkatesh & Bala, 2008) uncovered that other factors, such as practicality and trust, are significant rather than perceived ease of use.

Likewise, (Chiu et al., 2014; Wang et al., 2017) mentioned that consumers do not consider user-friendly as a significant factor influencing mobile technology acceptance because social attributes are more likely to influence consumers. Another recent research (Alalwan et al., 2018) unearthed that the relationship between perceived ease of use and mobile technology adoption was insignificant, as consumer confidence plays a more crucial role.

Moreover, online shopping plays a significant role in daily life, and consumers can easily access and compare products quickly and conveniently with just one mouse click (Arora et al., 2018). Due to the ease, flexibility, and security of electronic transactions using a digital wallet, payment with an e-wallet is becoming one of the most popular payment methods (Uddin et al., 2014). Consumers are increasingly shifting from cash-based to cashless transactions because of the proliferation of electronic payment systems. However, creating a cashless society is challenging, given how deeply ingrained current cash-based trading habits are (Yaokumah et al., 2017). One of the concerns that deter buyers from using e-wallets is the need for more security and privacy unless guaranteed (Milberg et al., 2000). The security features offered by mobile banking services increase trust. Trust is vital for adopting mobile banking to address customer concerns about security and privacy threats and fraudulent smartphone activities (Afshan et al., 2016). One concern cited as a barrier to adopting electronic banking, particularly mobile banking, is fear of inadequate security (Edwin, A. G. W. U., 2015).

Acceptance of any technology, including mobile technology in an online or retail business, depends on how hands-on the user can be. The ease of use, the simplest way to adopt a new working model, and the convenience of making transactions in online purchasing are essential factors. However, many consumers are still hesitant to try mobile technology for online shopping due to the complexities of the transaction process. In recent years, online retailers have improved the purchasing process, making it easier to complete transactions in just a few steps. As a result, more and more consumers are incorporating online purchasing into their daily routines. Today, even mobile banking processes are streamlined, with users able to complete payments or transfers with just one click, making it more accessible and popular. Based on the literature above, there are gaps. Therefore, the following hypothesis was developed to bridge the gaps in the literature:

H2: There is a statistically significant relationship between ease of use and mobile technology acceptance.

2.2.4 The Relationship between Perceived Usefulness and Mobile Technology Acceptance

Consumers tend to believe that technology models such as mobile payments are superior and more advantageous than traditional payment methods, leading to faster adoption. According to (Sufyan Habib et al., 2016), perceived usefulness is crucial in improving technology acceptance in businesses. eMarketer (2016) also states that when customers perceive a service or product as applicable, this expands the market and speeds up its adoption at various stages.

Additionally, Tandon et al. (2019) argue that customers always seek new and better payment methods they can use without training, which online payments offer today. After researching the utility of mobile technology, Teshome et al. (2020) discovered that it is more beneficial than traditional retail operations methods. Therefore, adopting technology benefits retailers and consumers, justifying the need to adopt it in

all retail shops worldwide (Kumar et al., 2020). Perceived usefulness has been found to impact attitudes toward all technologies. In contrast, previous research has shown that their attitudes influence business people's decision to adopt the technology.

Previous research has found that a consumer's usefulness of a system can influence their behavioural intention toward that system, as shown in studies by (Gao et al., 2014; Fong et al., 2015). Furthermore, (Venkatesh & Davis, 2000) has proven that perceived usefulness is a significant factor influencing consumers to adopt mobile technologies using the Technology acceptance model developed by (Davis, 1989). This was corroborated by (Park et al., 2019), who conducted recent research on the acceptance of mobile health and found similar results (Venkatesh & Davis, 2000). Moreover, (Wu & Chen, 2019) investigated the relationship between perceived usefulness and mobile technology acceptance and concluded a significant positive relationship. Comparably, research conducted in China by (Wang et al., 2017) discovered that perceived usefulness significantly impacts consumers' loyalty.

On the contrary, research conducted by (Al-Somali et al., 2009) discovered that perceived usefulness had an insignificant impact on mobile banking consumers. Likewise, a study in China by (Chong & Chan, 2012) found an insignificant relationship between the perceived usefulness of mobile e-commerce. Additionally, (Al-Gahtani, 2016) survey in Saudi Arabia discovered that perceived usefulness showed an insignificant impact on the adoption of mobile learning technology among students.

The degree to which a user perceives uncertainty and unfavorable effects of using an online application service, such as financial risk, physical danger, operational risk, social risk, time-loss risk, opportunity cost risk, and information risk, is generally referred to as "perceived risk" (Fernandes & Awamleh, 2006). Financial risk and security risk, connected to the possibility of a loss due to operating system flaws or the theft of funds through unauthorized external access, are expected to be the two most significant categories of perceived risk associated with Internet banking. Previous research has found that the favourable influence of Internet banking awareness on the intention to utilize Internet banking is mediated by performance, time, security, financial, and privacy risk (Fernandes & Awamleh, 2006); (Littler et al., 2006); (Hanazadeh et al., 2012).

Conversely, the argument arises that ease of use in TAM is similar to the ease of use in technology and that the intention to use technology is only sometimes correlated with ease of access (Yoon et al., 2007). However, numerous studies have revealed that external factors directly impact technical acceptability and indirectly influence perceptions of perceived usefulness and convenience (Burton-Jones et al., 2006; Moon et al., 2001; Ong et al., 2006; Yoon et al., 2007).

The elements influencing the intention to utilize mobile banking services are usability, social norms, and social risk. Researchers have also revealed that while relative advantage had a higher impact on male respondents' perceptions of utility, simplicity of use and social norms substantially impacted female respondents (Riquelme et al., 2010). Additionally, mobile banking services can speed up data processing and enhance efficiency, resulting in cost savings and facilitating change in retail banking (Laukkanen et al., 2005).

Mobile technology is valuable for both consumers and retailers. In some cases, it has benefited both the consumer and the retailer. However, consumers are still hesitant to adopt mobile technology in retail environments due to the risks in the online banking industries across the globe. The risk of mobile transactions has increased as more illegal operations occur in the current market. Most research shows that attitude has become a more substantial factor influencing mobile technology acceptance. Based on the literature above, there are gaps. Therefore, the following hypothesis was developed to bridge the gaps in the literature:

H3: There is a statistically significant relationship between perceived usefulness and mobile technology acceptance.

2.2.5 The Relationship between Cost of Operations and Mobile Technology Acceptance

According to (Alkafagi et al., 2019), adopting technology is cost-effective for retailers and customers. Customers can make purchases online without physically travelling to the business, and the business can operate with limited personnel, reducing operating costs. The COVID-19 pandemic has forced businesses to seek and adopt new technologies to improve performance, as traditional operation patterns have been disrupted (Willems, K., Verhulst, N., Brengman, M., 2021). Businesses have also been compelled to adopt technology to address conventional wisdom, increase labour costs, upskill employees, and remain competitive (YuSheng et al., 2019). Technology diffusion into all sectors of the economy has been made possible by the availability of technologically enabled phones, through which retailers and customers can carry out all operations. The pervasiveness of this technology in society has shaped users' perceptions of how easy it is to use other technologies to improve business, implying low operating and maintenance costs.

Adopting technology improves productivity and promotes the need to remain competitive with other businesses. The availability of technology and its low-cost foster effectiveness in operation. The phrase "perceived cost" describes the prospective expenses consumers may face as they adopt new technologies, such as initial, subscription, and communication charges (Shafinah et al., 2013). The expenses can be both monetary and non-monetary because the process of analysis and comparison before accepting new technology, such as mobile payment services, and cultivating a positive relationship with the new service provider requires time and effort (Teoh Teng Tenk, M., Yew, H. C., & Heang, L. T., 2020). The cost of purchasing a mobile device to use the mobile payment service is also included in this cost.

According to (Lin & Huang, 2012; Guo et al., 2018) cost of operating mobile data is a significant factor influencing consumers to adopt mobile technologies. Moreover, (Cho & Cheon, 2005) mentioned that when mobile operators reduce the cost of operations, they can offer the services to consumers at a lower price. Therefore, this will motivate the consumers to accept mobile technology as they perceive that the risk is not considered high.

In contrast, consumers are likely only to adopt new technology if they perceive it to be both effortful and costly. Studies, such as those conducted by Van der Heijden (2002), Mallat (2007), Chong (2013), and Oye et al. (2014), have incorporated perceived cost into their research models and have found a similar conclusion: perceived cost has a negative relationship with the adoption and acceptance of new technology. Additionally, (Van Slyke et al., 2004; Venkatesh & Davis, 2000) found that the perceived cost of operations was insignificant to mobile technology acceptance. According to (Al-Gahtani, 2016) study, the cost of operations was insignificant to students adopting mobile technology for their education. Another survey (Lee & Kim, 2010) discovered that the value of mobile services is more significant than the cost of operations. However, despite finding that perceived cost has no significant relationship with the adoption of mobile payments, (De Sena Abraho et al., 2016) concluded that it remains one of the major factors hindering the adoption or development of mobile payments in recent years. Moreover, many commercial banks in Malaysia have implemented mobile banking systems to enhance operations and reduce costs. The banking sector requires more than just physical branches to meet customer demands. Offering banking services via mobile banking has given bank customers an alternative way to obtain financial services quickly (Amin et al., 2008).

Customers' impressions of Indian Overseas Bank's mobile banking services are significantly influenced by their level of education, gender, and income (Palani et al., 2012). It is favourable for buyers and sellers, as traders accept e-wallets as a form of payment due to their quick transaction times, effective cash management, and low labour costs (Hayashi et al., 2014). Consumers are harmed by additional fees and service costs, leading to missed transactions (Normalini Md. Kassim et al., 2021).

The level of education, gender, and income of customers significantly influence their impressions of Indian Overseas Bank's mobile banking services (Palani et al., 2012). E-wallets have become a popular payment option for traders due to quick transaction times, effective cash management, and low labour costs (Hayashi et al., 2014). However, additional fees and service costs can concern consumers and lead to missed transactions (Normalini Md. Kassim et al., 2021).

