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
ASSURANCE ON THE RELIABILITY OF MOBILE PAYMENT SYSTEM AND ITS EFFECTS ON ITS' USE: AN EMPIRICAL EXAMINATION

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ABSTRACT

Mobile Payment Systems (MPS) such as Google Wallet are an emerging technology. This paper examines if mobile assurance as provided by examining the five criteria, namely security, availability, processing integrity, confidentiality and privacy (as per the Trust Framework by the American Institute of Certified Public Accountants (AICPA)) has any relationship with use of MPS. The theory used for this study is technology acceptance model (TAM). Some new measures were developed and validated. The data was collected by a survey and Structure Equation Model was used to analyze the data collected. The results of the study indicated that security, availability, processing integrity, confidentiality and privacy has a positive relation with the attitude towards use mobile payment system. The results of the study data suggest that mobile assurance using any of the trust services correctly predict the intention to use such Mobile payment systems. The contribution of this study is that this paper extends the TAM model to include the trust framework with an emerging technology such as MPS. Another contribution of this study is to provide empirical support in favor of engagements to provide assurance on the reliability of mobile payment system by public accounting firms and practitioners (using any of the Trust Services Principles and Criteria) to have a positive impact of its use.

•  *Webtrust, Systrust, Mobile payment systems, Mobile Assurance, Trust, Reliability*

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INTRODUCTION

Mobile payments are payments for goods, services, and bills with a mobile device (such as a mobile phone, smart-phone, or personal digital assistant) by taking advantage of wireless and other communication technologies (Dahlberg *et al.*, 2008). Mobile payment is defined as payment for products or services between two parties for which a mobile device, such as a mobile phone, plays a key role in the realization of the payment (Bailly, 2007). Mobile devices can be used for the payment for digital content (e.g., ring tones, coupons, logos, news, music, or games), auctions, tickets, parking fees and transport fares, or to access electronic payment services to pay bills and invoices. Payments for physical goods are also possible, both at vending and ticketing machines, and at manned point-of-sale (POS) terminals. The business technology research and advisory firm, the Aite Group, predicts an exponential surge in demand for point of sale payment systems, which enable mobile phone payment (Aite, 2011). Aite Group is predicting 214 billion dollars in mobile phone payments by 2014 in the United States (Aite, 2011). More and more businesses are accepting mobile phone payments, such as Starbucks (Grove, 2011) and Target (Harnick, 2010) and many banks already enable customers to use an application on smartphone devices to take a picture of a check, which is then used to make a deposit into the consumer's account. Also big players in the E-commerce business are setting up mobile payment system such as Paypal, Google, and Amazon (Amazon, 2011). Mobile phone service providers, Verizon, AT&T, and T-Mobile are also getting involved in mobile payments through a service called ISIS (Isis, 2011).

Paypal will utilize mobile applications that will bypass the need for near field communication equipment, presumably making it easier for businesses to incorporate mobile payments into retail operations (Kim, 2011). Google Wallet requires the use of a special chip on the mobile phone that enables the phone to communicate with a near field communication reader, to transmit the credit card and coupon information with a tap of the phone to the reader. While tapping a phone to a reader isn't substantially more convenient than swiping a credit card, the Google Wallet application on the phone can store not only all of one's credit cards, but also coupons, special deals, and loyalty rewards (Pogue, 2011).

