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Abstract

Mobile technologies, in particular, smartphones are reshaping individual and organisational behaviour at different levels and pace. This research focuses on the multi-cultural use and acceptance of proximity mobile payment (m-payment) which is more prevalent in some countries than other countries. Previous analysis of m-payment adoption extended the Technology Acceptance Model (TAM) to include external factors of use and acceptance identified through Organisational Semiotics (OS). This paper presents the development of constructs and measurements based on the identified requirements for m-payment adoption. It also presents the exploratory study results to validate the salient factors. This study furthers m-payment research by addressing the technical and social aspects via TAM and OS, as well as identifying empirical factors to increase m-payment adoption in multi-cultural context.

Keywords: Mobile Payment, Technology Acceptance Model, Organisational Semiotics, Technology Adoption, Near Field Communication

1.0 Introduction

The popularity of mobile devices (smart phones, tablets, smart watches, etc) has significantly changed our everyday lives. Financial transactions are no exception. Near Field Communication (NFC) allows a contactless short-range communication facilitating data transmission between mobile devices and payment terminals. With the support of NFC, proximity mobile payment (m-payment) allows users with compatible mobile devices to use m-payment function 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) and offers convenience and speed (Teo, et al., 2015). The use of proximity mobile payment (m-payment) is expected to exceed the revenue of 930 billion US dollars globally (Statista, 2018). However, according to WorldPay (2017), 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. Since the advent of m-payment, researchers have begun to identify the factors of m-payment adoption, including perceived ease of use (PEOU) and perceived usefulness (PU) (Kim, et al., 2010; Koenig-Lewis, et al., 2015), trust (Lu, et al., 2011), security and risks (Arvidsson, 2014), costs (Peng, et al., 2011), privacy (Slade, et al., 2013), use context (Mallat, et al., 2009), culture (Alalwan, et al., 2015), and social influence (Peng, et al., 2011; Alalwan, et al., 2015). Technology Acceptance Model (TAM) and its extensions have been widely applied in m-payment adoption research, as they provide a framework to understand the variables influencing intention to use. Despite the popularity of mobile devices, the adoption of m-payment amongst mobile device users is still relatively low (Deloitte, 2015). Therefore, it is 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 first phase of development through an exploratory study incorporating both social and technical adoption factors based on Technology Acceptance Model (TAM) and Organisational Semiotics (OS).

2.0 Literature Review

The aim of this section is to explore the various theoretical models proposed for technology use and adoption. Adoption models have roots in information systems (IS), psychology (Fishbein & Ajzen, 1977), and sociology (Davis, 1989; Venkatesh & Davis, 2000). However, many researchers ignore the social cultural aspects. Davis (1989) stated that group, cultural, or social aspects of decision making, and usage are not considered very much in technology acceptance research. The following sections provide background and context for this exploratory study through technology adoption, including TAM, and OS respectively.

2.1 Technology Acceptance Model (TAM) and Diffusion of Innovation (DoI)

TAM is used as a predictive and explanatory tool for testing user acceptance of technologies with the aim of understanding the impact of external factors on internal beliefs, attitudes, and intentions. TAM includes the determents of Perceived Usefulness (PU) and Perceived Ease-Of Use (PEOU) as shown in **Figure 1**. PU is defined as the

probability the user's job performance will increase given 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. In a recent review (Chhonker, et al., 2017) of adoption models, researchers found that most studies using TAM either used the original TAM constructs or extended TAM by adding new predictive constructs.