The cost of operation is a constant concern for both retailers and consumers. With technology evolving rapidly, the cost of newer technology is increasing daily. Labour costs have also increased, making the market more competitive between traditional and online-based businesses. Sometimes, retailers may prefer to spend a sum on capital costs instead of hiring high-cost labourers to maintain their business. Business owners also understand the need to move forward with technology while improving productivity. E-wallet payments are always favourable for buyers and sellers as they make payment easier and contribute to low labour costs. However, some mobile and online payment systems failed due to the additional fees introduced when many businesses initially adopted them. Based on the literature above, there are gaps. Therefore, the following hypothesis was developed to bridge the gaps in the literature:

H4: There is a statistically significant relationship between cost of operations and mobile technology acceptance.

2.3 Proposed Conceptual Framework

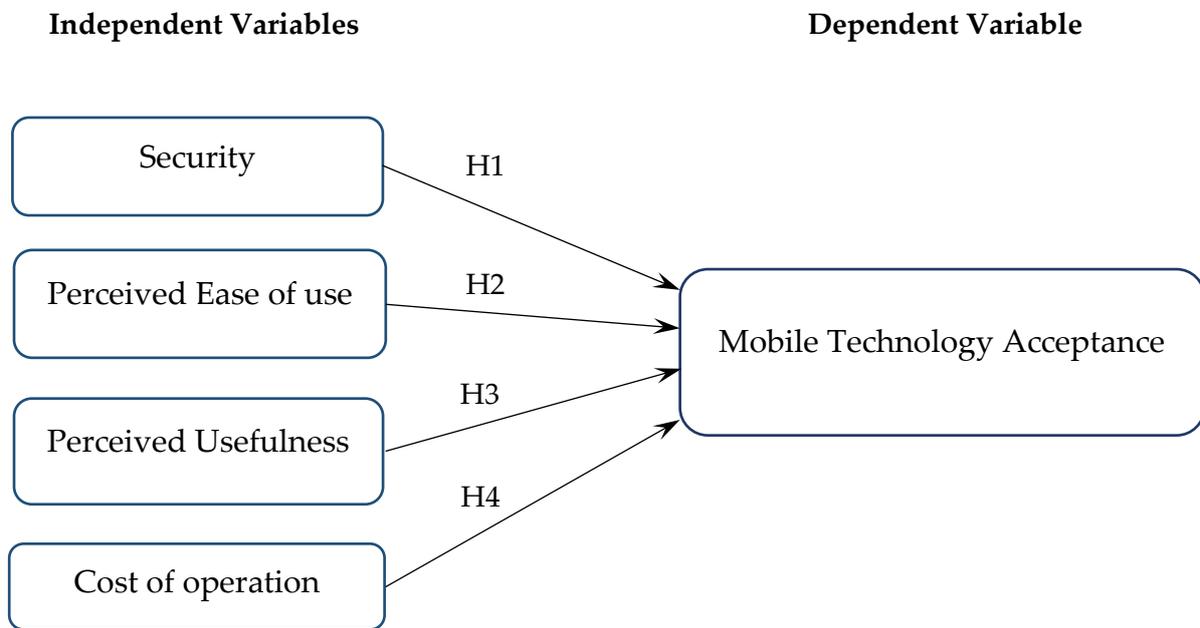


Figure 1: Proposed Conceptual Framework

3. Methodology

The following section provides the population, sampling, measurements, reliability analysis, and descriptive statistics.

3.1 Population, Sampling & Measurements

This study investigates mobile technology acceptance among Malaysian millennials aged between (27 – 42) years old, representing a population of 7.48 million in Malaysia (Department of Statistics Malaysia, 2022; Tjiptono et al., 2020). The sample size of 384 participants was determined using (Krejcie & Morgan, 1970) tabulation, with a 5% margin of error. The sampling technique used for this study was purposive sampling so that the unique characteristics of the millennials in Malaysia could be analysed. Data were collected using a survey questionnaire that included demographic information, the dependent variable is mobile technology acceptance. The independent variables are security, perceived ease of use, perceived usefulness, and cost of operations. A four-point Likert scale was employed to assess the respondents' opinions.

Data analysis was performed using SPSS version 28.0, including a reliability test to ensure the consistency of the measurements. The study followed a survey method, with questionnaires distributed electronically to millennials in Malaysia. After data collection, responses were input into SPSS for numerical calculations and analysis.

3.2 Reliability Analysis

Table 1: Reliability Analysis (N = 384)

Variables	Cronbach's Alpha	No. of Items
Security (SC)	0.624	5
Perceived Ease of Use (PE)	0.778	5
Perceived Usefulness (PU)	0.808	5
Cost of Operation (COO)	0.734	5
Mobile Technology Acceptance (MTA)	0.804	5

Based on Table 1, Reliability Analysis aims to ensure data accuracy and consistency of the survey instrument. Cronbach's alpha values were calculated for each variable: security (0.624) with 5 items, perceived ease of use (0.778) with 5 items, perceived usefulness (0.808) with 5 items, cost of operation (0.734) with 5 items, and mobile technology acceptance (0.804) with 5 items. With values greater than 0.7, the constructs are considered suitable for further analysis.

3.3 Mean and Standard Deviation Analysis

Table 2, Descriptive Statistics displays the mean, standard deviation, skewness, and kurtosis values of this research.

Table 2: Descriptive Statistics (N = 384)

Factors	Mean	SD	Skew	Kurtosis	Min	Max
Security (SC)	3.182	0.541	-0.638	1.038	1	4
Perceived Ease of Use (PE)	3.171	0.561	-0.692	1.194	1	4
Perceived Usefulness (PU)	3.443	0.524	-0.118	1.563	1	4
Cost of Operation (COO)	3.210	0.555	-0.357	-0.110	1	4
Mobile Technology Acceptance (MTA)	3.380	0.536	-1.087	1.299	1	4

From Table 2, Descriptive Statistics the factor Perceived Usefulness (PU) shows the highest mean value of 3.443 ± 0.524 . The lowest mean value is Perceived Ease of Use (PE), 3.171 ± 0.561 . The normality test denotes that the skewness and kurtosis values have a threshold of ± -2 which means that the data are distributed normal, as elucidated by (Chinna & Yuen, 2015; Gravetter & Wallnau, 2014).

4.1 Findings & Interpretation

The following section provides the findings of this study, including the respondents' demographic profiles, descriptive analysis, correlation, and regression analysis.

4.2 Demographic Profile

The profile of the respondents studied is displayed in Table 3.

Table 3: Demographic Profile of Respondents (N = 384)

Demographics	Frequency	Percentage (%)
Gender		
Male	210	55%
Female	174	45%
Age		
26 – 30	85	22%
31 – 35	91	24%
36 – 40	169	44%
41 – 45	39	10%
Education Level		
Secondary School	44	12%
Diploma	95	25%
Bachelor’s Degree	162	42%
Master’s Degree	75	20%
Doctorate Degree	8	2%
Job Position		
Intern / Fresh Graduate	56	15%
Associate / Executive Level	132	34%
Manager	122	32%
Senior Manager	20	5%
Director / VP / Senior VP	23	6%
C Level (CIO, CTO, COO, C)	31	8%
State		
Johor	8	2%
Kuala Lumpur	56	15%
Negeri Sembilan	8	2%
Perak	8	2%
Pulau Pinang	11	3%
Sabah	20	5%
Sarawak	32	8%
Selangor	241	63%

Table 3, Demographic Attributes with 384 respondents, reveal a balanced gender distribution of millennials, with 210 males (55%) and 174 females (45%). Respondents are predominantly aged between (36 – 40) which is 44% or 169, followed by 24% and 22% between (31 – 35) and (26 – 30) respectively. The age group of respondents between (41 - 45) has the lowest frequency at 10% or 39 respondents.

Most respondents hold a bachelor's degree (42%), 25% with a diploma, 20% with a master's degree, 12% with secondary education, and only 2% with a doctorate. Regarding job positions, 34% are at the associate or executive level, 32% are managers, 15% are fresh graduates or interns, and 8% are at C-level.

Geographically, 63% of respondents reside in Selangor, and 15% in Kuala Lumpur, totalling 78% from these two states. Other respondents come from Sabah (5%), Sarawak (8%), Pulau Pinang (3%), Negeri Sembilan (2%), Perak (2%), and Johor (2%). No participants are from Perlis, Kedah, Terengganu, Kelantan, Pahang, Melaka, Labuan, and Putrajaya.

4.3 Correlation Analysis

The Pearson's Correlation among variables in Table 4 shows the association between the variables tested in this study.

Table 4: Correlation Matric (N = 384)

Variable	SC	PE	PU	COO	MTA
Security (SC)	1				
Perceived Ease of Use (PE)	0.196**	1			
Perceived Usefulness (PU)	0.299**	0.776**	1		
Cost of Operation (COO)	0.144**	0.634**	0.626**	1	
Mobile Technology Acceptance (MTA)	0.174**	0.514**	0.605**	0.424**	1

**correlation is significant at the 0.01 level (2 tailed)

Table 4, Correlation Matrix, shows Pearson's coefficient to assess the association between the independent variables (security, perceived ease of use, perceived usefulness, and cost of operations) and the dependent variable (mobile technology acceptance). The results reveal statistically significant positive correlations between all independent variables and the dependent variable mobile technology acceptance. The strongest correlation is between perceived usefulness and mobile technology acceptance ($r = 0.605$, $p < 0.001$), followed by perceived ease of use ($r = 0.514$, $p < 0.001$), cost of operation ($r = 0.424$, $p < 0.001$), and security ($r = 0.174$, $p < 0.001$).

These findings indicate that perceived usefulness, ease of use, and cost of operation are key factors influencing millennials' acceptance of mobile technology in Malaysia, aligning with prior research on technology acceptance determinants. Recognizing these factors can aid organizations and policymakers in crafting effective strategies to promote mobile technology adoption among Malaysian millennials.

Pearson's correlation also illustrates the association between the independent variables among millennials in Malaysia, revealing the following critical insight.

Firstly, perceived ease of use and security ($r = 0.196$, $p < 0.001$): A significant positive, the very low correlation still suggests that users who perceive mobile technology as easy to use are more likely to perceive it as secure. An easy-to-use mobile interface can enhance millennial users' perception of security and increase their adoption rates.

Secondly, perceived usefulness and security ($r = 0.299$, $p < 0.001$): A significant positive low correlation indicates that enhancing the perceived usefulness of mobile technology can contribute to an increased perception of security and vice versa. Providers should consider both factors when designing and marketing their products to millennial consumers.