Mobile payment services may complement or replace traditional payment services such as cash, cheques, debit cards and credit cards. However, before this proliferation of mobile payment services takes place, research needs to be done to identify the valuable properties that traditional payment services do not have, and that Mobile payment services may need to offer (Dahlberg *et al.*, 2008). The principal objectives of this research study are to empirically examine,

What external variables related to mobile payment services could accelerate the proliferation/use of mobile payment services? The theory used for this study is technology acceptance model (TAM). Some new measures were developed and validated. The data was collected by a survey from 276 respondents and Structure

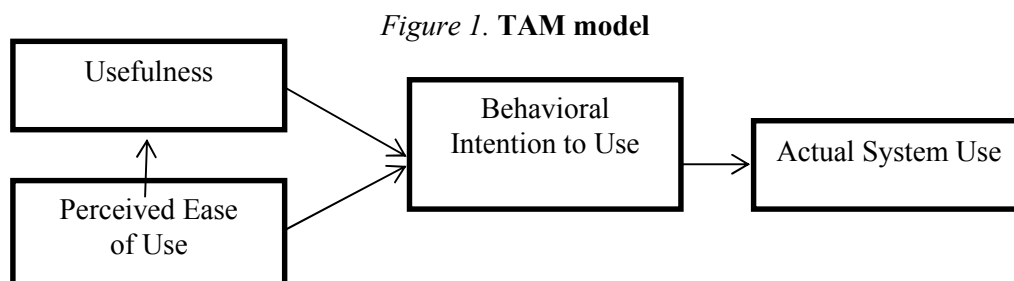
Equation Model was used to analyze the data collected. The contribution of this study is that this paper extends the TAM model to include the trust framework with an emerging technology such as MPS. Another contribution of this study is to provide empirical support in favor of engagements to provide assurance on the reliability of mobile payment system by public accounting firms and practitioners (using any of the Trust Services Principles and Criteria) to have a positive impact of its' use.

The remainder of the paper is organized as follows: In the next section the theoretical background for this research is discussed. In the third section the literature is reviewed and the hypothesis is developed. In the fourth section methodology is analyzed and in the fifth the results are presented. Finally, in the sixth section the paper concludes by discussing the outcomes of the survey.

1. THEORETICAL BACKGROUND

Mobile payment systems (MPS) are in the process of being developed, tested, and improved so as to gain wide consumer acceptance. Currently, with e-commerce payment systems, credit card use is the principle intermediary of payment (Kim *et al.*, 2010). While some research regarding the adoption of MPSs and modifies them to ascertain acceptance of new technology, such as the acceptance of mobile payment systems. This study will use the TAM model to predict the hypothesis related to *what external variables related to mobile payment services could accelerate the proliferation/use of mobile payment services?*

As seen in Figure 1. Perceived ease of use and perceived usefulness are the two core variables that are measured to determine an acceptance of a computer technology according to TAM developed by Davis.



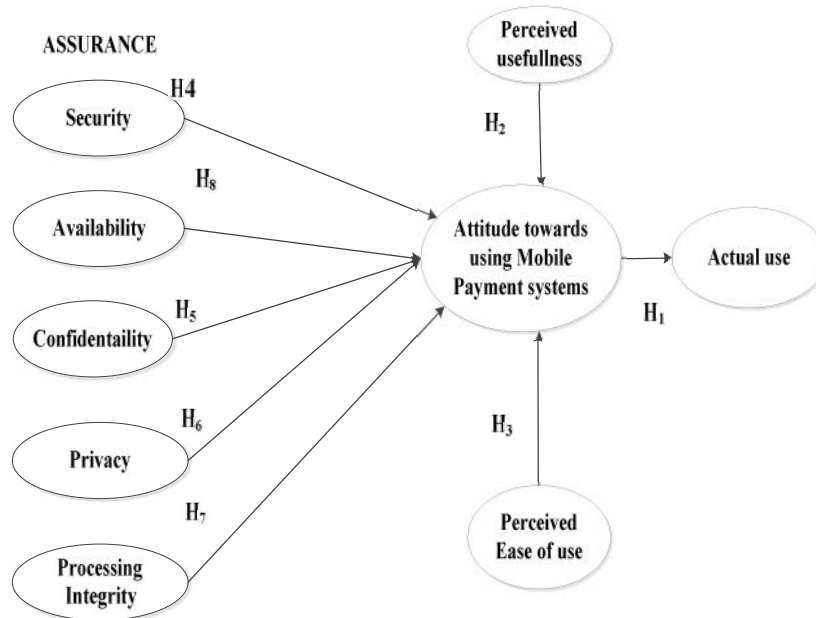
(Source: Davis, 1989)

