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Exploring Consumer Mobile Payment Adoption: A Multi-Country Study

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INTRODUCTION

The popularity of mobile devices (smartphones, tablets, smart watches, etc.) has significantly changed our everyday lives. Mobile devices are seen as an indispensable product as they improve the efficiency and quality of our daily activities (Lau, et al., 2016). Financial transactions are no exception. The term mobile payment can broadly refer to three different types of payment methods, including in-person proximity mobile payment, remote mobile payment, and peer-to-peer mobile payment (Liébana-Cabanillas et al., 2018). Remote mobile payment involves a remote authorisation and transaction process without the need for involved parties physically close to each other, such as PayPal. Peer-to-peer mobile payment involves individuals transferring funds to and from their own bank accounts, such as Pintit by Barclays. This paper focuses on in-person proximity mobile payment that is enabled by Near Field Communication (NFC) technology. NFC allows contactless short-range communication facilitating data transmission between mobile devices and payment terminals (Hayashi & Bradford, 2014). With the support of NFC, proximity mobile payment (m-payment) allows users with compatible mobile devices to use m-payment functions via their mobile devices for financial transactions when their devices and Point of Sale (POS) terminals are within 10 cm. M-payment eliminates the need for customers to carry and use cash (Pham & Ho, 2015) as well as offers convenience and speed (Teo, et al., 2015).

The use of m-payment is expected to exceed the revenue of 930 billion US dollars globally and reach 1.31 billion users by 2023 (Statista, 2019). One of the key drivers behind the increasing adoption of m-payment is the popularity of NFC-enabled smartphones (PwC, 2017). However, whilst 30% of customers have used mobile devices for contactless (tap and go) payment, 75% of customers prefer to use their credit or debit cards for contactless payment in the UK (WorldPay, 2017). According to the World Payments Report (Capgemini, 2021), nearly 45% of consumers frequently use mobile wallets to make payments (>20 transactions a year) up from 23% in 2020. With the potential for wide-spread usage, researchers have begun identifying the factors of m-payment adoption. Technology Acceptance Model (TAM) and its extensions have been widely applied to identify and assess adoption factors for mobile financial transactions including perceived ease of use (PEOU) and perceived usefulness (PU) (Kim, et al., 2010; Koenig-Lewis, et al., 2015), trust (Lu et al., 2011; Al-Saedi, et al., 2020), security and risks (Arvidsson, 2014; Al-Saedi et al., 2020; Choi et al., 2020), costs (Hongxia et al., 2011; Al-Saedi, et al., 2020), privacy (Slade et al., 2013), use context (Mallat et al., 2009), culture (Alalwan, et al., 2015), social influence (Alalwan, et al., 2015; Hongxia, et al., 2011), and personal innovativeness (Patil, et al., 2020).

These studies are an initial investigation into mobile financial transactions, but some are not focused specifically on m-payment adoption. The lack of m-payment research coupled with the lack of preference for m-payment by the majority of users makes it essential to further investigate the factors of adoption to identify the blocks as well as provide guidance to merchants on how to better encourage users to adopt m-payment. This paper presents the preliminary findings of m-payment adoption factors based on the TAM and Diffusion of Innovation (DoI).

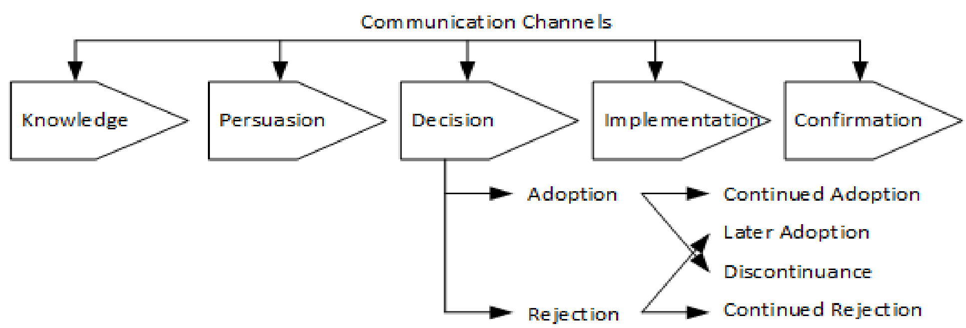
LITERATURE REVIEW

This section aims to explore the various theoretical models proposed for technology use and adoption. Adoption models have roots in information systems (IS), psychology (Fishbein & Ajzen, 1975), and sociology (Davis, 1989; Venkatesh & Davis, 2000). The following sections provide background and context for this through technology adoption, including the DoI and TAM.