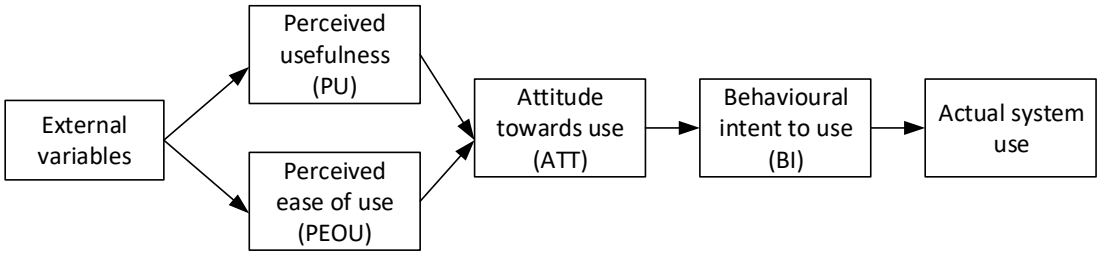

Figure 1. Original Technology Acceptance Model (TAM)

Diffusion of Innovation (DoI) explains how a new idea or product gains momentum and diffuses through a certain population. Researchers have applied DoI alongside TAM to investigate the adoption of m-payment (Luna, et al., 2018). There are five main factors that influence 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).

2.2 Organisational Semiotics (OS) in the context of M-Payment

Additionally, previous research extended TAM for proximity m-payment via Organisational Semiotics (Pan, et al., 2018) which will be expanded upon in this paper. Organisational semiotics (OS) is one of the social technical approaches for understanding the use of information systems in an organisation (Tan & Liu, 2013). OS roots in semiotics which is a study of signs (Peirce, 1935). OS is widely applied in the information systems studies where an organisation is seen as an information system, and signs are considered as information (Liu, 2000). In an organisation, norms are interpreted by all kinds of signs in an organisation (Stamper, 1985). A sign can either be an object or the effect produced by an object that conveys information. Norms always come into place before performing certain actions and the subsequent actions will generate more signs sooner or later.

The OS analysis of the social and technical factors of m-payment adoption by organisational containment analysis (OCA) and organisational semiotics framework

(OSF) can be categorised into six distinctive layers (**Figure 2**). OCA examines the *informal*, *formal*, and *technical* norms of the m-payment adoption. The *informal* norms refer to the society or community culture, customs and values in perceiving m-payment. The *formal* norms relate to the actual or an official usage of m-payment, whereas the *technical* norms refer to the feature of m-payment. OSF, on the other hand, delineates the granularity of signs (information) ranging from m-payment devices (*physics*, *empirics*, and *syntactic* layer), and the information perceived by the end user (*semantic* layer*),* to the effect or impact of signs (*pragmatics* and *social* layer).

<table>
<tr><td>OCA</td><td colspan="4">OSF</td></tr>
<tr><td rowspan="2">Informal</td><td colspan="3" rowspan="2">Human Information Functions</td><td>Social World: Social influence, peer pressure, perceived risks, confidence in service providers, culture…</td></tr>
<tr><td>Pragmatics: Time saving, convenience, accessible records, perceived advancement …</td></tr>
<tr><td>Formal</td><td colspan="4">Semantics: Contactless financial transactions, regulations for financial transactions, service agreements, terms and conditions …</td></tr>
<tr><td rowspan="3">Technical</td><td rowspan="2">The Platform</td><td colspan="3">Syntactics: Design and structure of M-payment application, compatibility, security protocol, encryption, verification, user guide…</td></tr>
<tr><td colspan="3">Empirics: NFC, transaction platform, portal, internet connectivity, connection speed and liability, archives…</td></tr>
<tr><td colspan="4">Physical World: POS terminal, mobile devices, server, cables, database…</td></tr>
</table>

Figure 2. Organisational Semiotics Framework (OSF) with Organisational Containment Analysis (OCA) for M-Payment

OSF and OCA contribute to the new conceptual model for understanding m-payment acceptance (see **Figure 3**), that will be used in this study to help develop the instrument to assess multi-cultural acceptance of m-payment. As this is a preliminary research, the first phase is concerned with developing a questionnaire to capture the user perspectives, focusing on the informal layer of OS, which consists of pragmatics and social. The formal and technical layers contain more tangible aspects of acceptance and thus will not be considered in this portion of the research.