This model has been studied for various technologies such as internet banking and wireless LAN usage (Schierz, 2010). The TAM model enables validation in a systematic and mathematical way the perceived usefulness and perceived ease of use of a technology. Perceived usefulness is the idea that a technology will enable a task to be performed with a greater efficiency. Ease of use refers to the level of effort

required to use, the less effort the easier is it use. Davis (1989) acknowledges in his ground breaking study that TAM is too parsimonious and other variables will need to be tested that are related to ease of use and perceived usefulness.

Also, integrating variables from related theoretical perspectives can provide a better understanding of consumer acceptance (Bagozzi, 2007; Nysveen *et al.*, 2005). In this study, to explain the proliferation of mobile payment services, several extensions to the TAM model are made in the research model for this study (Refer Figure 2).

Figure 2. Research Model



2. LITERATURE REVIEW

Limited literature has been published on the *external variables* for acceptance to mobile payment systems. A survey asking which characteristics of mobile payment were preferred by consumers was studied (Linck, 2006). The study found that consumers prefer secure, simple, and inexpensive payment systems.

Zmijewska (2004) completed studies to develop a user-oriented taxonomy for mobile payment applications. In their study, they evaluated MPS with a set of consumer-oriented criteria. Classification dimensions that were used in the study included simplicity, security, and cost. These dimensions were not tested for importance to the consumers.

Dahlberg (2003) performed group interviews to analyze factors contributing to the acceptance of MPS. Researchers coded participant's responses into three categories: perceived ease of use, perceived usefulness, and trust. The results from this study demonstrated that general applicability of the technology acceptance model to MPS.

In the study completed by Schierz (2010), they applied the TAM with some extended variables to MPS. The results showed they were able to apply TAM and some additional factors such as perceived mobility, compatibility and security as well. This study in 2010 suggested that research needs to be done about what it would take for a consumer to have trust in mobile payments, much like research was done for consumer trust in e-commerce online transactions (Schierz, 2010). There were no studies that examined the trust framework provided by the AICPA for providing assurance on the reliability of MPS.

Similar to the Schierz (2010) study we will begin our hypotheses section with the "core TAM" and incorporate variables of trust assurance service to extend the TAM model for MPS. As found in other studies trust is a component of whether or not users will use a technology. Intention to use is defined as the likelihood that an individual will use a technology (Venkatesh *et al.*, 2003). Based on Davis (1989), a key mediator of influence of other intention to use is a person's attitude toward using a technology. This relationship has been tested in other studies and has been verified as positive (Yang, 2004). We also adopt belief in our research model and hypothesize that attitude towards MPS is a factor to the intention to use MPS:

H₁: There is a positive relationship between the attitude towards MPS and the intention to use mobile payment services.

An important factor in users accepting a technology is having a clear benefit for potential users. According to diffusion theory, innovations are only accepted if these innovations provide an advantage over existing technologies (Rogers, 1995). The view given by diffusion theory is reflected in the perceived usefulness variable of TAM, which is a driver in attitudes toward use. Hence:

H₂: There is a positive relationship between perceived usefulness of MPS and attitudes towards using MPS.

Many different options are available for potential users of MPS. Credits cards, cash, and electronic payment systems are other options that users can choose, thus it is important that MPS are easy to use for users—more importantly users must *perceive* MPS as easy to use. Therefore, this TAM construct will be included and tested in our model.

H₃: There is a positive relationship between perceived ease of use of MPS and attitudes towards using MPS.