Diffusion of Innovation (DoI)

DoI is known through the work of Rogers (2003) which explains how a new idea or product gains momentum and diffuses through a certain population. Rogers states that there is a degree of uncertainty by the members of the social system because innovations are new. DoI indicates that there are five types of people in the social system based on the degree of willingness to accept this uncertainty when it comes to innovation adoption, namely innovators, early adopters, early majority, late majority, and laggards. Innovators tend to embrace innovations and are tolerant of the uncertainty that comes with the innovations. Early adopters are also in favour of new ideas but would only adopt after proper evaluation and exploration. Similar to innovators, early adopters only account for a small proportion of the social system. The early and late majority refers to the mainstream in the social system. Laggards are those that adopt at a very late stage or even never adopt. Diffusion, therefore, concentrates on the conditions (attributes) which increase or decrease the likelihood that a new idea, product, or practice will be adopted by those members. Subsequently, the rate of adoption has been defined as the relative speed with which an innovation is adopted by members of a social system (Rogers, 2003). Hence, the perceived attributes of an innovation have a significant role in the rate of adoption of the innovation. Rogers further states that these attributes are known to have a 49-87% impact on the rate of adoption. Additionally, he states three other factors will have an impact on the rate of adoption. These are the innovation-decision type which can be optional, collective, or authority, communication channels including mass media or interpersonal channels, and social system as well as the change agents who may increase the rate of adoption of innovations. DoI lays out a five-stage decision-making process that occurs through a social system's communication channels (Figure 1). The communication channel depicts the flow of the steps in relation to adoption along with the characteristics of the decision-making unit and perceived characteristics of innovation. The five stages are knowledge, persuasion, decision, implementation, and confirmation. In the knowledge stage, individuals get exposed to and become aware of the innovation, but they might not have access to information about the innovation. In the persuasion stage, individuals who are interested in the innovation would actively seek information about the innovation. The decision stage is when individuals make their own decision about whether they would adopt the innovation or not based on their evaluation of the information obtained in the previous stages. In the implementation stage, individuals gain experiences and form their perception based on the experiences of the innovation. In the final stage, confirmation, individuals decide whether they would continue with the innovation or abandon the previously adopted innovation.

Figure 1 Diffusion of Innovation (Rogers, 2003).



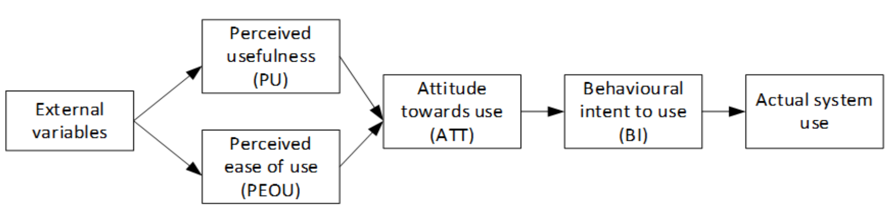
In the persuasion stage, there are five perceived characteristics of innovation that influence an individual's perception of the innovation, which leads to the decision to adopt or not. These innovation characteristics, namely relative advantage, complexity, compatibility, trialability, and observability. Relative advantage refers to an individual's perception of the superior value the innovation can provide in comparison with alternatives. Compatibility addresses how well the innovation fits into an individual's existing world, including cultural values, social norms, lifestyles, and past experiences. Complexity encompasses the perceived level of difficulty an innovation is to use or understand by an individual within the social system. Trialability is the degree to which an individual can experiment with the innovation without making a full commitment. Observability is the perceived exposure or visibility of the advantages from the adoption of an innovation.

Five main factors influence the adoption of an innovation: relative advantage, complexity, compatibility, trialability, and observability (Rogers, 2003). The five key factors have been adopted to understand user acceptance of financial technologies (Al-Jabri & Sohail, 2012; Chen, 2008). Researchers have applied DoI to investigate various technology innovations such as connected autonomous vehicles (Talebian & Mishra, 2018), electronic books (Raynard, 2017), computerised nurse care planning system (Lee, 2004), healthcare informatics (Ward, 2013), and m-payment (de Luna, et al., 2019).