Thirdly, cost of operations and security ($r = 0.144$, $p < 0.001$): A significant positive, very low correlation still implies that millennial users will pay more for secure mobile transactions. Organizations should invest in mobile technology's cost and security to improve millennial user adoption rates.

Fourthly, perceived usefulness and perceived ease of use ($r = 0.776$, $p < 0.001$): A significant positive high correlation suggests that users perceive mobile technology as

more valuable when it is easy to use and vice versa. Developers should consider both factors to improve millennial user acceptance and adoption rates.

Fifthly, cost of operations and perceived ease of use ($r = 0.634, p < 0.001$): A significant positive high correlation implies that organizations should invest in user-friendly mobile technologies to reduce the cost of operations associated with training and supporting millennial users.

Finally, cost of operations and perceived usefulness ($r = 0.626, p < 0.001$): A significant positive high correlation implies that organizations should invest in cost-effective mobile technologies that offer high levels of usefulness to the millennials. Balancing cost and usefulness when implementing mobile technology solutions is essential to increase millennial users' adoption rates.

4.4 Regression Analysis

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.611	0.373	0.368	0.430
Predictors: (Constant), Cost of Operation, Perceived Usefulness and Perceived Ease of Use. Dependent Variable: Mobile Technology Acceptance				

Table 5, Model Summary, $R = 0.611$, indicates a high degree of predictive accuracy between the independent variables (security, perceived ease of use, perceived usefulness, and cost of operation) and the dependent variable (mobile technology acceptance). The R-square value is 0.373 which suggests that these independent variables account for 37.3% of the variation in the dependent variable (mobile technology acceptance). The adjusted R-square value (0.368), slightly lower than the R-square value, demonstrates that the model does not overfit the data. The standard error of the estimate (0.430) measures the average distance between the observed data points and the regression line, indicating how well the line fits the data points. In summary, the model summary reveals that security, perceived ease of use, perceived usefulness, and cost of operation can significantly be used to explain their influence on mobile technology acceptance.

Table 6: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.493	4	5.623	10.293	0.000b
	Residual	207.046	379	0.546		
	Total	229.539	383			
a. Dependent Variable: Mobile Technology Acceptance b. Predictors: (Constant), Security, Cost of Operation, Perceived Usefulness and Perceived Ease of Use.						

Table 6 displays the ANOVA results for the multiple linear regression model. The ANOVA table indicates that the regression model is significant, with an F-value of 10.293 and a p-value of less than 0.001. This finding suggests that the independent variables

(security, perceived ease of use, perceived usefulness, and cost of operation) significantly predict the variation in mobile technology acceptance.

The sum of squares for regression is 22.493, with degrees of freedom = 4, and the mean square is 5.623. The sum of squares for the residual is 207.046, with degrees of freedom = 379, and the mean square is 0.546. The total sum of squares is 229.539, with degrees of freedom = 383. The mean square values reveal that the variance explained by the regression model is higher than the unexplained variance, indicating that the model is a good fit for the data.

Table 7: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
		B	Std. Error			
Variables	(Constant)**	1.144	0.154		7.426	0.000
	Security (SC)	0.125	0.039	0.161	3.192	0.002
	Perceived Ease of Use (PE)	0.090	0.065	0.093	1.375	0.170
	Perceived Usefulness (PU)	0.518	0.069	0.501	7.481	0.000
	Cost of Operation (COO)	0.051	0.053	0.052	0.960	0.338

**Dependent Variable: Mobile Technology Acceptance

Table 7 shows that the coefficients for Security (SC) and Perceived Usefulness (PU) are significant at $p < 0.05$, indicating that these factors are statistically significant in predicting mobile technology acceptance. However, the p-values for Perceived Ease of Use (PE) and Cost of Operation (COO) are insignificant, with p-values of 0.170 and 0.338, respectively. The higher p-values for Perceived Ease of Use (PE) and Cost of Operation (COO) suggest that these factors cannot influence the mobile technology acceptance of millennials in this study.

The regression equation represents the relationship between the independent variables (Security, Perceived Usefulness, Perceived Ease of Use, and Cost of Operation) and the dependent variable (mobile technology acceptance).

Based on Table 7 Coefficients, the linear regression equation is as follows:

$$\text{MTA} = 1.144 + 0.125 (\text{SC}) + 0.518(\text{PU})$$

Where,

MTA = Mobile Technology Acceptance

SC = Security

PU = Perceived Usefulness

1.144 is the constant or the y-intercept.

The findings indicate that a one-unit increase in security leads to a 0.125-unit increase in mobile technology acceptance, while a one-unit increase in perceived usefulness results in a 0.518-unit increase in mobile technology acceptance. This suggests

that enhancing security and perceived usefulness can significantly boost mobile technology acceptance among Malaysian millennials. Organizations should invest in these critical factors to improve mobile technology adoption rates.

4.5 Summary of Hypothesis Test

Table 7: Summary of Hypothesis Results (N = 384)

Hypothesis	P-value	Result
H1: There is a statistically significant relationship between security and mobile technology acceptance	0.002	Supported by data
H2: There is a statistically significant relationship between perceived ease of use and mobile technology acceptance.	0.170	Not supported by data
H3: There is a statistically significant relationship between perceived usefulness and mobile technology acceptance.	0.000	Supported by data
H4: There is a statistically significant relationship between cost of operations and mobile technology acceptance.	0.338	Not supported by data

For a sample size of 384, the hypothesis results support the idea that security and perceived usefulness have a significant relationship with mobile technology acceptance. However, perceived ease of use and cost of operations show an insignificant relationship with mobile technology acceptance.

5. Discussion

Motivated by the increasing popularity of mobile technology in various forms of usage such as shopping, data gathering, financial transactions, information sharing, business, and more, this study aims to explore the key factors influencing Mobile Technology Acceptance among millennials in Malaysia, using the Technology Acceptance Model (TAM).

The study recruited respondents aged 26 to 45, representing Malaysian millennials, including millennials in their household, and through supplier references. Therefore, increasing the credibility of the results. A total of 384 respondents were recruited, meeting the minimum sample size recommendation of (Krejci & Morgan, 1970). Therefore, the gathered data is adequate to represent the population of millennials at 7.48 million based on (Department of Statistics Malaysia, 2022).

Responses for the first independent variable, security, indicated a statistically significant relationship between security and mobile technology acceptance. Based on the data, p is less than 0.05. Therefore, hypothesis H1 was accepted. The following discussion answers the first research question: Is there a statistically significant relationship between security and mobile technology acceptance?

Past studies by (Li & Lin, 2019; Kim & Park, 2017) indicate that security influences millennial consumers to accept mobile technology because it gives them the confidence to try it out by not fearing a breach of personal information. Additionally, a study by (Wasiul Karim et al., 2020) found that if customers' mobile activities are appropriately

protected, they will be more likely to trust and accept the mobile technology. Therefore, these previous findings complement this study and negate the findings of previous studies by (Woon et al., 2018; Ondrus & Pigneur, 2018), who found that security breaches might diminish consumers' intent to accept mobile technology.

Subsequently, the findings of this study had proved that security was a vital component for millennials when they chose mobile technology. As such mobile technology developers should not ignore or take for granted the security feature within the mobile technology offered to build confidence and trust among millennials. The findings of this study have ascertained that security features are crucial to overcoming the personal data of the millennials from beings compromised. Thus, answering the first research question.

Responses for the second independent variable, perceived ease of use, indicated a statistically insignificant relationship between perceived ease of use and mobile technology acceptance. Based on the data, $p = 0.170$. Therefore, hypothesis H2 was not accepted. The following discussion answers the second research question: Is there a statistically significant relationship between perceived ease of use and mobile technology acceptance?

This study contradicts previous researchers (Wu & Chen, 2019; Liu & Li, 2018; Venkatesh et al., 2003) who found that perceived ease of use influences mobile technology acceptance. According to their findings, consumers perceive that easy to use influences them to accept mobile technologies and continue to use them because of their simplified and user-friendly features. On the other hand, this study complements the findings of (Chong & Chan, 2012; Venkatesh & Bala, 2008), who uncovered that other factors, such as practicality and trust, are incredibly significant for consumers to accept mobile technology compared to perceived ease of use.

Consequently, the findings of this research support the views of researchers who suggest that other factors significantly influence mobile technology acceptance. The millennials may seek more complex features that they could use to solve their problems at work. As such mobile technology, developers should look into ways to fulfil the needs of millennials by incorporating more multifaceted features in the mobile technology offered. Thus, answering the second research question.

Responses for the third independent variable, perceived usefulness, indicated a statistically significant relationship between perceived usefulness and mobile technology acceptance. Based on the data, p is less than 0.05. Therefore, hypothesis H3 was accepted. The following discussion answers the third research question: Is there a statistically significant relationship between perceived usefulness and mobile technology acceptance?

Previous research by (Tandon et al., 2019; Wu & Chen, 2019; Sufyan Habib et al., 2016; Venkatesh & Davis, 2000) is in line with this study, whereby their findings also prove that perceived usefulness influences consumers to accept mobile technologies. Therefore, perceived usefulness has been found to impact the attitudes of millennials in this study toward mobile technology acceptance. Contrarily, this study refutes the findings of previous researchers (Praveena et al., 2013; Al-Somali et al., 2009; Burton-

Jones et al., 2006; Yoon et al., 2007; Ong et al., 2006; Moon et al., 2001) who mention that other factors impact the intention to utilize mobile technology such as usability, social norms, and social risk compared to perceived usefulness.

Consequently, this study affirms that perceived usefulness significantly influences mobile technology acceptance among millennials. The findings of this study also support previous studies which indicate that perceived usefulness can influence the mindsets of millennials towards mobile technology acceptance. Moreover, this study could give an idea to organizations on how to attract the millennials who seek practicality in mobile technology. Thus, answering the third research question.

Responses for the fourth independent variable, cost of operations, indicated a statistically insignificant relationship between the cost of operations and mobile technology acceptance. Based on the data, $p = 0.338$. Therefore, hypothesis H4 was not accepted. The following discussion answers the fourth research question: Is there a statistically significant relationship between the cost of operations and mobile technology acceptance?

Earlier studies by (Alkafagi et al., 2019; Guo et al., 2018; Lin & Huang, 2012) have indicated that adopting mobile technology is cost-effective for customers. Therefore, customers will readily accept mobile technology to enhance their productivity. However, this study contradicts the findings of these researchers.