Based on the study completed by Kim (2010) trust for electronic payment systems is positive predictor of use of the technology. The AICPA list five principles and criteria that they evaluate for trust services. These principles and criteria are: security, availability, processing integrity, confidentiality, and privacy (AICPA, 2009). In our model, we will address trust by including perceived security, perceived confidentiality, and perceived privacy in our research model. The first variable we will discuss is perceived security. With mobile payment services being such a new technology the perceived security of this new technology is important for adoption by users. As a new technology that users are not very familiar with, user will tend to view this technology as more risky. Consumers view mobile payments with a relatively high loss potential – in regards to privacy, personal data and transactions itself (Bauer, 2005). Similar to Schierz (2010), we propose a positive link between perceived security and attitude towards using MPS.

H₄: There is a positive relationship between perceived security of MPS and attitudes towards using MPS.

With the use of MPS (such as Google wallet), users will have to transfer their personal information. Confidential information in an electronic payment systems context is described as information related to the transaction such as the identity of payer/payee, purchase content, amount, and credit card information (Asokan, 1997). Confidentiality requires that this information be restricted only to the parties involved in the transaction (Asokan, 1997). This can be achieved by encrypting transmissions and properly protecting user information. As the normal users do not understand the technical aspects of confidentiality, it is important that users perceive that MPS properly protect confidential information.

H₅: There is a positive relationship between perceived confidentiality of MPS and attitudes towards using MPS.

The next construct that will be tested in our research model is perceived privacy. Privacy is the ability of the individual to control the terms under which personal information is acquired and used. Personal information is information identifiable to an individual. The final construct that will be tested in our research model is perceived privacy. Privacy refers to “the rights and obligations of individuals and organizations with respect to the collection, use, retention, disclosure, and destruction of personal information” (AICPA, 2009). Users of technology place critical importance on privacy, thus it is important that they perceive MPS are able to keep their information private. Services that collect unauthorized information and/or distribute their information to non-authorized parties will not be used by consumers.

H₆: There is a positive relationship between perceived privacy of MPS and attitudes towards using MPS.

The next construct that will be tested in our research model is perceived processing integrity. Perceived processing integrity is the component of the mobile payment system that provides assurance that System processing is complete, accurate, timely and authorized (AICPA, 2009).

H₇: There is a positive relationship between perceived processing integrity of MPS and attitudes towards using MPS.

The final construct that will be tested in our research model is perceived availability which is the ability to use the system at any time with any mobile device. Also, the availability of the service must be operational on demand (AICPA, 2009). Interruption of mobile payment service due to technical issues (e.g., a malfunctioning part of a computer or communications device), purely natural phenomena (e.g., earthquake, flood) may hinder the attitude towards using the mobile payment system.

H₈: There is a positive relationship between perceived availability of MPS and attitudes towards using MPS.

3. RESEARCH METHOD

The population of the study comprises all persons in India who are able to use mobile applications. The information required for this study was not available in the form of secondary data, so we 276 primary data through a survey. The survey was conducted using a standardized online questionnaire, which was subjected to comprehensive pretesting prior to implementation. Table 1 summarizes the sample and population characteristics.

Table 1. Demographic Information

AGE (YEARS)	18-27	28-37	38-47	48-57
Number	112	50	80	34
Percentage	41%	18%	29%	12%
GENDER	Female		Male	
Percentage	48.2%		51.8%	

Measurements for our questions will be based off of a Likert scale, ranging from 1 (“strongly disagree”) to 7 (“strongly agree”). Where possible, we adopted or modified existing measures for our study. Appendix 1 provides a list of all measurement items and their sources.

To examine the latent variables within their causal structure, we applied structural equation modeling (SEM) using AMOS and the Maximum Likelihood (ML) procedure. We chose an SEM approach as it is a powerful generalization of earlier statistical approaches with the key benefit being that each explanatory and dependent variable is associated with measurement error in contrast to OLS regression, for example, that is based on the assumption that variables are measured perfectly (Bollen, 1989). In addition, SEM allows for multiple indicators of latent variables which are a more realistic representation of the variables under study.