Technology Acceptance Model (TAM)

One of the most well-known models regarding user acceptance of technology is TAM (Davis, 1989), which has been extensively used as a predictive and explanatory tool for drivers of user acceptance of technologies. TAM aims to realise external factors that impact internal beliefs, attitudes, and intentions. TAM evolved from the Theory of Reasonable Action (TRA), which suggests that actual behaviour is an outcome of their behavioural intentions to perform the activities (Ajzen & Fishbein, 1980). TRA suggests that an individual’s intention is determined by two factors, namely an individual’s positive or negative attitude towards a behaviour and an individual's perception of subjective norms to perform the behaviour. Although TAM and TRA both suggest that usage is determined by behavioural intentions, TAM also considers behavioural intentions as being jointly determined by the person's attitude toward using the system and perceived usefulness (Davis, 1989). TAM includes the two key determinants of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as shown in Figure 2. TAM provides the theoretical foundation to understand how external variables could influence attitude, intention, as well as actual use directly or indirectly. The external variables could affect intention and actual use through their mediated effects on PEOU and PU. PU is defined as the probability the user’s job performance will increase given the use of a specific application, and PEOU pertains to how effortless the new system will be for the user (Davis, 1989). These two determinants, PU and PEOU, influence a user’s attitude toward using. A user’s attitude towards use influences their behavioural intent (BI) to use, which determines their actual use.

Figure 2 Classic Technology Acceptance Model.



However, Bagozzi (2007) claimed that the TAM's emphasis on PU and PEOU limited research into identification of other essential determinants of technology adoption. In a recent review of adoption models (Chhonker et al., 2017), researchers found that most studies using TAM either used the original TAM constructs or extended TAM by adding new predictive constructs. The original TAM has been verified as an effective, robust, and parsimonious method for m-payment adoption (de Luna, et al., 2019). Researchers have applied TAM in mobile payment adoption.

M-payment adoption

Researchers have been investigating the adoption of various forms of mobile payment for the past decade, however, new technologies continue to emerge, and adoption has been relatively slow. In an exhaustive literature review on the research into mobile adoption, Slade et al. (2013) categorise mobile payment research into three categories: an examination of readiness and determinants of acceptance and use; those developing, characterising, compare and evaluating different m-payment systems and/or the technologies involved; and analysis of m-payment ecosystem, business models, and stakeholders. The following section highlights previous research on acceptance and use of mobile payment through TAM and DoI.

Li, et al. (2019) employed TAM in investigating the adoption behaviour of Chinese users' in adopting Alipay (a popular m-payment application in China). Their study found that PEOU and PU have a significant effect on ATT and BI, and that the perceived risk has a negative effect on PEOU and PU.

Another m-payment study indicated that there is a significant relationship between PEOU and PU on BI, and external variables including trust and personal innovativeness have positive effects on BI too (Leong et al., 2013). Keramati et al. (2012) investigated the adoption of m-payment and found that PEOU, PU, trust, perceived compatibility, cost, social norms, payment habits, availability of mobile phone skills, and convenience have an effect on adoption.

Furthermore, Hamza & Shah (2014) extended TAM with two additional variables, namely perceived compatibility, and social norm, to investigate m-payment adoption in Nigeria. Their studies found that PEOU, PU, and social norms have an effect on BI. Although there is no significant difference in the gender adoption of m-payment, social norms have more influences amongst female participants than amongst male participants.

Bailey, et al. (2017) extended TAM to include my-payment self-efficacy, privacy concerns, and technology anxiety to investigate m-payment adoption in the US. The findings support the use of TAM variables of PU, PEOU, attitude towards mobile payment, and the intention to use them as factors of m-payment adoption. Additionally, their findings suggest self-efficacy and privacy concerns influence m-payment adoption. However, a limitation of this investigation was the use of a convenience sample of students from one university and, as such, the results cannot be generalised to society.

Scholars such as de Luna, et al. (2019) used TAM alongside DoI for studying the m-payment adoption behaviour. Their studies compared three common mobile payment systems used today, namely NFC, QR (Quick Response), and SMS to investigate consumer acceptance from a behavioural model standpoint. The results from the study were found to be consistent with previous research supporting the robustness of the original TAM model for m-payment adoption research. The TAM model determinants and their relationships were validated for all mobile payment systems investigated except the relationship between ease of use and attitude in NFC and QR mobile payment systems. The authors further emphasise the importance of PU by consumers and suggest companies surpass user expectations as a key motivator for mass adoption. The authors identify additional salient factors besides usefulness as speed, convenience, and other advantages that will lure traditional payment (cash, check, credit cards, etc) users to switch to m-payment.

