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# A UNIFIED RISK-BENEFIT ANALYSIS FRAMEWORK FOR INVESTIGATING MOBILE PAYMENT ADOPTION

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# A UNIFIED RISK-BENEFIT ANALYSIS FRAMEWORK FOR INVESTIGATING MOBILE PAYMENT ADOPTION

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## Abstract

*The paper proposes a unified risk-benefit analysis framework for investigating consumers' adoption of mobile payment technology. Based on perceived risk theory and risk-benefit analysis literature, the proposed framework integrates three variables—perceived risk, perceived benefit and perceived value, to predict consumers' intention to use mobile payment. All the proposed hypotheses are well supported based on an empirical validation of 336 useful survey samples. The results show that consumers consider both the beneficial and risky aspects of using mobile payment to evaluate the overall desirability (perceived value) of adoption decision. Further, perceived value, together with perceived risk and benefit directly affects consumers' intention to adopt the technology. Financial risk is found to be the key resource of the risks of using mobile payment. Both theoretical and practical implications are discussed.*

*Keywords: Mobile payment, Perceived risk, Perceived value, Technology acceptance.*

# 1 Introduction

Since the inception of online shopping in 1990s, scientists have invested much effort in advancing online payment systems in order to guarantee a secure online transaction and to protect consumer privacy, etc. Well-adopted online payment systems have leveraged the success of various online business solutions, such as B2C and C2C commerce, online auction and group shopping. In this regard, if a widely-adopted online payment system is the key to the success of Internet shopping, consumers' uptake of mobile payment system emerges as an important prerequisite for the coming era of mobile commerce. Indeed, mobile payment has been ranked as one of the most innovative mobile Innovations by consumers today (Bouwman et al., 2012). Hence, it is imperative for researchers to identify the key driving factors of mobile payment adoption. In the present study, mobile payment is defined as the payment services performed via the use of mobile phones.

Mobile payment in China is now at the critical stage of takeoff. Many innovative mobile payment approaches (i.e. SMS-based, WAP-based and RFID-based approaches) have been proposed while the transaction conducted through mobile payment is increasing considerably in recent years. According to the estimate of iResearch (2011), the size of transactions conducted through mobile payment in China has already received 530 million Yuan in 2009 and 2.03 billion Yuan in 2010. The figure is expected to hit 10.27 billion Yuan in 2011, 31.28 billion Yuan in 2012 and 132.46 billion Yuan in 2014 (iResearch, 2011). Apparently, the potential of mobile payment abounds. While the emergence of online payment gives rise to a new approach of distant shopping at any time of consumers' convenience, mobile payment gives rise to not only a ubiquitous shopping solution, but also a new possibility of using personal mobile phones to substitute the function of cash and rechargeable cards (i.e. public transport card).

Prior models of technology acceptance, i.e. the Technology Acceptance Model (TAM), generally consider the beneficial sides of using a technology, or to what extent using a technology would bring advantages to actual users, i.e. usefulness. However, few of them is found to take the possible risky or disadvantageous sides of technology use into account, for instance as a key theoretical component. In this concern, perceived risk theory, as a key theory in marketing research, is applied to underpin our proposed research framework. In daily life, it is common for people to consider both the favourable and unfavourable outcomes of a possible future behaviour before they actually adopt the activity, in particular when the activity requests particular scarce resources, i.e. money, energy or physical efforts. Indeed, perceived risk has been one of the most widely investigated factors across the literature related to commerce-oriented IT innovations, i.e. online banking (Lee, 2009; Tan and Teo, 2000), e-commerce (Pavlou, 2003; Teo and Liu, 2007), Internet shopping (Forsythe and Shi, 2003) and online shopping (for a review see. Chang, et al., 2005). Therefore, based on perceived risk theory and risk-benefit analysis literature, the study proposes a unified risk-benefit analysis framework for commerce-related information technologies and applied it to investigate mobile payment adoption. A questionnaire survey is conducted to validate the proposed research framework. The remainder of the paper is structured as follows: in the next section, related literature and theoretical background of the present study will be discussed, followed by the research methodology section. The results will be discussed and conclusion will be made in the section 4. In the section 5, research limitations and future research directions will be discussed.