3.0 Exploratory Study and Hypotheses Development

Scholars have applied OS (Al-Rajhi, et al., 2010) and DoI (Oliveira, et al., 2016) in extending the behavioural factors in TAM. Based on TAM, DoI and OS, this paper proposes a model (Figure 3) to further investigate m-payment adoption factors. The model can be explained as follows: m-payment acceptance can be evaluated in three

levels, technical (technology characteristics), formal (organisational antecedents), and informal (external environment). These three levels affect the intention to use and adopt m-payment. In this exploratory study, the informal level of variables is categorised into compatibility, perceived risks and personal innovativeness. The exploratory study survey will measure the key variables that could influence actual m-payment use (MU), which will also be captured in the survey. The following sections will address the variables and consequently develop the hypotheses.

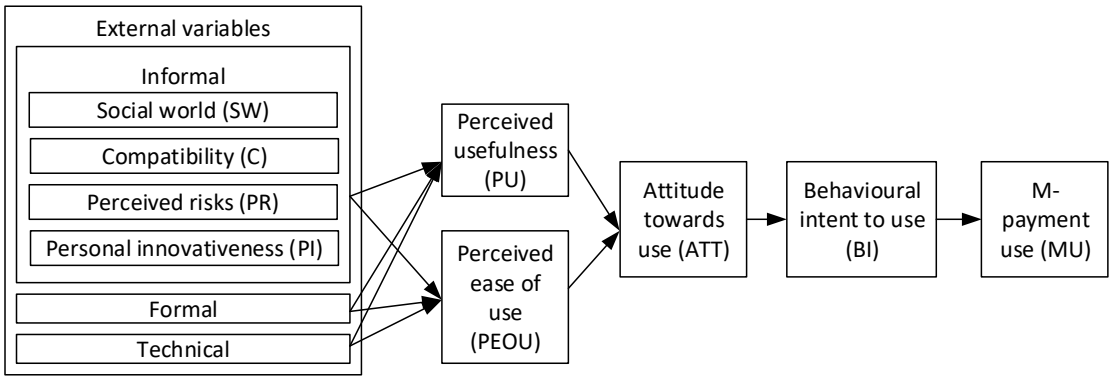

Figure 3. Conceptual Model for Understanding M-Payment Acceptance

3.1 Social World (SW)

The social world pays attention to what and how the outside norms influence and are influenced by the system, e.g. social influence and peer pressure (Liu, 2000). An individual's perception of the social norms and impact that he/she believes the use of a given technology will have, will determine his/her attitudes and intention towards the use of technology (Al-Rajhi, et al., 2010). Subjective norms based on individuals' perception of what people important to them consider on whether they should adopt could influence their decision of technology adoption (Venkatesh & Bala, 2008), such as m-payment (Schierz, et al., 2010). Therefore, the proposed hypotheses formulated for social world relation to m-payment are:

H1: Subjective norms determine a consumer's perceived usefulness of m-payment.

H2: Subjective norms determine the perception of the ease of use of m-payment by the consumer.

3.2 Compatibility (C)

Compatibility is a key adoption factor that focuses on the innovation's fit with user's lifestyle depending on how consistent they perceived it to be with their existing values,

beliefs, behaviours, lifestyles, and experiences (Rogers, 2003; Chen, et al., 2004). Compatibility can be a significant predictor in consumers' attitude towards financial technology adoption (Ndubisi & Sinti, 2006). Compatibility was found to be an important factor for m-payment as it combines technological innovation with values, behavioural patterns and consumer experiences (Luna, et al., 2018). This study proposes the following hypotheses to test the relation between compatibility and m-payment:

H3: A consumer's perceived compatibility determines his/her perceived ease of use of m-payment.

H4: A consumer's perceived compatibility determines his/her perceived usefulness of m-payment.