On the other hand, this study supports the findings of (Oye et al., 2014; Chong, 2013; Van Slyke et al., 2004; Venkatesh & Davis, 2000), who have mentioned that consumers are unlikely to adopt mobile technology if they perceive it to be costly.

Therefore, the findings of this research indicate that the cost of operations has a negative impact on the acceptance of mobile technology. Consequently, this research supports the notion that millennials will only accept mobile technologies introduced to them if it is cost-effective for them. Thus, answering the fourth research question.

6. Conclusion

With the rapid advancement of technology in new information and communication technologies, which are becoming the new choice of media, they are increasingly infiltrating and spreading into our personal lives. The main objective of this research was to study the factors that influence mobile technology acceptance by millennials in Malaysia.

Many Malaysians are shifting to online shopping, which has increased demand for numerous e-commerce retailers (Yusheng et al., 2019). Millennials in Malaysia were early adopters of mobile devices and used them extensively for various activities, including purchasing. Mobile banking, online shopping, online learning, online retailers, and a growing number of online technological platforms have significantly increased consumer purchasing power. The millennials have embraced mobile technology on a large scale to enhance the power of technology in modern lifestyles and conditions.

The first objective of this study was to investigate the significant relationship between security and mobile technology acceptance. The researchers have revealed a

significant relationship between security and mobile technology acceptance among millennials in Malaysia. Therefore, this study negated the findings of previous scholars (Wang & Liang, 2019; Woon et al., 2018; Ondrus & Pigneur, 2018), who elucidated that security was not the primary concern for the consumer using mobile technology.

Additionally, numerous secure and reliable mobile payment platforms are available, such as e-wallets, GoPay, Grab-pay, Pay-direct, QR-Pay, Duit-Now, Kiple, FPX, and many others. These payment methods are widely used, and customers have accepted them as safe payment gateways. Mobile-based payment systems are commonly used for transactions, and payments are made through mobile applications because consumers perceive this approach to be advantageous (Gokilavani et al., 2018). In the future, payment alternatives will primarily be made via mobile devices, and local banks and financial institutions will need to adopt these safer procedures. Security concerns regarding mobile payments have been thoroughly addressed; however, financial institutions must continually improve security measures. Consumers will likely adopt mobile technology for online transactions without worrying about security. Thus, this study has narrowed the gap in the literature indicating the significance of security features for millennials when accepting mobile technology.

The second objective of this study was to examine the significant relationship between perceived ease of use and mobile technology acceptance by millennials in Malaysia. The researchers have exposed that, in general, millennial users in Malaysia did not readily embrace mobile technology due to the perceived complexity of mobile applications. This study supports the previous researchers (Alalwan et al., 2018; Wang et al., 2017; Chiu et al., 2014) who have also found an insignificant relationship between these two variables. Moreover, if the millennials need to understand the technology, process information, and follow usage, procedures become easier (Sinha et al., 2019). Earlier research also showed that mobile technology was not a popular topic due to the complexity and number of steps required to accomplish a transaction or activity. The application appeared unattractive, and difficult for users to input personal data and activate the pin (Wu et al., 2017). Thus, this study has narrowed the gap in the literature, indicating the insignificance of perceived ease of use for millennials when accepting mobile technology.

The third objective of this study was to scrutinize the significant relationship between perceived usefulness and mobile technology acceptance by millennials in Malaysia. The researchers have proven a significant relationship between perceived usefulness and mobile technology acceptance among millennials in Malaysia. Therefore, supporting the findings of previous researchers (Wu & Chen, 2019; Wang et al., 2017; Venkatesh & Davis, 2000), who explicated that customers will continue to adopt mobile technology if they find it useful.

Moreover, perceived usefulness is a critical Technology Acceptance Model (TAM) element. It posits that it predicts the relationship between behavioural intention to use technology and perceived usefulness (Park et al., 2014). Online customers do so because they believe it will improve their shopping performance, productivity, and efficiency. This can be rationally explained by online shopping allowing people to free up more time

to balance their personal and professional lives. Therefore, they can shop whenever it is convenient using online shopping platforms. Moreover, millennials were born and raised in the technological age and belonged to a generation with extensive online and internet expertise. Hence, using various applications on mobile phones is familiar to them. Thus, this study has narrowed the gap in the literature, indicating the significance of perceived usefulness for millennials when accepting mobile technology.

The fourth objective of this study was to examine the significant relationship between the cost of operations and mobile technology acceptance. The researchers have demonstrated an insignificant relationship between the cost of operations and mobile technology acceptance among millennials. Therefore, this study contradicted the findings of previous scholars (Guo et al., 2018; Lin & Huang, 2012; Cho & Cheon, 2005), who stated that the lower the cost of operations, the higher the acceptance of mobile technology by consumers.

In a true sense, the cost of operations will increase periodically with rising consumption costs as the demand for online retailers increases. Our surveys show that millennial consumers disagree with this as the cost of operation increases and have rejected the cost influence. The perceived cost barrier has been one of the major factors hindering the adoption or development of mobile payment in past years; however, it has no significant relationship with the adoption of mobile payment (De Sena Abrahão et al., 2016). The perceived cost barrier does not impact the adoption of mobile commerce. This study concludes that the traditional barrier significantly influences people's intentions to adopt mobile commerce (Krishna Moorthy et al., 2020). Thus, this study has narrowed the gap in the literature, indicating the insignificance of operational costs for millennials when accepting mobile technology.

To summarize, this study found that several factors influence mobile technology acceptance among millennials in Malaysia. These factors include perceived usefulness and security needs. In addition, this study found that the frequency of mobile technology use among millennials increases as each dimension of mobile acceptance is addressed, including perceived ease of use and cost of operations. However, the study also found that the perceived ease of use and cost barrier are insignificant factors in adopting mobile technology.

Overall, this study provides valuable insights into the factors that influence mobile technology adoption among millennials in Malaysia. Organizations can use these insights to develop effective mobile technology strategies and enhance millennial consumers' engagement and interest in mobile technologies.

7. Limitations and Further Research

This paper has several limitations. Due to the snapshot temporal data collection limitations, the study used a small sample size. As a result, the findings cannot be extrapolated to another research setting. Further research should use more substantial in-depth qualitative interviews to understand mobile application acceptability among millennials better nationwide.

If future researchers were to replicate this study, they could first expand or expedite data collection by surveying different target respondent groups. The characteristics of the new target population should be described in detail. For example, future studies could focus on different geographic locations, economic sectors, social groups, age ranges, or other population components that this survey does not cover.

Next, researchers can enhance our model by incorporating new dependent and independent variables and the latest findings from literature and journals. Moderating variables can also be included to strengthen the model. A moderating variable can enhance, weaken, nullify, or otherwise affect the relationship between independent and dependent variables. Moderating factors can also change the direction of this relationship. Moderating variables can be categorical (e.g., race) or continuous (e.g., weight) and are only used in quantitative research. Moderating variables help explain the relationships between independent and dependent variables. These moderators provide additional information on the association between two variables in quantitative research by describing what qualities might make that link stronger, weaker, or even absent.

Moreover, future researchers could use qualitative approaches such as focus groups, protocol analysis, or structured interviews to understand the issue and its findings better.

Acknowledgments

The authors would like to express their genuine appreciation to all the respondents for allowing the authors to conduct this research and value the time they have spent answering the questionnaire.

Conflict of Interest Statement

The authors of this research would like to assert that there are no conflicts of interest linked with this research, and it was not supported by anyone that could have influenced its results. As the researchers of this study, the authors authenticate its originality, accentuate that this research has not been published previously, and validate that it is not presently intended for publication elsewhere.

About the Authors

There are 4 authors involved in this research. Below is a brief introduction of each author. **Vanitamalar Perumal** is an experienced professional with a Master of Business Administration from UNITAR International University and a Diploma in Private Secretaryship (PSC) from Stamford College, Kuala Lumpur. She has obtained professional certifications in Retail Operation and HRDF Train The Trainer and attended various courses to enhance her skills. Additionally, she has held various positions in her career, including Talent Acquisition at Mydin Mohammed Holdings Berhad, Retail Trainer at Mydin Retail Academy, Project Administrator at Mydin Mohammed Holdings Berhad and IBM Malaysia, and PMO Administrator at EDS Malaysia. She has also

worked as an Executive Secretary at the Federation of Malaysian Manufacturers and a Project Coordinator at Inreal Technology.

Mohanantass Permal earned his Bachelor of Science in Computing and Graduate Diploma in Management of Information Systems from the University of Greenwich, London, in 2001. He has obtained various specialized technical certifications, mainly from Cisco Systems, including Cisco Certified Design Associate (CCDA), Cisco Express Foundation Design Specialist, Cisco Certified Lifecycle Services Advanced Wireless, Cisco Certified Lifecycle Service Express, Cisco Certified Advanced Wireless LAN System Engineer, Cisco Express Foundation Design Specialist, Cisco Express Networking, and Cisco Certified Network Associate. In addition, he completed other technical certifications such as Certified Allied Telesyn System Engineer, Authorized Motorola Broadband Wireless Installer, EnGenius Cloud Management Specialist, Fortinet Network Security Expert (NSE) (course completion), and Intransa Certified System Engineer (Specialized CCTV Storage Solution). He is now a technical manager at a well-established firm called Databridge Communications (M) Sdn. Bhd. With over 20 years of experience in Malaysia's IT industry.

Shariffah Haszeqah Bt S. Jainal Abdibin completed her Foundation in Business Admin with UNITAR. She graduated from the Management and Science University (MSU) with an International Business in Marketing Research degree. She has amassed a wealth of experience in various service sectors, allowing her to develop solid skills and knowledge. Shariffah's career began in the hotel industry. It expanded to include event management, automotive, construction, development, soft skills, safety, and health training. She focused on sharing her skills and knowledge by becoming a full-time trainer. Since 2018, she has served as a Training, Management, and People Development Specialist with Western Digital Malaysia. She obtained her Train the Trainer certification from the Human Resources Development Corporation in 2012, became a Certified Training Professional through ARTDO-ITDWorld in 2019, and earned her Certified Coaching & Mentoring Professional certification in 2021.