4. RESULTS

We first conducted analyses separately for each factor and calculated coefficient alphas, composite reliabilities, and average variances extracted. The respective values are indicative of a reliable and valid measurement of the individual factors. All coefficient alphas exceed the recommended threshold of 0.7 (Nunnally & Bernstein, 1978)), composite reliabilities are greater than .7, and average variances extracted surpass values of 0.5 (Bagozzi, 2007).

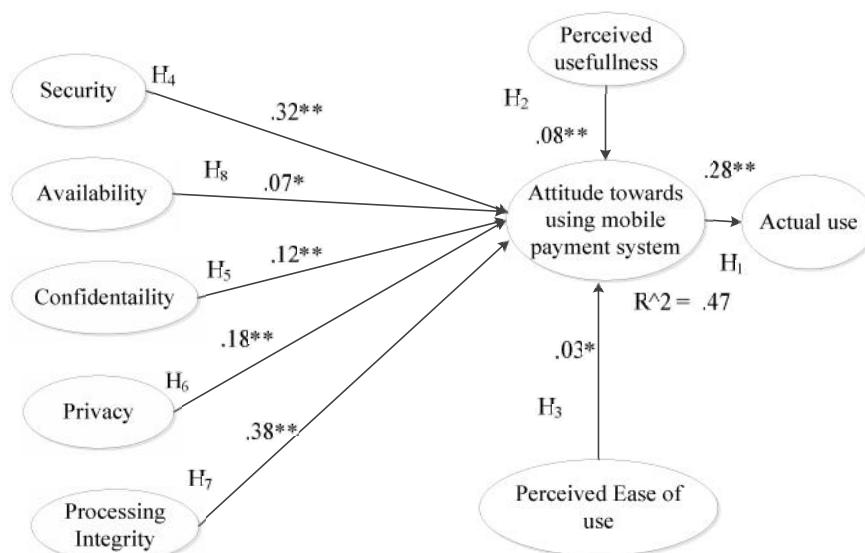
In an analysis based on Fornell and Larcker (1981), we subsequently assessed the discriminant validity of the factors. The results indicate that there are no problems with respect to discriminant validity; the average variance extracted by the measure of each factor is larger than the squared correlation of that factor's measure with all measures of other factors. Moreover, we checked for the existence of common method bias in the data. Harman's one-factor test was employed, in which no single, general factor was extracted (Podsakoff & Organ, 1986). The results of the study indicate that that common method bias does not seem to be a serious concern for this study.

After having gained confidence about the appropriateness of the measurement, the next step was to examine the structural model. The goodness of fit measures for the structural model show satisfactory values (cmin/df = 2.432; GFI = 0.94; AGFI = 0.90; TLI = 0.92; RMSEA = 0.049). Figure 3 presents the standardized estimates. The significant path coefficients ($p < 0.05$) appear to support the proposed model.

In support of H1, we find a significant and positive relationship between the attitude towards MPS and the intention to use mobile payment services. ($\beta = 0.28$; $p < 0.01$). Moreover, the path coefficient of 0.08, significant at a 1% level, points to a strong positive relationship between the perceived usefulness of MPS and attitudes towards using MPS. Thus, H2 is supported. Further, the structural link from perceived ease of use of MPS and attitudes towards using MPS is positive and significant ($\beta = 0.03$; $p < 0.05$), supporting H3. In addition, the relationship proposed in H4 is confirmed; that is, perceived security of MPS and attitudes towards using MPS. ($\beta = 0.32$; $p < 0.01$). The results also provide strong evidence for the effects of perceived confidentiality ($\beta = 0.12$; $p < 0.01$) on attitudes towards using MPS in

support of H5. Similarly, perceived privacy of mobile payment ($\beta = 0.18$; $p < 0.01$), perceived processing integrity ($\beta = 0.38$; $p < 0.01$) and perceived availability ($\beta = 0.38$; $p < 0.01$) of mobile payment system is found to predict attitudes towards using MPS as hypothesized in H7. Finally, the structural link from availability of MPS and attitudes towards using MPS is positive and significant ($\beta = 0.07$; $p < 0.05$), supporting H8.