3.3 Perceived Risks (PR)

Before adopting new technologies, users assess the two dimensions of potential risks, namely the level of uncertainty and the seriousness of impacts, to determine whether they are willing to take the risks (Featherman & Pavlou, 2003). Consumers will evaluate immediate and internal consequences to assess potential benefits or risks when adopting new technologies (Cho, 2004). Trialability refers to the extent to which an innovation can be experimented by users before commitment to adoption (Rogers, 2003), which could reduce users' perceived uncertainty and lead to adoption (Tan & Teo, 2000). In addition, perceived risks could influence the adoption of financial technologies (Ndubisi & Sinti, 2006). The following hypotheses were formulated to test the relationship between perceived risks and m-payment:

H5: A consumer's perceived security of m-payment determines his/her perceived ease of use of m-payment.

H6: A consumer's perceived security of the m-payment determines his/her perceived usefulness of m-payment.

3.4 Personal Innovativeness (PI)

Personal innovativeness refers to the willingness of a person to try a new technology (Agarwal & Prasad, 1998). Personal innovations could influence PU and PEOU (Parveen & Sulaiman, 2008), as well as behavioural intention (Leong, et al., 2013). The proposed hypotheses to test the relationship between perceived ease of use and m-payment are:

H7: The Personal Innovativeness of the consumer determines his/her perceived ease of use of m-payment.

H8: The Personal Innovativeness of the consumer determines his/her perceived usefulness of m-payment.

3.5 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). The hypothesis for testing the relationship between PEOU and m-payment is:

H9: The consumer's perceived ease of use of m-payment determines his/her attitude towards using m-payment.

3.6 Perceived Usefulness (PU)

Perceived Usefulness (PU) is the degree to which users believe that adopting a new technology will increase their effectiveness and performance (Davis, 1989). Studies indicate that PU has a relationship with attitude and intention to use (Huang, et al., 2013). The proposed hypothesis to test the relationship between PU and m-payment is stated as:

H10: The consumer's perceived ease of use of m-payment determines his/her attitude towards using m-payment.

3.7 Attitude (ATT)

Attitude is considered a multi-dimensional construct, consisting of cognitive, affective, behavioural factors (Fishbein & Ajzen, 1977). User attitude could influence the intention of using m-payment systems (Schierz, et al., 2010), therefore the following hypothesis is formulated:

H11: The attitude (ATT) towards the use of m-payment with a mobile device determines the intention to use m-payment.

3.8 Behavioural Intention (BI)

Behavioural intention could lead to actual use. Users' behavioural intention to adopt can be influenced by attitude (Davis, 1989), subjective norms (Fishbein & Ajzen, 1977) and personal innovativeness (Leong, et al., 2013). The hypothesis to test the relationship between intention and m-payment.

H12: The intention to use determines the actual use of m-payment with a mobile device.

4.0 Exploratory Study Method

In order to explore and investigate new ideas scholars require broader understanding of different philosophical assumptions (Creswell, 2007). It is widely believed that the outcome of the exploratory study allows the scholars to explain proportions found in the literature and developed the research framework and then the questionnaire for the main study.

The data collection method selected was online survey targeting m-payment users. The online survey was used to reach a wider range of participants in order to collect more information about specific constructs and to explore the actual use of m-payment in different cultures. This survey will help the researchers to understand the current situation and future perspective of m-payment use.

A pilot survey for examination of user acceptance of NFC enabled m-payment was designed to test the eleven hypotheses highlighted in the previous section. Each of the constructs were exposed from a literature review of technology acceptance and organizational semiotics. The survey consisted of 37 questions comprised of 32 construct questions and 5 demographic questions. The survey instrument contained at least three measurement questions per construct except actual use of m-payment (MU), dependent variable, which only had two questions. In obtaining informed consent, participants were assured in 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 data were collected from a total of 48 participants of which only 20 were complete records. Results from the exploratory study will be discussed in the following section.

5.0 Results from Exploratory Study

Data were collected from different demographic groups to identify several constructs that may influence the use of m-payment. The following sections report the demographic and constructs analysis.