Although existing research has begun to illuminate m-payment adoption factors with varying degrees of significance, there are still gaps in our understanding of m-payment adoption. For instance, the results are often limited to consumers of a certain country or region (de Luna, et al.,2019; Li, et al., 2019; Bailey, et al., 2017; Hamza & Shah, 2014; Leong et al., 2013; Keramati et al., 2012), the use of convenience samples (Bailey, et al, 2017), and the use of limited determinants (Li, et al., 2019). Additionally, the research by Keramati et al., (2012) did not meet the standard recommendation of .50 to show convergent validity for average variance extracted (AVE). The AVE was only .30 meaning that the constructs in their model are not highly related. Also, Leong, et al.'s (2013) research was focused on the intention to use rather than actual use. Furthermore, individuals' perceptions could change over time, and their payment habits also change (NTT Data, 2017). The changing nature of individuals' payment habits highlights the need for continuous research into up-to-date m-payment adoption. Therefore, the purpose of this paper is to further investigate m-payment adoption factors and address the gaps for future adoption in the fast-changing world.

METHODOLOGY

The chosen data collection method was an online survey targeting m-payment users (both existing and prospective). The online survey targeted a wider range of participants to collect information about specific constructs and to explore the actual use of m-payment. This survey will help the researchers to understand the current situation and analyse the factors influencing m-payment adoption via testing the below hypotheses.

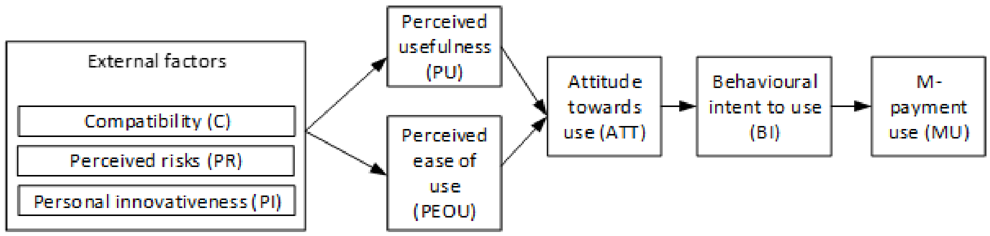
A survey to examine user acceptance of NFC enabled m-payment was designed to test the ten hypotheses highlighted in the previous section. Each of the constructs was exposed from a literature review of technology acceptance. The survey consisted of 30 questions comprising 25 construct questions and 5 demographic questions. The survey instrument contained at least three measurement questions per construct. In obtaining informed consent, participants were assured on the first page of the survey the data confidentiality, and their right to withdraw from participation at any stage of the study. The online survey was released through social media websites, namely Facebook, Twitter, and LinkedIn. The survey was open for a period of two weeks. All variables were created based on a 7-point Likert-type scale.

The reliability will be tested via Cronbach's Coefficient Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Cronbach's coefficient alpha will be conducted to test the internal consistency of the multiple-item scale. The convergent and divergent validity of the scale reliability will be evaluated through Confirmatory Factor Analysis. Confirmatory Factor Analysis is a suitable approach because the hypothesis statements are rooted in established theory, whereas Exploratory Factor analysis permits dimension exploration and reduction when no expectations exist in order to create theory (Henson, 2006; Williams et al., 2010). The output values for CR and AVE will be used as the reliability indicator. The goodness of fit indicators from the Structural Equation Model (SEM) will be utilised to verify the structural relationship between measured variables and latent constructs.

Hypotheses

Similar research has applied DoI (Oliveira et al., 2016) in extending the factors in behavioural models such as UTAUT2 Along the same line, this paper proposes a model (see Figure 3) to further investigate m-payment adoption factors, based on TAM and DoI. This study survey will assess the level of influence of the key variables on the actual m-payment use (MU). The following sections will address the variables and consequently develop the hypotheses.

Figure 3 Conceptual Model for Understanding M-Payment Acceptance.