Kumaran Kanapathipillai holds a PhD in Management/Business from Management and Science University (Malaysia). With 22 years of experience as an academic and researcher, he has specialized in Management, Marketing, Supply Chain Management, and Logistics Management. He supervises and assesses Master and PhD candidates. He conducts entrepreneurship, creative problem-solving, and project management training across various industries. His primary areas of interest and research focus on contemporary entrepreneurship, management, and marketing.

References

- Aboelmaged, M., & Gebba, T. R. (2013). Mobile Banking Adoption: An Examination of Technology Acceptance Model and Theory of Planned Behavior. *International Journal of Business Research and Development*, 2(1).
<https://doi.org/10.24102/ijbrd.v2i1.263>

- Afshan, S., & Sharif, A. (2016). Acceptance of mobile banking framework in Pakistan. *Telematics and Informatics*, 33(2), 370–387. <https://doi.org/10.1016/j.tele.2015.09.005>
- Akhlaq, A., & Ahmed, E. (2013). The effect of motivation on trust in the acceptance of internet banking in a low-income country. *International Journal of Bank Marketing*, 31(2), 115–125. <https://doi.org/10.1108/02652321311298690>
- Akram, U., Fülöp, M. T., Tiron-Tudor, A., Topor, D. I., & Căpușneanu, S. (2021). Impact of Digitalization on Customers' Well-Being in the Pandemic Period: Challenges and Opportunities for the Retail Industry. *International Journal of Environmental Research and Public Health*, 18(14), 7533. ncbi. <https://doi.org/10.3390/ijerph18147533>
- Al-Gahtani, S. S. (2016). An empirical investigation of the acceptance of mobile learning in Saudi Arabia. *Journal of King Saud University-Computer and Information Sciences*, 28(4), 427-435.
- Al-Gahtani, S. S. (2016). Modeling the determinants of mobile learning adoption in higher education. *Journal of Computing in Higher Education*, 28(1), 148-167.
- Al-Harbi, N., & Al-Shehri, A. (2018). The effect of perceived security on mobile payment acceptance. *Journal of Theoretical and Applied Electronic Commerce Research*, 13(1), 81-95.
- Al-Somali, S. A., Gholami, R., & Clegg, B. (2009). An investigation into the acceptance and use of electronic banking in Saudi Arabia. *Journal of Systems and Information Technology*, 11(2), 197-221.
- Aladwani, A. M. (2003). Key Internet characteristics and e-commerce issues in Arab countries. *Information Technology & People*, 16(1), 9-20. <https://doi.org/10.1108/09593840310462998>
- Alalwan, A. A., Baabdullah, A. M., R (2018). Investigating the factors influencing continuance intention to e-government services: Empirical evidence from Saudi Arabia. *International Journal of Information Management*, 39, 80-96.
- Alalwan, A. A., Dwivedi, Y. K., & Rana, N. P. (2017). Factors influencing adoption of mobile banking by Jordanian bank customers: Extending UTAUT2 with trust. *International Journal of Information Management*, 37(3), 99-110.
- Alkafagi, A. A., Salameh, A. A., & Abu AlSondos, I. A. (2019). The Importance of Individual Technology Factors for Adoption of Internet Banking. *European Journal of Business and Management*, 11(36). <https://doi.org/10.7176/ejbm/11-36-01>
- Altounjy, R., Alaeddin, O., Hussain, H. I., & Kot, S. (2020). Moving from Bricks to Clicks: Merchants' Acceptance of the Mobile Payment in Malaysia. *International Journal of EBusiness and EGovernment Studies*, 12(2), 136–150. <https://doi.org/10.34111/ijeveg.202012204>
- Amin, H., Abdul Hamid, M. R., Lada, S., & Anis, Z. (2008). The adoption of mobile banking in Malaysia: the case of Bank Islam Malaysia Berhad (BIMB). *International Journal of Business and Society*, 9(2), 69–86.
- Arora, N. and Aggarwal, A. (2018). The role of perceived benefits in formation of online shopping attitude among women shoppers in India. *South Asian Journal of Business Studies*, 7(1), 91-110. <https://doi.org/10.1108/SAJBS-04-2017-0048>

- Asenahabi, B. M. (2019). Basics of Research Design: A Guide to selecting appropriate research design. *International Journal of Contemporary Applied Research*, 6(5), 76–89.
- Bailey, A. A., Pentina, I., Mishra, A. S., & Ben Mimoun, M. S. (2017). Mobile payments adoption by US consumers: an extended TAM. *International Journal of Retail & Distribution Management*, 45(6), 626–640. <https://doi.org/10.1108/ijrdm-08-2016-0144>
- Balasubraman, S., Peterson, R. A., & Jarvenpaa, S. L. (2002). Exploring the Implications of M-Commerce for Markets and Marketing. *Journal of the Academy of Marketing Science*, 30(4), 348–361. <https://doi.org/10.1177/009207002236910>
- Banerjee, Syagnik (Sy) and Dholakia, Ruby Roy, Mobile Advertising: Does Location-Based Advertising Work? (2008). *International Journal of Mobile Marketing*, December 2008, Available at SSRN: <https://ssrn.com/abstract=2135087>
- Barnes, S. J. (2002). The mobile commerce value chain: analysis and future developments. *International Journal of Information Management*, 22(2), 91–108. [https://doi.org/10.1016/s0268-4012\(01\)00047-0](https://doi.org/10.1016/s0268-4012(01)00047-0)
- Benedict Leong (2020). COVID-19's impact on Malaysia's ecommerce market. <https://janio.asia/articles/ecommerce-online-shopping-malaysia-covid-19/>
- Bhalla, M. (2016). 7 reasons why customers are abandoning your mobile shopping cart. Ventureburn. <https://ventureburn.com/2016/01/7-reasons-why-customers-are-abandoning-your-mobile-shopping-cart/>
- Bryman, A., & Bell, E. (2015). *Business research methods* (4th ed.). Oxford University Press.
- Burton-Jones, A., & Hubona, G. S. (2006). The mediation of external variables in the technology acceptance model. *Information & Management*, 43(6), 706–717. <https://doi.org/10.1016/j.im.2006.03.007>
- Butcher, K., Sparks, B. and O'Callaghan, F. (2001). Evaluative and relational influences on service loyalty. *International Journal of Service Industry Management*, 12(4), 310–327. <https://doi.org/10.1108/09564230110405253>
- Chen, Y.-C., Wu, J.-H., & Chang, H.-Y. (2016). Users' perceptions of e-learning services: Psychological dimensions, perceived quality and behavioural intention. *Behaviour & Information Technology*, 35(12), 1164–1174.
- Chinna, K. & Yuen, C. W. (2015). *Statistical Analysis Using SPSS*. (2nd ed.). Pearson Malaysia.
- Chiu, C.-M., Huang, H.-Y., Chen, K.-J., & Lin, T.-C. (2014). What drives purchase intention for paid mobile apps? An expectation confirmation model with perceived value. *Electronic Commerce Research and Applications*, 13(6), 402–412.
- Cho, Y., & Cheon, J. (2005). Why do people avoid advertising on mobile devices?: Antecedents of mobile advertising avoidance. *Journal of Interactive Advertising*, 6(2), 41–51.
- Chong, A. Y. L. (2013). *Predicting m-commerce adoption determinants: A neural network approach*. *Expert systems with applications*, 40(2), 523–530.
- Chong, A. Y.-L., & Chan, F. T.-S. (2012). Mobile commerce acceptance factors in the People's Republic of China: A structural equation model. *Journal of Electronic Commerce Research*, 13(1), 51–78.

- Chopdar, P. Kr., Korfiatis, N., Sivakumar, V. J., & Lytras, M. D. (2018). Mobile shopping apps adoption and perceived risks: A cross-country perspective utilizing the Unified Theory of Acceptance and Use of Technology. *Computers in Human Behavior*, 86, 109–128. <https://doi.org/10.1016/j.chb.2018.04.017>
- Cyr, D., Head, M., Larios, H., & Pan, B. (2009). Exploring human images in website design: A multi-method approach. *MIS quarterly*, 539-566. <https://doi.org/10.1016/j.ijhcs.2009.07.004>
- D. Davis, F. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), p.319-340. <https://doi.org/10.2307/249008>
- Dahlberg, T., Mallat, N., Ondrus, J., & Zmijewska, A. (2008). *Past, present and future of mobile payments research: A literature review. Electronic commerce research and applications*, 7(2), 165-181. <https://doi.org/10.1016/j.elerap.2007.02.001>
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- de Sena Abrahão, R., Moriguchi, S. N., & Andrade, D. F. (2016). Intention of adoption of mobile payment: An analysis in the light of the Unified Theory of Acceptance and Use of Technology (UTAUT). *RAI Revista de Administração e Inovação*, 13(3), 221-230.
- Delafrooz, N., Hj. Paim, L., & Khatibi, A. (2010). Students' Online Shopping Behavior: An Empirical Study. *Journal of American Science*, 6(1).
- Department of Statistics Malaysia. (2022). Current population estimates Malaysia 2022. Retrieved from <https://dev.dosm.gov.my/portal-main/release-content/current-population-estimates-malaysia-2022>
- Dillon, A., & Morris, M. G. (1996). *User acceptance of new information technology: theories and models 1996*, 14(4): 3-32. <http://hdl.handle.net/10150/105584>
- Dumelle, M., Higham, M., Ver Hoef, J. M., Olsen, A. R., & Madsen, L. (2022). A comparison of design-based and model-based approaches for finite population spatial sampling and inference. *Methods in Ecology and Evolution*, 13(9), 2018–2029. <https://doi.org/10.1111/2041-210x.13919>
- Edwin, A. G. W. U. (2015). *Analysis of obstacles to uptake of internet banking services in Nigeria. Research Journal of Business and Management*, 2(1), 99-114.
- eMarketer. (2016). *Mobile Commerce Round Up*. <https://docplayer.net/15139605-Mobile-commerce-roundup.html>
- Fernandes, C. & Awamleh, R. (2006). Diffusion of internet banking amongst educated consumers in a high-income non-OECD country. *Journal of Internet Banking and Commerce*, 11(3), 1-17.
- Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. *Philosophy & Rhetoric*, 130-132.
- Fitriansyah, A., & Harris, I. (2018). Pengukuran Kepuasan Pengguna Situs Web Dengan Metode End User Computing Satisfaction (EUCS). *Journal of Information Systems*, 2(1).