Figure 3. Results of Model estimation



In total, the R² value of the dependent variable “Attitude towards using mobile payment system” (47%) indicates that the model highlights that mobile assurance as provided by set of important factors (Security, privacy, confidentiality, processing integrity and availability) are associated with consumer acceptance of mobile payment services.

In this study, Ease of use, usefulness, Confidentiality, privacy, availability, processing integrity, security of use are all assumed to be independent variables. These independent variables are being used to predict and explain the value of the dependent variable. If the independent variables in a multiple regression problem are correlated to some degree with another then the model or equation may have a severe multi collinearity problem. Finally, we assessed the issue of multi collinearity by looking at the magnitude of the bivariate correlations between the exogenous variables (see Table 2). All correlations between our independent variables are far below the common cutoff value of 0.8 (Berry & Feldman, 1985). An examination of the results of these tests indicated that multi collinearity was not a problem.

Table 2. Correlations among the exogenous variables

		Correlations						
		Usefulness	Easeofuse	Securit	Privacy	Confidentiality	Availability	Integrity
Usefulness	Pearson Correlation	1	.676**	.575**	.586**	.361**	.426**	.276**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	276	276	276	276	276	276	276
Easeofuse	Pearson Correlation	.676**	1	.542**	.500**	.374**	.394**	.181**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.002
	N	276	276	276	276	276	276	276
Securit	Pearson Correlation	.575**	.542**	1	.509**	.311**	.267**	.245**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	276	276	276	276	276	276	276
Privacy	Pearson Correlation	.586**	.500**	.509**	1	.273**	.330**	.165**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.006
	N	276	276	276	276	276	276	276
Confidentiality	Pearson Correlation	.361**	.374**	.311**	.273**	1	.179**	.148*
	Sig. (2-tailed)	.000	.000	.000	.000		.003	.014
	N	276	276	276	276	276	276	276
Availability	Pearson Correlation	.426**	.394**	.267**	.330**	.179**	1	.138*
	Sig. (2-tailed)	.000	.000	.000	.000	.003		.022
	N	276	276	276	276	276	276	276
Integrity	Pearson Correlation	.276**	.181**	.245**	.165**	.148*	.138*	1
	Sig. (2-tailed)	.000	.002	.000	.006	.014	.022	
	N	276	276	276	276	276	276	276

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

CONCLUSION

Based on prior studies completed on the subject matter, we found out positive relationships on all our tested variables related to mobile assurance (Schierz, 2010). The results of this study suggest that attitudes towards using MPS will lead to intention to use of these systems. Also, we found out the components of Trust Services Principles and Criteria that we choose to test in our study had a positive relationship with attitudes toward use. Based on the results of this study on MPS, we believe that perceived privacy and confidentiality will correctly predict the attitudes towards use.

The limitation of this study is that it is tested on a small same and this research can be extended by use of large scale sample. Also other variables such as location based service, trialability of mobile payment services and its relationship with consumer acceptance and use of mobile payment system have not studied in the past and future research can be done to extend this study by examining such relationships.

This study extends the TAM model by incorporating the Trust framework. This study also provides empirical evidence in favor of Engagements to provide mobile assurance on the reliability of mobile payment system by public accounting firms and practitioners (using any of the Trust Services Principles and Criteria). Assurance on MPS has a positive relation with the attitude towards use and intention to use mobile payment system. The results of the study data suggest that mobile assurance correctly predict the attitudes towards use.