Compatibility (C)

Compatibility is a key adoption factor that focuses on the innovation's fit with the user's lifestyle. It focused on the consistency between end-user's perception of the innovation and their existing values, beliefs, behaviours, lifestyles, and experiences (Chen et al., 2004; Rogers, 2003). Compatibility could be a significant predictor of end- users' attitudes towards financial technology adoption (Ndubisi & Sinti, 2006). Compatibility was also found to be a vital factor for m-payment adoption as it combines technological innovation with values, behavioural patterns, and end-user experiences (de Luna et al., 2019). Therefore, this study proposes the following hypotheses to test the relation between compatibility and m-payment.

H1: An end-user's perceived compatibility determines their perceived ease of use of m-payment.

H2: An end-user's perceived compatibility determines their perceived usefulness of m-payment.

Perceived risks (PR)

Prior to technology adoption, end-users assess the two dimensions of risks, i.e., the level of uncertainty and the seriousness of impacts, to decide whether they are willing to take such risks (Featherman & Pavlou, 2003). When adopting new technologies, consumers evaluate the consequences to assess potential benefits and/or risks (Cho, 2004). When it comes to financial technologies, perceived risks play a significant role in adoption (Ndubisi & Sinti, 2006). Trialability refers to the extent to which an innovation can be experimented with by users before commitment to adoption (Rogers, 2003). Trialability could reduce users' perceived uncertainty and lead to adoption (Tan & Teo, 2000). Al-Saedi et al. (2020) investigated recent studies in m-payment adoption and found that risk is one of the most frequently identified determinants. Choi et al. (2020) also found that risk is the most critical m-payment adoption factor in South Korea. Therefore, the following hypotheses were formulated to test the relationship between perceived risks and m-payment.

H3: An end-user's perceived security of m-payment determines their perceived ease of use of m-payment.

H4: An end-user's perceived security of the m-payment determines their perceived usefulness of m-payment.

Personal innovativeness (PI)

Personal innovativeness refers to the likelihood of an individual to try new technologies (Agarwal & Prasad, 1998). Personal innovativeness could influence PU and PEOU (Parveen & Sulaiman, 2008), as well as behavioural intention (Leong, et al., 2013) for technology adoption. It has been found to influence m-payment adoption in India (Patil et al., 2020). The proposed hypotheses are to test the relationship between personal innovativeness and PU and PEOU of m-payment.
H5: The personal innovativeness of the end-user determines their perceived ease of use of m-payment.
H6: The personal innovativeness of the end-user determines their perceived usefulness of m-payment.

Perceived ease of use (PEOU)

Complexity is the extent to which an innovation can be considered relatively difficult to use (Rogers, 2003). Complexity is the opposite of ease of use. PEOU and complexity could influence user adoption (Davis, 1989; Rogers, 2003). A hypothesis for testing the relationship between PEOU and m-payment is proposed.
H7: An end-user's perceived ease of use of m-payment determines their attitude towards using m-payment.

Perceived usefulness (PU)

Perceived Usefulness (PU) is the extent to which users believe that adopting new technology will increase their effectiveness and performance (Davis, 1989). PU has a relationship with attitude and intention to use (Huang et al., 2013). A hypothesis to test the relationship between PU and m-payment is proposed.
H8: An end-user's perceived ease of use of m-payment determines their attitude towards using m-payment.

Attitude (ATT)

Attitude is considered a multidimensional construct, consisting of cognitive, affective, behavioural factors (Fishbein & Ajzen, 1975). User attitude could influence the intention of using m-payment (Schierz et al., 2010), therefore the following hypothesis is formulated.
H9: The attitude (ATT) towards the use of m-payment with a mobile device determines the intention to use m-payment.

RESULTS

The survey had a total of 157 responses, of which 113 were complete and valid. This meets the minimum sample size of at least 100 suggested by researchers (Gorsuch, 2014; Kline, 1994). The data were collected from multiple countries to identify constructs that may influence m-payment use. The following sections will cover the demographic analysis and constructs analysis including the hypotheses test results. The biggest group of the respondents are in the age range of 18-25, contributing to 23% of the responses. The second biggest group (17%) is age 25-30, and the third biggest groups are age 31-35 and 36-40 (both 13%). Most of the respondents are educated to bachelor's degree level (41%). More than half (53%) of the respondents are in full-time employment. Most of the respondents reside in the UK (43%) and the US (29%). The profiles of the respondents in terms of age, gender, educational level, and employment status are summarised and descriptive statistics can be found in Table 1. The following section will then present the constructs analysis as well as hypothesis testing.