- Flavián, C. and Guinalú, M. (2006). Consumer trust, perceived security and privacy policy: Three basic elements of loyalty to a web site. *Industrial Management & Data Systems*, 106(5), 601-620. <https://doi.org/10.1108/02635570610666403>
- Fong, K. K.-K., & Wong, S. K. S. (2015). Factors Influencing the Behavior Intention of Mobile Commerce Service Users: An Exploratory Study in Hong Kong. *International Journal of Business and Management*, 10(7). <https://doi.org/10.5539/ijbm.v10n7p39>
- Gandhi, S. K. (2016). India's Jumbo Jump from E-Commerce to Mobile Enabled Services (MES): A Review. *Productivity*, 56(4), 326-331.
- Gao, L., & Bai, X. (2014). A unified perspective on the factors influencing consumer acceptance of internet of things technology. *Asia Pacific Journal of Marketing and Logistics*, 26(2), 211-231. <https://doi.org/10.1108/apjml-06-2013-006>
- George, D. & Mallery, P., 2003. *SPSS for Windows Step by Step: A Simple Guide and Reference*. 11.0 Update. 4th ed. Boston: Allyn & Bacon.
- Gokilavani, R., Kumar, D. V., Durgarani, M., & Mahalakshmi, R. (2018). Can India Move Towards Digital Sovereign Currency? A Study on Perception of Consumers Towards. *International Journal of Pure and Applied Mathematics*, 119(17), 2167-2175.
- Gravetter, F. & Wallnau, L. (2014). *Essentials of Statistics for the Behavioural Sciences*. (8th ed.), Belmont, CA: Wadsworth.
- Guo, X., Huang, L., & Zhou, J. (2018). An empirical study of factors influencing users' adoption of mobile payment services in China. *Telematics and Informatics*, 35(6), 1646-1657.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.
- Hanafizadeh, P., Asadi, J., & Khedmatgozar, H. R. (2012). Decisive Factors in Adoption of Internet Banking (Case Study: Eghtesad Novin Bank). *Sharif Journal of Industrial Engineering & Management*, (1), 87-98.
- Harris, I. (2019). Kehebatan Situs Belanja Daring dalam Mempengaruhi Emosi dan Kepercayaan Pembeli. *JMD: Jurnal Riset Manajemen & Bisnis Dewantara*, 2(2), 81-88. <https://doi.org/10.26533/jmd.v2i2.369>
- Hassan, D., & Ali, S. (2012). Exploring E-commerce Activity in Malaysia: Challenges and opportunities. *Journal of Economics and Sustainable Development.*, 3(10).
- Hassan, M. A., & Shukur, Z. (2019, September). *Review of digital wallet requirements*. In 2019 *International Conference on Cybersecurity (ICoCSec)* 43-48. IEEE.
- Hayashi, F., & Bradford, T. (2014). Mobile Payments: Merchants' Perspectives. *Economic Review*, Q(2), 33-58.
- Hillman, S., & Carman, N. (2017). Trust and mobile commerce in North America. *Computers in Human Behavior* 70(2017): 10-21. <https://doi.org/10.1016/j.chb.2016.12.061>
- Hoffman, D. L., Novak, T. P., & Peralta, M. (1999). Building consumer trust online. *Communications of the ACM*, 42(4), 80-85. <https://doi.org/10.1145/299157.299175>

- Holdings, N. (2014). *Malaysians rank among the world's most avid online shoppers*. The Nielsen Global Survey of E-Commerce. <http://www.nielsen.com/my/en/press-room/2014/e-commerce.html>
- Hu, P. J., Chau, P. Y. K., Sheng, O. R. L., & Tam, K. Y. (1999). Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology. *Journal of Management Information Systems*, 16(2), 91–112. <https://doi.org/10.1080/07421222.1999.11518247>
- Hung, M. (2018). An examination of the determinants of mobile shopping. *International Journal of Electronic Business Management*, 10(1), 29–37.
- Hung, M. C., Yang, S. T., & Hsieh, T. C. (2012). *An examination of the determinants of mobile shopping continuance*. *International journal of electronic business management*, 10(1), 29.
- Jocevski, M., Ghezzi, A., & Arvidsson, N. (2020). Exploring The Growth Challenge Of mobile Payment Platforms: A business Model Perspective. *Electronic Commerce Research and Applications*, 40(March–April), 100908. <https://doi.org/10.1016/j.eelerap.2019.100908>
- Kanapathipillai, K. (2020). The impact of the silent enemy (Covid-19 pandemic) on the marketing efforts undertaken by the automotive industries in Malaysia. *European Journal of Management and Marketing Studies*, 5(4). DOI: <http://dx.doi.org/10.46827/ejmms.v5i4.886>
- Kanapathipillai, K., & Kumaran, S. (2022). The mediating effect of relationship marketing strategy between digital marketing strategy and consumers' purchase decisions in the automotive industry in Malaysia. *European Journal of Management and Marketing Studies*, 7(2), 1-27. DOI: <http://dx.doi.org/10.46827/ejmms.v7i2.1205>
- Kanapathipillai, K., & Mahbob, N. N. (2021). The impact of relationship marketing on customer loyalty in the tour and travel companies in Malaysia during CoV-19 pandemic: Parallel mediation of social media and relationship quality. *European Journal of Management and Marketing Studies*, 6(4), 1- 30. DOI: <http://dx.doi.org/10.46827/ejmms.v6i4.1144>
- Kassim, N. M., & Ramayah, T. (2015). *Perceived Risk Factors Influence on Intention to Continue Using Internet Banking among Malaysians*. *Global Business Review*, 16(3), 393–414. <https://doi.org/10.1177/0972150915569928>
- Kassim, N. M., Mohamad, W. N., & Talib, Z. M. (2021). Mobile shopping acceptance among millennials in Malaysia Public University. *Electronic Journal of Business and Management*, 6(1), 1-19.
- Khoo, D. (2021). *Driving Digital Transformation: Lessons from Building the First ASEAN Digital Bank*. Marshall Cavendish International Asia Pte Ltd.
- Kim, H. W., & Park, S. Y. (2017). An investigation of mobile device security and user acceptance of mobile payment. *Industrial Management & Data Systems*, 117(2), 327-342.
- Kim, Y. H., Kim, D. J., & Wachter, K. (2013). *A study of mobile user engagement (MoEN): Engagement motivations, perceived value, satisfaction, and continued engagement intention*. *Decision support systems*, 56, 361-370. <https://doi.org/10.1016/j.dss.2013.07.002>

- King, W. R., & He, J. (2006). *A meta-analysis of the technology acceptance model*. *Information & management*, 43(6), 740-755.
- Ko, E., Kim, E. Y., & Lee, E. K. (2009). *Modeling consumer adoption of mobile shopping for fashion products in Korea*. *Psychology and Marketing*, 26(7), 669-687. <https://doi.org/10.1002/mar.20294>
- Krejcie, R., & Morgan, D. W. (1970). *Determining sample size for research activities*. *Educational and Psychological Measurement*, 30(3), 607-610. <https://doi.org/10.1177/001316447003000308>
- Kristina, N., Venny, V., & Vironika, V. (2019). *Entrepreneurial Factors and Work Environment Factors for Millennial Women's Performance*. *MBIA*, 18(2), 134-140. <https://doi.org/10.33557/mbia.v18i2.346>
- Kshetri, N. (2013). *Cybercrime and cyber-security issues associated with China: some economic and institutional considerations*. *Electronic Commerce Research*, 13, 41-69. <https://doi.org/10.1007/s10660-013-9105-4>
- Kumar, R., Sachan, A., & Kumar, R. (2020). *The impact of service delivery system process and moderating effect of perceived value in internet banking adoption*. *Australasian Journal of Information Systems*, 24. <https://doi.org/10.3127/ajis.v24i0.1923>
- Kuo, Y.-F., Wu, C.-M., & Deng, W.-J. (2009). *The relationships among service quality, perceived value, customer satisfaction, and post-purchase intention in mobile value-added services*. *Computers in Human Behavior*, 25(4), 887-896.
- Kyriazos, T. A. (2018). *Applied Psychometrics: Sample Size and Sample Power Considerations in Factor Analysis (EFA, CFA) and SEM in General*. *Psychology*, 09(08), 2207-2230. <https://doi.org/10.4236/psych.2018.98126>
- Laukkanen, T., & Lauronen, J. (2005). *Consumer value creation in mobile banking services*. *International Journal of Mobile Communications*, 3(4), 325. <https://doi.org/10.1504/ijmc.2005.007021>
- Lazer, David, Alex Pentland, Lada Adamic, Sinan Aral, Albert-László Barabási, Devon Brewer, Nicholas Christakis. (2009). *Computational social science*. *Science* 323(5915), 721-723. <https://www.science.org/doi/10.1126/science.1167742>
- Lee, H., Fiore, A. M., & Kim, J. (2006). *The role of the technology acceptance model in explaining effects of image interactivity technology on consumer responses*. *International Journal of Retail & Distribution Management*, 34(8), 621-644. <https://doi.org/10.1108/09590550610675949>
- Lee, Y., & Kim, Y. (2010). *Understanding factors affecting trust in and satisfaction with mobile banking in Korea: A modified DeLone and McLean's model perspective*. *Interacting with Computers*, 22(4), 340-348.
- Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). *The technology acceptance model: Past, present, and future*. *Communications of the Association for information systems*, 12(1), 50.
- Legris, P., Ingham, J., & Collerette, P. (2003). *Why do people use information technology? A critical review of the technology acceptance model*. *Information & management*, 40(3), 191-204.