With Google wallet currently being introduced to the U.S. market, privacy, trust, security, confidentiality, processing integrity and availability factors of this new mobile payment technology will be important for user acceptance. Personal information, such as credit card information, contact information, and purchase details, will be made available to Google (much like current Google applications). It is important that users feel comfortable with the information being collected about them and that this information is only being shared with authorized parties, since this information is very sensitive. With improved trust in MPS, namely Google wallet, higher rates of user acceptance will occur.

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APPENDIX Measurement Items

Items	References
1. Attitude toward using MPS	
Using mobile payment services is a good idea Using mobile payment services is wise Using mobile payment services is beneficial Using mobile payment services is interesting	(Oh, 2003), (van der Heijden, 2003), (Yang, 2004), (Schierz, 2010)
2. Intention to use mobile payment services	
Given the opportunity, I will use mobile payment services I am likely to use MPS in the near future I am willing to use MPS in the near future I intend to use mobile payment services when the opportunity arises	(Davis, 1989), (Gefen, 2003), (Venkatesh, 2000), (Schierz, 2010)
3. Perceived usefulness of mobile payment services	
Mobile payment services are a useful mode of payment Using MPS makes the handling of payments easier Mobile payment services allow for a faster usage of mobile applications (e.g. ticket purchase) By using MPS, my choices as a consumer are improved (e.g. flexibility, speed)	(Bhattacharjee, 2001), (Devaraj, 2002), (van der Heijden, 2003), (Schierz, 2010)
4. Perceived ease of use of MPS	
It is easy to become skillful at using MPS The interaction with MPS is clear and understandable It is easy to perform the steps required to use MPS It is easy to interact with MPS	(Bhattacharjee, 2001), (Davis, 1989), (Taylor & Todd, 1995), (Venkatesh, 2000), (Schierz, 2010)
5. Perceived Security of MPS	
The risk of an unauthorized third party overseeing the payment process is low The risk of abuse of usage information (e.g. names of business partners, payment amount) is low when using MPS The risk of abuse of billing information (e.g. credit card number, bank account data) is low when using MPS I would find MPS secure in conducting my payment transactions	(Luarn, 2005), (Parasuraman, 2005), (Schierz, 2010)
6. Perceived Privacy	
I believe my personal information (i.e. address, credit card, date of birth) will not be shared with other unauthorized third parties I feel comfortable with the information being collected about me by the MPS I believe the information (personal and behavioral) being collected about me is not being used for purposes other	new measure

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Items	References
<p>than the ones I authorized</p> <p>I believe the information being collected is only information that is needed for the mobile payment system</p> <p>I feel comfortable with how my collected information is being used.</p>	
7. Perceived Confidentiality	
<p>I believe my personal information (credit card information and purchase details) is being properly protected</p> <p>I believe my personal and behavioral information is properly protected against unauthorized access by use of user-IDs and passwords</p> <p>I believe my personal information is stored in a secure and encrypted database</p> <p>I believe my personal information is not being exposed to unauthorized third party</p>	new measure
8. Perceived Availability	
<p>The risk of interruption of service due to purely technical issues (e.g., a malfunctioning part of a computer or communications device) is low when using MPS</p> <p>The risk of interruption of service due to purely natural phenomena (e.g., wind or water) is low when using MPS</p> <p>The risk of interruption of service due to human causes (accidental or deliberate) is low when using MPS</p> <p>The risk of interruption of service due to changes will be communicated to management and users who will be affected when using MPS.</p>	new measure
9. Perceived Processing Integrity	
<p>I believe that entered into the mobile payment system have not been changed inappropriately, whether by accident or deliberately malign activity</p> <p>I believe that the data displayed in the in the mobile payment actually came from the authorized person or entity, rather than an imposter.</p> <p>I believe that the data that was transmitted or entered into the Mobile payment system was not corrupted.</p> <p>I believe that the MPS provided to me the terms and conditions of mobile payment system (such as time frame for completion of mobile payment transactions)</p> <p>I believe that the errors and omissions, and breaches of systems security and for submitting complaints will be communicated to authorized users</p>	new measure