Table 1 Profile of Respondents.

Respondents Characteristics	No of Respondents (n= 113)	Percentage
Age		
18 - 25	26	23%
25 - 30	19	17%
31 - 35	15	13%
36 - 40	15	13%
41 - 45	7	6%
46- 50	11	10%
51 - 55	7	6%
56 - 60	4	4%
61-65	5	4%
66-70	2	2%
Over 70	1	1%
Education		
Associate or Foundation degree	7	6%
Bachelor's degree	46	41%
Doctoral degree	9	8%
High School or Secondary Degree	14	13%
Master's degree	30	27%
Other	3	3%
Professional degree (JD, MD)	3	3%
Employment		0%
Employed full time	59	53%
Employed part time	6	5%
Other	1	1%
Retired	5	4%
Self-employed	7	6%

Student	29	26%
Unemployed looking for work	5	4%
Industry		
Arts, entertainment, or recreation	4	4%
Educational services	24	21%
Finance or insurance	8	7%
Food and restaurant services	3	3%
Health care or social assistance	12	11%
Information	9	8%
Management of companies or enterprises	7	6%
Manufacturing	3	3%
Other	14	13%
Professional, scientific or technical services	18	16%
Real estate or rental and leasing	1	1%
Retail trade	6	5%
Tourism and hospitality services	3	3%
Country		
Australia	2	2%
Canada	2	2%
Germany	1	1%
India	1	1%
Ireland	1	1%
Italy	4	4%
Japan	1	1%
Netherlands	7	6%
Portugal	2	2%
Saudi Arabia	8	7%
Slovakia	1	1%
Taiwan	2	2%
United Kingdom	48	43%
United States of America	32	29%

Actual m-payment use (MU)

The respondents were asked about their actual use of m-payment. The majority (40.18%) of the respondents never use m- payment. The closest category was those that use every day at 20.54% and weekly users at 16.07%. The most used type of NFC payment is Apple Pay at 16.81% of respondents which includes non-NFC payments. The next highest type of NFC selected was Debit/Credit Card's mobile payment apps (e.g., AMEX Pay, Visa Pay, Barclay Pay) at 13.27%. The majority of respondents were non-use responses at 39.8%

Reliability testing

Cronbach's coefficient alpha was performed to measure the reliability, or internal consistency, of the scale items. Some researchers consider 0.7 as a cut-off value for Cronbach's alpha (Hair et al., 2013), and others suggest 0.6 and greater as a satisfactory level (Hair et al., 2013). Cronbach's alpha score for the responses was above .80 confirming that all of the questions have an acceptable or better score for consistency. The Cronbach's α results in Table 2 indicate a high correlation of the ranked values among every measurement set used in the survey. The lowest overall Cronbach's alpha score was for the measurement set of PU with a .836 and the highest alpha score was .951 for the measurement set of intent to use. The results from the study confirm the findings found in previous studies (Askool et al., 2019; de Luna et al., 2019; Liébana-Cabanillas et al., 2018).

Composite Reliability standard of .70 or greater and Average Variance Extracted (AVE) standard of .50 or greater are considered a good indication for the items having internal consistency with the indicator variables (Bollen, 1987; Hair et al., 2013). As shown in Table 2, the composite reliability scores for the responses were all above 0.8 confirming the internal consistency of the scale items. The AVE scores were all above the threshold of .50 with a range between 0.672 and 0.911 confirming the convergent validity.

Table 2 Scale Reliability Testing.

Construct	**# of Items**	**Cronbach's α set score**	**Composite Reliability**	**Average Variance Extracted (AVE)**
ATT	4	0.913	0.938	0.791
BI	3	0.951	0.968	0.911
C	3	0.937	0.960	0.889
PEOU	4	0.893	0.934	0.824
PR	4	0.912	0.938	0.790
PU	4	0.836	0.891	0.672
PI	3	0.871	0.920	0.794

Model fit

In order to determine the fit of the model a Structural Equation Model was run. The Goodness of Fit indicators were then compared to standard thresholds determined by previous researchers (Hooper, et al., 2008; Kline, 2015). Table 3 below provides the goodness of fit measures and the corresponding thresholds from literature. The table also provides the output indices from the Mobile Payment Model and whether or not the threshold was met. Interestingly, none of the indicators were at or above these thresholds. However, Goodness of Fit indicators are sensitive to sample size. Although some research (Tabachnick and Fidell, 2019) suggests that a sample of 100-150 is the minimum required for SEM, the sample size could be a cause for the low level of Goodness of Fit. The sample size for this research was 113 just over the lowest of the range 100-150.