- Leong, B. (2020). COVID-19's *impact on Malaysia's e-commerce market*. Retrieved online from <https://janio.asia/articles/ecommerce-online-shopping-malaysia-covid-19>
- Li, J., & Lin, C. (2019). Factors influencing user acceptance of healthcare mobile apps: A comparative study of user groups with different age and gender. *International Journal of Medical Informatics*, 125, 1-10.
- Liao, S.-H., & Yang, L.-L. (2020). Mobile payment and online to offline retail business models. *Journal of Retailing and Consumer Services*, 57, 102230. <https://doi.org/10.1016/j.jretconser.2020.102230>
- Lin, H. F., & Huang, S. W. (2012). Exploring the factors affecting user acceptance of mobile technology. *Computers in Human Behavior*, 28(6), 1834-1848.
- Lin, H.-H., Wang, Y.-S., & Liang, T.-P. (2008). An examination of the determinants of customer loyalty in mobile commerce contexts. *Information & Management*, 45(6), 359-367.
- Littler, D., & Melanthiou, D. (2006). *Consumer perceptions of risk and uncertainty and the implications for behaviour towards innovative retail services: the case of internet banking*. *Journal of retailing and consumer services*, 13(6), 431-443.
- Liu, C., & Li, X. (2018). Understanding factors affecting mobile commerce adoption: A trust-based decision-making model. *Information & Management*, 55(1), 64-79.
- Lu, J., Yao, J. E., & Yu, C. S. (2011). Personalized mobile advertising: Its key attributes, trends, and social impact. *Journal of Electronic Commerce Research*, 12(4), 342-361.
- Lu, J., Yu, C. S., & Liu, C. (2011). Enhancing consumer initial trust in mobile payment services: An empirical study. *Behaviour & Information Technology*, 30(2), 181-199.
- Lu, Y., Yang, S., Chau, P. Y., & Cao, Y. (2011). Dynamics between the trust transfer process and intention to use mobile payment services: A cross-environment perspective. *Information & management*, 48(8), 393-403. <https://doi.org/10.1016/j.im.2011.09.006>
- Luarn, P., & Lin, H.-H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior*, 21(6), 873-891. <https://doi.org/10.1016/j.chb.2004.03.003>
- Madan, K., & Yadav, R. (2018). Understanding and predicting antecedents of mobile shopping adoption: A developing country perspective. *Asia Pacific Journal of Marketing and Logistics*, 30(1), 139-162. <https://doi.org/10.1108/APJML02-2017-0023>
- Mallat, N. (2007). *Exploring consumer adoption of mobile payments—A qualitative study*. *The Journal of Strategic Information Systems*, 16(4), 413-432. <https://doi.org/10.1016/j.jsis.2007.08.001>
- Malmqvist, J., Hellberg, K., Möllås, G., Rose, R., & Shevlin, M. (2019). Conducting the Pilot Study: A Neglected Part of the Research Process? Methodological Findings Supporting the Importance of Piloting in Qualitative Research Studies. *International Journal of Qualitative Methods*, 18(1), 1-11. <https://doi.org/10.1177/1609406919878341>
- Mason, A. N., Narcum, J., & Mason, K. (2021). Social media marketing gains importance after Covid-19. *Cogent Business & Management*, 8(1), 1870797. Tandfonline. <https://doi.org/10.1080/23311975.2020.1870797>

- McKechnie, S., Winklhofer, H., & Ennew, C. (2006). Applying the technology acceptance model to the online retailing of financial services. *International Journal of Retail & Distribution Management*, 34(4/5), 388-410. <https://doi.org/10.1108/09590550610660297>
- Milberg, S. J., Smith, H. J., & Burke, S. J. (2000). Information privacy: Corporate management and national regulation. *Organization Science*, 11(1), 35–57. <https://doi.org/10.1287/orsc.11.1.35.12567>
- Moon, E., & Domina, T. (2015). Willingness to use fashion mobile applications to purchase fashion products: A comparison between the United States and South Korea. *Journal of Textile and Apparel, Technology and Management*, 9(3).
- Moon, J. W., & Kim, Y. G. (2001). *Extending the TAM for a World-Wide-Web context. Information & management*, 38(4), 217-230.
- Moorthy, K., Chun Ting, L., Chea Yee, K., Wen Huey, A., Joe In, L., Chyi Feng, P., & Jia Yi, T. (2020). *What drives the adoption of mobile payment? A Malaysian perspective. International Journal of Finance & Economics*, 25(3), 349-364.
- Moorthy, K., Suet Ling, C., Weng Fatt, Y., Mun Yee, C., Ket Yin, E. C., Sin Yee, K., & Kok Wei, L. (2017). Barriers of mobile commerce adoption intention: Perceptions of Generation X in Malaysia. *Journal of Theoretical and Applied Electronic Commerce Research*, 12(2), 37–53. <https://doi.org/10.4067/s0718-18762017000200004>
- Mossel, E., Sly, A., & Tamuz, O. (2015). *Strategic learning and the topology of social networks. Econometrica Journal of The Econometric Society*, 83(5), 1755-1794. <https://doi.org/10.3982/ECTA12058>
- Nielsen, N. (2014). *Global consumers are willing to put their money where their heart is when it comes to goods and services from companies committed to social responsibility. http://www.nielsen.com/us/en/press-room/2014/global-consumers-are-willing-to-put-their-money-where-their-heart-is.html*
- Noor, R. M. (2006). *A Study on the Factors that Influence the Adoption of E-commerce Among Malaysian Small and Medium Enterprises* (Doctoral dissertation, Kulliyah of Information and Communication Technology, International Islamic University Malaysia).
- Normalini, M. K., Ramayah, T., & Shabbir, M. S. (2019). Investigating the impact of security factors in E-business and internet banking usage intention among Malaysians. *Industrial Engineering & Management Systems*, 18(3), 501-510.
- Oliveira, T., Thomas, M., Baptista, G., & Campos, F. (2016). Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology. *Computers in Human Behavior*, 61(August 2016), 404–414. <https://doi.org/10.1016/j.chb.2016.03.030>
- Ondrus, J., & Pigneur, Y. (2018). Mobile payment acceptance: A state of the art. *Journal of Systems and Information Technology*, 20(2), 135-159.
- Ong, C.-S., & Lai, J.-Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior*, 22(5), 816–829. <https://doi.org/10.1016/j.chb.2004.03.006>

- Oye, N. D., Iahad, N. A., & Rahim, N. A. (2014). The history of UTAUT model and its impact on ICT acceptance and usage by academicians. *Education and Information Technologies, 19*, 251–270.
- Palani, A., & Yasodha, P. (2012). A study on customer perception towards mobile banking in Indian overseas bank Chennai. *International Journals of Marketing and Technology, 2*(4), 262–276.
- Parasuraman, A., Zeithaml, V. A., & Malhotra, A. (2005). ES-QUAL: A multiple-item scale for assessing electronic service quality. *Journal of service research, 7*(3), 213-233. <https://doi.org/10.1177/109467050427>
- Park, E., & Kim, K. J. (2014). An integrated adoption model of mobile cloud services: exploration of key determinants and extension of technology acceptance model. *Telematics and Informatics, 31*(3), 376-385. <https://doi.org/10.1016/j.tele.2022.101810>
- Park, S. E., Kim, H. J., Lee, K. H., & Lee, S. M. (2019). Investigating factors affecting the adoption of mobile health apps from a trust-transfer perspective. *Internet Research, 29*(2), 340-360.
- Peng, S., Yang, A., Cao, L., Yu, S., & Xie, D. (2017). Social influence modeling using information theory in mobile social networks. *Information Sciences, 379*, 146-159. <https://doi.org/10.1016/j.ins.2016.08.023>
- Population ages 15-64 (% of total population) - Malaysia | Data. (2022). Data.worldbank.org. <https://data.worldbank.org/indicator/SP.POP.1564.TO.ZS?locations=MY>
- Praveena, K., & Thomas, S. (2013). Continuance intention to use Facebook: Role of perceived enjoyment and trust. *The International Journal of Business & Management, 1*(6), 26–32.
- Priporas, C.-V., Stylos, N., & Kamenidou, I. (Eirini). (2019). City image, city brand personality and generation Z residents' life satisfaction under economic crisis: Predictors of city-related social media engagement. *Journal of Business Research, 119*(October 2020). <https://doi.org/10.1016/j.jbusres.2019.05.019>
- Ramadan, R., & Aita, J. (2018). A model of mobile payment usage among Arab consumers. *International Journal of Bank Marketing, 36*(7), 1213–1234. <https://doi.org/10.1108/ijbm-05-2017-0080>
- Ramayah, T., Ma'arif, J. J., Jantan, M., & Osman, M. (2002, October). *Technology Acceptance Model: is it applicable to users and non-users of internet banking*. In The proceedings of the international Seminar, Indonesia-Malaysia, the role of harmonization of Economics and business discipline in global competitiveness, Banda Aceh, Indonesia 14-15
- Raviadaran, H., Dastane, D. O., Ma'arif, M. Y., & Mohd Satar, N. S. (2019). Impact of Service Quality Dimensions on Internet Banking Adoption, Satisfaction and Patronage. *International Journal of Management, Accounting and Economics, 6*(10).
- Rehman, Z. U., Omar, S. S. B., Zabri, S. B. M., & Lohana, S. (2019). Mobile payment adoption and its determinants in Malaysia. *International Journal of Innovative Technology and Exploring Engineering, 9*(1), 4231-4239.