## **2 Literature review and theoretical background**

### **2.1 The Models of IT acceptance and risk-benefit analysis**

Current models of IT acceptance, such as TAM, are focused on how the advantages of using a new IT innovation would help to motivate users to adopt the innovation. For instance, if a technology can save users' mental and physical efforts to use and promote their job performance, the technology would be more likely to be adopted (Davis, 1989). In statistics, these 'plus' effects of using a technology show up as a positive motivators of the technology acceptance. However, using a new technology does not always bring about benefits alone; for instance, when adopting a new technology to replace the old solution, the consequence is always associated to various uncertainties and therefore the decision of new technology adoption becomes risky (c.f. Mitchell, 1999). Hence, a comprehensive consideration of both the beneficial and risky sides of adopting a new IT innovation would contribute to a more complete understanding on IT adoption.

Considering both benefits received and sacrifices given to evaluate the over desirability of particular future action is a key theme of decision science. For instance, theories, such as expectancy utility theory and prospect theory (see. Kahneman and Tversky, 1979), have been proposed and widely adopted to support the decision-making process of managers, project leaders in particular in finance and economics contexts (c.f. Conchar et al., 2004). In this regard, sacrifices given has been dominantly measured through risk, as an individual's decision or action often produces social and economic consequences that cannot be estimated with certainty (i.e. see. Zinkhan and Karandde, 1991; Campbell and Brown, 2005; Rashid and Hayes, 2011). Similar evidences can be found in marketing research on individual consumer behaviour alike (i.e. Dardis and Stremel, 1981; Wood and Scheer, 1996). For instance, Dardis and Stremel (1981, p. 554) applied risk-benefit analysis to study consumers' acceptable risk and measured risk assessment as "both the probabilities of various outcomes and the consequences of such outcomes expressed in dollar terms", and generated a risk-benefit ratio to evaluate the desirability of particular products in retailing. Concerning new technologies in food industry, Bruhn (2007) argued that the acceptance of a technology depends on the consumer's perception of benefits and risks.

Different from prior works which evaluate risk from an objective manner, recent marketing research refer to risk from a subjective perspective, such as perceived risk theory. This theory has been widely applied in the context of information systems research alike (i.e. Lee. 2009; Featherman and Pavlou, 2003). In the present study, it is proposed that perceived risk and perceived benefit, like two sides of a coin, have to be both considered in order to obtain a more complete view of consumers' decision making.

### **2.2 Perceived risk theory**

Individuals face risk when a particular decision or action brings about social and economic outcomes associated with uncertainty (Zinkhan and Karandde, 1991); as a result, research on risk abounds and is under such disciplines as economics, psychology, decision sciences, management, risk and insurance, public policy, and finance (Conchar et al., 2004). Serious attentions on consumers' perceived risk in marketing research was aroused after the work of Bauer (1960), who first proposed that consumer behaviour could be viewed as an instance of risk taking. Thereafter, perceived risk theory has been widely adopted by scholars in marketing research to interpret consumer behaviour (for a review see. Ross, 1975). According to Mitchell (1999), the popularity of perceived risk theory attributes to the facts that (i) the theory has intuitive appeal, which facilitate marketers seeing the world through consumers' eyes; (ii) the theory can almost be universally applied and is highly versatile; (iii) the

theory gains advantages as consumers are more often motivated to avoid mistakes than to maximize utility in purchasing; (iv) the theory facilitates marketing resource allocation decisions. The theory chiefly concerns subjective (perceive) risk other than real-world (objective) risk, which makes it differ from prior risk-related works in economics and finance (see. i.e. Bauer, 1960; Ross, 1975; Mitchell, 1999). Most of scholars refer to consumers' perceived risk as a kind of a multi-dimensional construct (i.e. Lee, 2009; Cunningham, 1967; Featherman and Pavlou, 2003). For instance, Kaplan et al. (1974) indicated that the components of perceived risk include physical, psychological, social, financial, performance risk. Roselius (1971) suggested that consumer risk includes four categories of loss, which are time, hazard, ego and money loss. Lee (2009) investigated five types of risk in studying Internet banking adoption, including performance, social, time, financial and security risk. Featherman and pavlou (2003) adopted performance, financial, time, psychological, social, privacy and overall risk as the key facets of perceived risk to predict the e-services adoption. Based on the perceived risk theory, many studies have been conducted to investigate commerce-related IT innovations adoption, as noted already. Following this stream of thought, our research framework, grounded on perceived risk theory, also adopts perceived risk as a key component. Concerning mobile payment service, the perceived risk is defined as the extent of which an individual's subjectively belief about the potential losses caused by uncertainties of using mobile payment technology. Based on the above discussion, the following hypothesis is proposed:

**H1:** Perceived risk negatively relates to intention to use.

Consistent with prior studies (i.e. Lee, 2009; Cunningham 1967; Featherman and Pavlou, 2003), the paper measures perceived risk as a multidimensional construct alike. In the paper, three key facets of perceived risk of mobile payment are investigated, which are financial, psychological and privacy risk. Their definitions are available as follows:

**Financial risk:** The possible loss unreasonable financial loss caused by transaction in mobile services, i.e. extravagantly pricing, maliciously charging (Yang and Zhang, 2009).