Table 3 Goodness of Fit.

Measure	**Name**	**Cut-off for Good Fit**	**GFI Indicator**	**Met/Not Met**
X2	Chi-Square	p-value> 0.05	<.0001	Not Met
(A)GFI	(Adjusted) Goodness of Fit	GFI ≥ 0.95 AGFI ≥0.90	.548	Not Met
TLI	Tucker Lewis index	NFI ≥ 0.95 NNFI ≥ 0.95	.681	Not Met
CFI	Comparative Fit Index	CFI ≥.90	.706	Not Met
RMSEA	Root Mean Square Error of Approximation	RMSEA < 0.08	.1463	Not Met
(S)RMR	(Standardised) Root Mean Square Residual	SRMR <0.08	.274	Not Met

Hypothesis testing

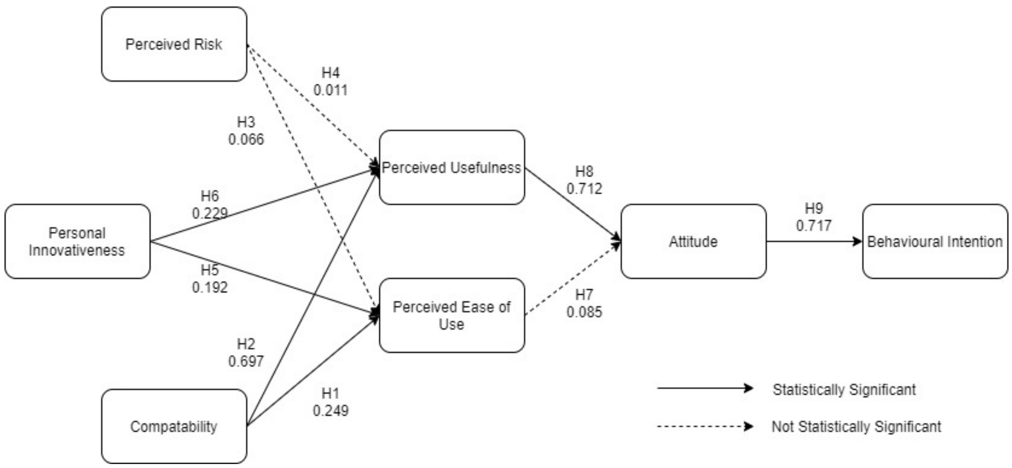
The hypothesis tests were conducted using Structural Equation Modelling with bootstrapping. The difference in effects was found to be statistically significant for six hypotheses' tests. The p-value for the was <.0001 for H2, H6, H8 and H9, whilst the p-value for H1 and H5 were .00085 and .0157 respectively. H3, H4 and H7 were not statistically significant with p-value being .508, .881 and .311 respectively.

Table 4 Hypothesis Test Result.

#	**Hypothesis**	**Path Coefficients**	**P Values**
H1	Compatibility -> Perceived Ease of Use	0.249	0.047
H2	Compatibility -> Perceived Usefulness	0.697	<.0001
H3	Perceived Risk -> Perceived Ease of Use	0.066	0.508
H4	Perceived Risk -> Perceived Usefulness	0.011	0.881
H5	Personal Innovativeness -> Perceived Ease of Use	0.192	0.072
H6	Personal Innovativeness -> Perceived Usefulness	0.229	0.001
H7	Perceived Ease of Use -> Attitude	0.085	0.311
H8	Perceived Usefulness -> Attitude	0.712	<.0001
H9	Attitude -> Behavioural Intention	0.717	<.0001

The path coefficient diagram is depicted in Figure 4. The diagram shows the path from the external factors to the behavioural intentions for use of mobile payment. The solid lines represent the relationships between latent variables that are statistically significant whilst the dotted lines represent those found to be statistically insignificant. The values on the lines are the standardised regression weights between the latent variables.

Figure 4 Path Coefficient Diagram.