5.1 Demographic Analysis

In this section, the profiles of the respondents in terms of age, gender, equational level, and culture are summarized and descriptive statistics can be found in **Table 1.**

Respondents Characteristics	Number of respondents (n=20)	Percentage (%)
Age		
18 to less than 31	5	25
31 to less than 41	5	25
41 to less than 51	5	25
51 to less than 61	2	10
61 and more	3	15
Education		
High school or Secondary Degree	2	10
Professional degree (JD, MD)	1	5
Bachelor's degree	4	20
Master's degree	9	45
Doctoral degree	4	20
Employment		
Employee full time	12	60
Employee part time	1	5
Student	2	10
Unemployed looking for a job	2	10
Retired	3	15
Industry		
Educational Services	7	35
Professional, scientific or technical services	3	15
Information	3	15
Health care or social assistance	2	10
Utilities	1	5
Retail trade	1	5
Mining	1	5
Manufacturing	1	5
Management of Companies of enterprises	1	5
No of Respondents per country		
United States	9	45
Europe	5	25
South America	4	20
Middle East	2	10

Table 1. Profile of Respondents

The results determined that the respondents were between the ages of 18 and over 60. The majority of respondents (75%) were aged between 18 and 50 years old. The participants were from several countries live in USA, UK, Netherlands, Sweden, Brazil,

Ecuador, and Saudi Arabia. More than half of the respondents (70%) have a graduate level degree including Master's, Doctorate, or Professional degree (e.g. JD).

The employment categories of the participants range from working full-time to not employed. Sixty percent (60%) of the respondents are employed full-time and only (5%) are employed part-time. Twenty-five (25%) are not working, either retired or seeking employment and only (10%) are currently students. The largest proportion of respondents work in educational services (35%), followed by Information and Professional, scientific or technical services (15%) each, then Health care or social assistance (10%), then Management of companies or enterprises, Manufacturing, Mining, Retail, and Utilities (5%) each.

Actual M-Payment Use (MU)

The respondents were asked about their actual use of m-payment. The majority (63%) of the respondents never use m- payment. The closest category was those that use 4-6 times a week and daily at 14.8% each. The most used type of NFC payment is 'Other' at 33.33% of respondents which includes non-NFC payments, non-use responses and Ideal, an e-commerce mobile banking app in Netherlands. The second closest at 29.63% of respondents use debit/credit card-based m-payment apps, e.g. AMEX Pay, Visa Pay, and Barclay Pay.

5.2 Constructs Analysis

Scale Reliability Testing

All variables were created based on a 7-point Likert-type scale. Consequently, Cronbach coefficient alpha was conducted to test the consistency of multiple-item scale. Some researchers consider 0.7 as cut-off value for Cronbach alpha (Hair, et al., 2006), others suggest 0.6 and greater as a satisfactory level (Hair, et al., 2006). However, Alpha value lower than 0.50 are acceptable in exploratory research (Nunnally, 1978).

Constructs	No of items	Cronbach Alpha (α) for set
Social World (SW)	4	.9125
Compatibility (C)	3	.7954
Perceived Risk (PR)	4	.9042
Personal Innovativeness (PI)	3	.8885

Perceived Ease of Use (PEOU)	4	.9643
Perceived Usefulness (PU)	4	.8502
Attitude Towards Use (ATT)	4	.8651
Behavioural Intention to Use (BI)	4	.9307

Table 2. Cronbach's Alpha reliability tests

The Cronbach's α results in Table 1**Table 2** indicate a high correlation of the ranked values among every measurement sets used in the survey. The lowest overall Cronbach's alpha score was for the measurement set of compatibility with a .7954 and the highest alpha score was .9643 for the measurement set of perceived ease of use. The results from the exploratory study confirm the findings found in (Luna, et al., 2018).

Constructs Descriptive Analysis

Since the objective of the exploratory study was to identify factors that may influence the use the m-payment, the participants were asked about specific factors that were found in previous literature. The following sections will summarise the respondents' opinion about each construct.

Social World (SW)

When asked about the norms in social world, the responses showed that subjective norm has impact on using m-payment with around 65%. This could be due to the absence of experience with mobile technology as the potential adopters are more likely to consult those whom they trust and have experience with the mobile technology.

Compatibility (C)

Compatibility is not considered an issue because the proportion of respondents that specified somewhat agree to strongly agree that m-payment fits with their lifestyle using this technology is consistent with the way they like to buy products and services.