**Privacy risk:** The possible loss caused by private information of consumer individuals exposed in mobile services (Yang and Zhang, 2009).

**Psychological risk:** The possibility that consumers bear mental stress of the technology use (Lim, 2003).

## **2.3 Perceived benefit**

"Consumers do not ask for technologies, rather they seek products with specific benefits" (Bruhn, 2007, p. 555). In other words, consumers make a risky decision not for the purpose of taking risk itself, but for obtaining gains or benefits. Users tend to overcome difficulties in using new an information technology if the benefits of usage are substantive (Porter and Donthu, 2006). In a study on Internet banking, Lee (2009) noted that there are various benefits of using the technology, such as financial benefits, faster transaction speed, and increased information transparency. Lee (2009)'s work further found that perceived benefit has a significant influence on intention to use while the influence is even stronger than that of attitude. The work Dholakis and Uusitalo (2002) suggested that perception of shopping benefits should be considered when evaluating how consumers choose physical and electronic stores. Melenhorst et al. (2001) interpreted the acceptance of communication technologies in terms of cost-benefit analysis, and found that users weigh the individually perceived benefits and costs to decide their adoption of the technology. In a similar way, perceived benefits have been widely utilized as a direct determinant of particular IS adoption (Lacovou et al., 1995; Lee, 2009; Siegrist, 2000). Therefore, perceived benefit is included as an important construct of the framework proposed, which is defined as the overall benefits that an individual perceives of adopting a particular IT (Kim and Olfman, 2011). Based on the above discussion, the following hypothesis is made:

**H2:** Perceived benefit positively relates to intention to use.

## 2.4 Perceived value

It is apparent that consumers sacrifice monetary (i. e price) or non-monetary resources (i.e. time, energy and effort) in order to obtain the utility of products or services (Monroe and Chapman, 1987; Zeithaml, 1988). Hence, it comes naturally that consumers evaluate the tradeoff between the benefits received and sacrifices given to decide the desirability of a particular decision or action (c.f. Monroe, 1979; Monroe and Chapman, 1987; Zeithaml, 1988). In this concern, marketing researchers proposed a concept of perceived value to measure this tradeoff (Monroe, 1979; Monroe and Chapman, 1987; Zeithaml, 1988). For instance, Zeithaml (1988, p. 14) referred to perceived value as “consumers’ overall assessment of the utility of a product based on perceptions of what is received and what is given” (Zeithaml, 1988, p. 14). As early as 1980s, researchers have identified that a high perceived benefit tends to lead to a high perceived value while a high perceived sacrifice in contrast tends to reduce the perceived value (i.e. Monroe, 1979; Monroe and Chapman, 1987; Zeithaml, 1988). Another stream of evidences can be obtained from cost-benefit and risk-benefit analysis literature, which broadly adopts cost-benefit ratio and risk-benefit ratio to evaluate the overall value or desirability of adopting a particular system or decision (i.e. Dardis and Stremel, 1981; Harford, 2006; Horton et al., 2011). Hence, based on the above discussion, it is proposed that:

**H3:** Perceived benefit positively relates to perceived value.

In order for people to adopt a particular IT innovation, like mobile payment, people have to share the control of monetary resources to the system and invest an ‘unpredictable’ amount of both mental and physical efforts in order to learn to use the system. Perceived risk therefore can also be viewed as the subjective expectation of a loss or sacrifice (Sweeney et al., 1999). From a perspective of risk-benefit analysis literature, a high risk is negatively related to the overall desirability of the decision investigated. Sweeney et al. (1999) investigated consumer behavior in a retail environment, and found that perceived value is a mediator between perceived risk and willingness to buy. Perceived risk has a negative impact on consumers’ perceived value (Sweeney et al., 1999). Hence, it is hypothesized that:

**H4:** Perceived risk negatively relates to perceived value.

Consistent with prior studies (i.e. Sweeney et al., 1999; Turel et al., 2007; Kim and Oh, 2011), it is expected that perceived value is a significant predictor of intention to use. Therefore, the following hypothesis is included into the framework as well.