The analysis indicates that external factors of compatibility and personal innovativeness determine the end-users' perceived ease of use (H1, H5) and perceived usefulness (H2, H6) of m-payment. An end-user's perceived usefulness (H8) of m-payment determines their attitude towards using m-payment. The attitude towards the use of m-payment with a mobile device determines the intention to use m-payment (H9). However, contrary to previous researchers' findings, the end-users' perceived risk does not influence either perceived usefulness (H3) or perceived ease of use (H4). Additionally, perceived ease of use does not impact attitude (H7).

DISCUSSION AND CONCLUSION

With the growth of NFC enabled m-payments, there is a greater need for understanding the factors that impact the adoption of m-payments. Hence, this research has proposed a conceptual model to reveal the impact of external factors of compatibility, perceived risks, and personal innovativeness on the adoption of m-payments by extending the TAM by DoI attributes. The conceptual model (see Figure 3) visualises the relationships amongst the three m-payment adoption factors from the DoI model and nine hypotheses. An online survey was then designed based on the identified factors to explore the current situation of using m-payment to better understand the impact of external factors on the behavioural intention to use m-payment.

The scale reliability was tested via Cronbach's Coefficient Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). The output from these tests confirms that all of the questions have an acceptable or better score for consistency. Lastly, a SEM analysis was performed to test the model fit.

This survey results recognise a statistically significant relationship between compatibility, personal innovativeness, and behavioural intention to use m-payment. The results from the study confirm some of the findings from previous research (Askool et al., 2019; de Luna et al., 2019; Liébana-Cabanillas et al., 2018). The results do confirm the importance of external factors of personal innovativeness and compatibility on the behavioural intention to use m-payment. However, contrary to their research, this research found three model relationships to be statistically insignificant, i.e., perceived risk to perceived ease of use, perceived risk to perceived usefulness, and perceived ease of use to attitude.

The findings of this study confirm the influence of external factors, i.e., compatibility and personal innovativeness, determines the end-users' perceived usefulness and perceived ease of use of m-payment which subsequently determines their attitude towards using m-payment and the intention to use m-payment.

This paper posits contributions in three folds: theoretical, methodological, and practical. From the theoretical perspective, this research has extended the TAM model by incorporating the DoI attributes. According to Askool et al. (2019), the informal and social factors are vital for understanding and managing user expectations and technology acceptance, particularly in the context of M-payment. Integrating DoI attributes to a behavioural model like TAM brings new perspectives on adopting M-payment. For instance, the decision stage in DoI will determine the adoption. However, DoI does not offer a mechanism for what drives the adoption. This gap is complemented adequately by TAM, illustrating the factors that affect adoption. This research addresses this gap by producing the conceptual model as in Figure 3. Moreover, while existing research focuses on the intention of use, this research provides insights into the actual use of M-payment. Hence, there is a significant theoretical contribution by incorporating DoI with TAM.

From the methodological perspective, this research has produced a questionnaire based on the conceptual model, as in Figure 3. This model could potentially be replicated or adapted for future research that studies adoption leading to actual use of any mobile applications such as mobile health. Moreover, this research also opens future research opportunities of how to integrate or extend this model by other behavioural models such as UTAUT and UTAUT2. More importantly, this research produces a series of analysis methods that are plausible and essential to inspire future similar research by scholars in the field.

From the practical perspective, this research delivers a significant framework that suggests the fundamental principles for organisations wanting to develop the m-payment transactions. This is pivotal for organisations to understand what makes their users adopt the technology before the actual implementation. The actual usage level ensures the success of the m-payment technology itself, leading to increasing the competitive advantage of the organisation. Hence, the features of the adoption factors could be further decomposed or translated into the system design from the front end (user interface) to the back-end perspective.

This research has a few limitations. Firstly, this survey was conducted online, which may limit the diversity of the sample. For instance, most of the responses were solicited from the US and the UK. There is a need to conduct further research to collect data in more countries to gain a better understanding. Secondly, it would be preferential to have a larger sample size considering the population. Thirdly, this research examined the external factors, perceived usefulness, perceived ease of use, attitude towards use, and behavioural intention. Other social and informal factors such as social influence and capital have not been considered in this research. Therefore, the conceptual model as in Figure 2 could be further extended in the future, which again opens new opportunities in integrating with other behavioural models such as UTAUT or UTAUT2**.**

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