Perceived Risks (PR)

Some respondents see m-payment as a high risk due to the possibility of billing information theft (e.g. credit card number, bank account data) and the abuse of information use (e.g. names of business partners, payment amount). Slightly over half,

52.63%, of the participants disagree that the risk is low, and they are looking for safe financial transaction.

Personal Innovativeness (PI)

An individual's level of innovative behaviour has an impact on technology acceptance. The level of personal innovativeness among the respondents in this exploratory study is moderate; only marginally less than half (46%) were open to use m-payment.

Perceived Ease of Use (PEOU) and Perceived Usefulness (PU)

While the majority (70%) of the participants felt it was easy to use m-payment and they could become skilful at using m-payment. Also, 75% of the participants found that using m-payment is useful.

Attitude Towards Use (ATT)

The attitude towards m-payment use among the respondents in this exploratory study is moderate with only 55% having a positive attitude towards use of this method of payment.

Behavioural Intention (BI)

The result of the survey showed that 75% of the respondents indicated that they would use m-payment if given the opportunity and they are open to using it in the near future.

In summary, the responses have supported the view of this research which was developed based on literature and technology adoption models. However, in order to test the relationship between constructs and validate the research model the survey will be modified to include other aspects of the informal layer not developed thus far.

6.0 Discussion and Conclusion

Mobile payments become popular in developed and developing countries. Due to this growth it is expected to see more mobile payments industry to meet the growing demands of consumers. Therefore, this research has proposed a conceptual model for

understanding proximity mobile payment adoption by TAM and OS. The conceptual model (**see Figure 3)** suggests the eight m-payment adoption factors from the social and technical perspective and twelve hypotheses. A pilot survey was then designed based on the identified factors to explore the current situation of the using m-payment. The survey results are highlighted some additional factors that will be included in the future research. In summary, the preliminary results confirm that it is vital to consider the social and technical factors prior to m-payment adoption. The results confirm the findings in Luna et al (2018)'s work and justify the twelve hypotheses identified in this research.

This research posits theoretical and practical contributions. From the theoretical perspective, this research has addressed the social gap in TAM, identified by Bagozzi (2007) with OS and DoI. OS is a sound social technical approach, and it contributes to study the adoption of m-payment by OCA and OSF. OCA, a norm-based approach helps to understand the individual and societal norms from the *informal*, *formal* and *technical* perspective via OCA. OSF, a sign-based approach where it is also instrumental for studying the features and design of m-payment to its application in the society, which later leads to perception and adoption. OCA and OSF are intertwined, and the analysis is an iterative process. The existing perception and adoption of m-payment will create new signs and norms which later can be considered in enhancing the existing m-payment system. In hindsight, TAM is a hard instrument in studying adoption, and OS is a soft instrument that consolidates the existing factors in TAM and identifying new factors from the norm-based approach. The combination of OS and TAM in returns offers a solid and dynamic method for m-payment providers to response to the rapid changes in a defined market.

Moreover, this research has extended the existing application of OS. OS is generally applied in information system studies. And this research provides a pivotal finding where norms based OCA and sign based OSF are applied in the m-payment. From the empirical perspective, this research provides an instrument for practitioners to measure social and technical factors of m-payment adoption. This research yields a new perspective for practitioners about adoption especially from the impact or effect of using m-payment. The outcome will minimise the design errors or misperception of m-payment.

The research framework is based on literature review and exploratory study. However, the proposed research model illustrates the relationships between OS and TAM. The

limited number of responses is not suitable to conduct a more deep analysis to test the relationships between constructs. Technical and formal factors are not yet identified.

The constructs that are identified in the exploratory study will be used for further analysis of using m-payment which could result in deep understanding of accepting this technology by customers. The conceptual model (**see Figure 3**) will be expanded from the formal and technical perspective. In addition, the relationship among constructs will be examined to determine the importance in each construct and validate the research model by collecting empirical data from consumers.

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