- Riquelme, H. E., & Rios, R. E. (2010). The moderating effect of gender in the adoption of mobile banking. *International Journal of Bank Marketing*, 28(5), 328–341. <https://doi.org/10.1108/02652321011064872>
- Salah Uddin, M., & Yesmin Akhi, A. (2014). E-Wallet System for Bangladesh an Electronic Payment System. *International Journal of Modeling and Optimization*, 4(3), 216–219. <https://doi.org/10.7763/ijmo.2014.v4.376>
- Schierz, P. G., Schilke, O., & Wirtz, B. W. (2010). Understanding consumer acceptance of mobile payment services: An empirical analysis. *Electronic Commerce Research and Applications*, 9(3), 209–216. <https://doi.org/10.1016/j.elelap.2009.07.005>
- Seah, C. S., Loh, Y. X., Wong, Y. S., Jalaludin, F. W., & Loh, L. H. (2022). *The Influence of COVID-19 Pandemic on Malaysian E-Commerce Landscape: The case of Shopee and Lazada*. In Proceedings of the 6th International Conference on E-Commerce, E-Business and E-Government, 17-23. <https://doi.org/10.1145/3537693.3537726>
- Shafinah, K., Sahari, N., Sulaiman, R., Yusoff, M. S. M., & Ikram, M. M. (2013). Determinants of user behavior intention (BI) on mobile services: A preliminary view. *Procedia technology*, 11, 127-133.
- Shaikh, A. A., & Karjaluo, H. (2015). Mobile banking adoption: A literature review. *Telematics and Informatics*, 32(1), 129–142. <https://doi.org/10.1016/j.tele.2014.05.003>
- Shen, O. W., & Yazdanifard, R. (2015). Has mobile payment finally live up to its expectation in replacing cash and credit? *International Journal of Management, Accounting and Economics*, 2(5), 489–498.
- Shrestha, N. (2020). Detecting multicollinearity in regression analysis. *American Journal of Applied Mathematics and Statistics*, 8(2), 39–42. <https://doi.org/10.12691/ajams-8-2-1>
- Shukla, A., & Sharma, S. K. (2018). Evaluating Consumers' Adoption of Mobile Technology for Grocery Shopping: An Application of Technology Acceptance Model. *Vision: The Journal of Business Perspective*, 22(2), 185–198. <https://doi.org/10.1177/0972262918766136>
- Silva, P. (2015). Davis' technology acceptance model (TAM)(1989). Information seeking behavior and technology adoption: *Theories and trends*, 205-219.
- Sinha, M., Majra, H., Hutchins, J., & Saxena, R. (2019). Mobile payments in India: The privacy factor. *International Journal of Bank Marketing*, 37(1), 192–209. <https://doi.org/10.1108/ijbm-05-2017-0099>
- Stack, L. (2018, March 1). *Are You 21 to 37? You Might Be a Millennial*. www.nytimes.com. <https://www.nytimes.com/2018/03/01/style/millennials.html>
- Stewart, K. A., & Segars, A. H. (2002). An empirical examination of the concern for information privacy instrument. *Information systems research*, 13(1), 36-49. <https://doi.org/10.1287/isre.13.1.36.97>
- Sufyan Habib, Nawaf N. Hamadneh (2016). Impact of Perceived Risk on Consumers Technology Acceptance in Online Grocery Adoption amid COVID-19 Pandemic. *Sustainability*, 13(18), 10221. <https://doi.org/10.3390/su131810221>
- Suganthi, B., & Suganthi, B. (2001). Internet banking patronage: an empirical investigation of Malaysia. *Journal of Internet Banking and commerce*, 6(1).

- Sulaiman, A., Yusoff, R. M., & Zain, M. (2017). Factors influencing consumers' online buying behavior and mobile app acceptability for fashion products: A study in Malaysia. *Journal of Fashion Marketing and Management: An International Journal*, 21(1), 41-53.
- Tan, C. F. (2012). Malaysian Consumers' Perceptions of Online Shopping. *COMM 803 Empirical Quantitative Research*.
- Tandon, U., Kiran, R., & Sah, A. N. (2017). Customer satisfaction as mediator between website service quality and repurchase intention: An emerging economy case. *Service Science*, 9(2), 106-120.
- Tapscott. (1996). Six themes for new learning from: the digital economy: promise and peril in the age of networked intelligence. *Educom Review*, 31.
- Taylor, E. (2016). Mobile payment technologies in retail: a review of potential benefits and risks. *International Journal of Retail & Distribution Management*, 44(2), 159–177. <https://doi.org/10.1108/ijrdm-05-2015-0065>
- Tenk, T. T., Melissa, T. T., Chin Yew, H., & Heang, L. T. (2020). E-wallet adoption. *a case in Malaysia*.
- Teoh, C. H. & Md Nor, K. (2007). Consumer Acceptance of Mobile Banking. *Journal of Technology Management Entrepreneurship*, 6(1):1-17.
- Teshome, Z., Belete, B., Gizaw, G., & Mengiste, M. (2020). *Customer satisfaction and public service delivery: The case of Dire Dawa Administration. Public Policy and administration research*, 10(7).
- The Eighth Malaysia Plan 2001-2005. (n.d.). In <https://www.epu.gov.my/en/economic-developments/development-plans/rmk/eight-malaysia-plan-2001-2005>.
- The Mobile Mandate: Criteo Q2 State of Mobile Commerce Report Highlights Powerful Role that Apps and Cross Device Play in Purchasing Cycle*. (2015, June Criteo. <https://www.criteo.com/news/press-releases/2015/07/the-mobile-mandate-criteo-q2-state-of-mobile-commerce-report/>
- Tjiptono, F., Khan, G., Yeong, E. S., & Kunchambo, V. (2020). Generation Z in Malaysia: The Four "E" Generation. *The New Generation Z in Asia: Dynamics, Differences, Digitalisation*, 149–163. <https://doi.org/10.1108/978-1-80043-220-820201015>
- Tripathi, R., Khatri, N., & Mamde, A. (2020). Sample size and sampling considerations in published clinical research articles. *J Assoc Physicians India*, 68(3), 14–18.
- Tsu Wei, T., Marthandan, G., Yee-Loong Chong, A., Ooi, K., & Arumugam, S. (2009). What drives Malaysian m-commerce adoption? An empirical analysis. *Industrial Management & Data Systems*, 109(3), 370–388. <https://doi.org/10.1108/02635570910939399>
- Uddin, M. S., & Akhi, A. Y. (2014). *E-Wallet System for Bangladesh an Electronic Payment System. International Journal of Modeling and Optimization*, 4(3), 216
- van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 28(4), 695-704.
- van der Heijden, Hans, (2002). Factors Affecting the Successful Introduction of Mobile Payment Systems. *BLED 2002 Proceedings*. 20. <http://aisel.aisnet.org/bled2002/20V>

- Van Slyke, C., Belanger, F., & Comunale, C. L. (2004). Factors influencing the adoption of mobile financial services: A study of the diffusion of mobile banking. *Journal of Information Privacy and Security*, 1(1), 33-52.
- Venkatesh, V. (1999). Creation of favorable user perceptions: exploring the role of intrinsic motivation. *MIS Quarterly*, 23(2), 239. <https://doi.org/10.2307/249753>
- Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, 39(2), 273-315. <https://doi.org/10.1111/j.1540-5915.2008.00192.x>
- 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. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, 24(1), 115-139. <https://doi.org/10.2307/3250981>
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.
- Venkatesh, V., Speier, C., & Morris, M. G. (2002). *User acceptance enablers in individual decision making about technology: Toward an integrated model*. *Decision sciences*, 33(2), 297-316.
- Wang, Q., & Liang, Y. (2019). Factors affecting Chinese consumers' adoption of mobile health applications: An empirical study. *Telemedicine and e-Health*, 25(3), 182-188.
- Wang, X., Yu, J., & Wei, X. (2020). Exploring the impact of mobile device security features on user adoption of mobile payment. *Telematics and Informatics*, 50, 101399.
- Wang, Y., Hernández, J. E., & Wang, S. (2017). Determinants of mobile commerce customer loyalty in China: A structural equation model analyzing perceived value and satisfaction. *Journal of Global Information Management*, 25(2), 42-63.
- Wasiul Karim, M., Arije Ulfy, M., & Nazmul Huda, M. (2020). Determining Intention to Use Smartphone Banking Application among Millennial Cohort in Malaysia. *International Journal of Management and Sustainability*, 9(1), 43-53. <https://doi.org/10.18488/journal.11.2020.91.43.53>
- Willems, K., Verhulst, N., Brengman, M. (2021). How COVID-19 could accelerate the adoption of new retail technologies and enhance the (e-)servicescape. In: Lee, J., Han, S.H. (eds) *The future of service post-COVID-19 pandemic*, Volume 2. The ICT and Evolution of Work. Springer, Singapore. https://doi.org/10.1007/978-981-33-4134-0_6
- Willman, J. (2015). *The sharing millennials: How differences in sharing behaviors affect mobile app usage among Western and Eastern consumers* (Doctoral dissertation, The Ohio State University). <https://doi.org/10.1177/0972262918766136>
- Wong, C. H., Tan, G. W. H., Ooi, K. B., & Lin, B. (2015). Mobile shopping: the next frontier of the shopping industry? An emerging market perspective. *International Journal of Mobile Communications*, 13(1), 92. <https://doi.org/10.1504/ijmc.2015.065892>

- Woon, L. P., Tan, G. W. H., & Ismail, H. (2018). Security, privacy, and trust in mobile applications: A review. *International Journal of Multimedia and Ubiquitous Engineering*, 13(8), 139-152.
- Wu, J.-H., & Chen, Y.-C. (2019). Continuance intention to use mobile payment services: Exploring the moderating effect of switching costs. *Journal of Information Systems and Technology Management*, 16, e2019030201
- Wu, J., Liu, L., & Huang, L. (2017). Consumer acceptance of mobile payment across time. *Industrial Management & Data Systems*, 117(8), 1761–1776. <https://doi.org/10.1108/imds-08-2016-0312>
- Wu, Y., & Chen, Y. (2019). Factors influencing the adoption of mobile payment services: Empirical evidence from Taiwan. *International Journal of Mobile Communications*, 17(1), 40-60.
- Yan, L.-Y., Tan, G. W.-H., Loh, X.-M., Hew, J.-J., & Ooi, K.-B. (2021). QR code and mobile payment: The disruptive forces in retail. *Journal of Retailing and Consumer Services*, 58, 102300. <https://doi.org/10.1016/j.jretconser.2020.102300>
- Yaokumah, W., Kumah, P., & Okai, E. S. A. (2017). Demographic Influences on E-Payment Services. *International Journal of E-Business Research*, 13(1), 44–65. <https://doi.org/10.4018/ijebr.2017010103>
- Yoo, S. J., & Kim, S. H. (2021). Analysis of the adoption of mobile healthcare applications: A comparison of users and non-users. *Healthcare Informatics Research*, 27(2), 102-109.
- Yoon, C., & Kim, S. (2007). Convenience and TAM in a ubiquitous computing environment: The case of wireless LAN. *Electronic Commerce Research and Applications*, 6(1), 102–112. <https://doi.org/10.1016/j.elerap.2006.06.009>
- YuSheng, K. and Ibrahim, M. (2019). Service innovation, service delivery and customer satisfaction and loyalty in the banking sector of Ghana. *International Journal of Bank Marketing*, 37(5), 1215-1233. <https://doi.org/10.1108/IJBM-06-2018-0142>
- Zhang, J., Zhang, H., & Sun, Q. (2021). Examining the effects of perceived usefulness and perceived ease of use on mobile payment adoption: An empirical study in China. *Information Technology and People*, 34(4), 1179-1203.

Creative Commons licensing terms

Author(s) will retain the copyright of their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s). Open Access Publishing Group and European Journal of Social Sciences Studies shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflicts of interest, copyright violations and inappropriate or inaccurate use of any kind content related or integrated into the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/)