**H5:** Perceived value positively related to intention to use.

The proposed framework is graphically presented in figure 1.

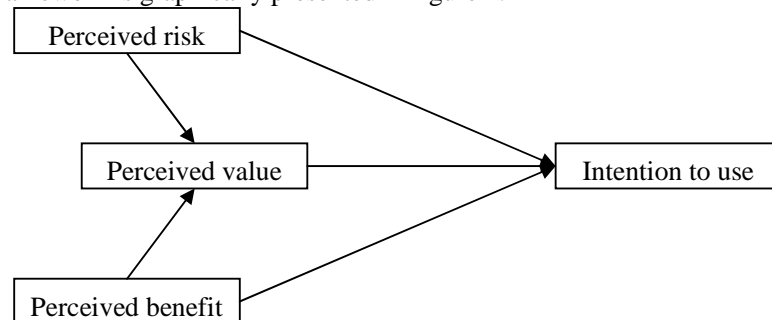


Figure 1. The Unified Risk-Benefit Analysis Framework of IT acceptance

## **2.5 Applicability of the framework**

Many IS researchers argued that the predictive power of a particular theory or a construct may be constrained in relevance to specific IT categories being measured. For instance, van der Heijden (2004) indicated that the predictive power of perceived usefulness is restricted to measure utilitarian information systems, while perceived enjoyment is a better predictor in the case of hedonic information systems. In a similar manner, Liu et al. (2010) conducted research on mobile learning acceptance, and noted that perceived long-term usefulness contributes to a more influential predictor of educational information systems acceptance. Note that similar arguments can be found in a large number of prior studies (i.e. Sun and Zhang, 2006; Verhagen, et al., 2009; Wen et al. 2011). Therefore, it is necessary to discuss the applicability of the proposed framework in relevant to the perceived risk theory.

As the framework is grounded on perceived risk theory, the applicability of perceived risk theory also affects the applicability of the framework proposed. As mentioned above, individuals face risk under the condition that their decision or action is likely to cause essential economic and social loss (c. f. Zinkhan and Karande, 1991); while “less complex situations or routine choice situations are more likely to lead to simpler processes or even to ignore risk issues altogether” (Mitchell, 1999; Payne, 1973; Wright 1975; cited from: Conchar, 2004, p. 424). Hence, the framework should be especially good to be applied to study commerce-related IT innovations. Indeed, perceived risk theory appears to be one of the most widely applied theories of consumer behaviour research in for instance e-commerce area, as noted before.

## **3 Research methodology**

### **3.1 Sample and measurement**

In order to validate the research model, an online questionnaire survey was conducted in a professional online survey website (<http://www.sojump.com>). The site has over 2.6 million registered members who are willing to take part in the survey that they are interested in. Hence, our samples are collected from users who are familiar with Internet. All the items for measuring the latent variables were derived from prior studies. Measurement for financial risk is from the work of Featherman and Pavlou (2003) and Hassan et al. (2006) while measurement for psychological risk is built upon Featherman and Pavlou (2003), Hassan et al. (2006) and Stone et al. (1993). Items for measuring privacy risk are derived from the study of Featherman and Pavlou (2003) and Miyazaki and Fernandez (2001). Perceived benefit is measured based on the items from the works of Davis (1989), Kim et al. (2010) and Taylor et al. (1995) while perceived value is measured using the scales from the work of Wood et al. (1996). A seven-point Likert-scale ranging from strongly disagree (1) to strongly agree (7) was used to measure each item. All the samples (337 responses) are found to be validated and therefore retained for model evaluation. The sample consists of 194 males and 143 females. Majority of respondents are between 25-35 years old with an income between 1000-4999 RMB.

As the perceived risk is measured as a second order formative factor, SmartPLS 2.0 is utilized to validate the research model. Considering the advantages of the repeated indicator approach and the two-step approach in modeling higher-order construct (see. Ciavolino and Nitti, 2010), the study first analyzed the measurement properties of all the constructs and sub-constructs of the instrument using repeated indicator approach; then the factor scores of first-order constructs are applied as indicators for the second-order construct for the purpose of hypotheses testing (c.f. Wang and Benbasat, 2005; Vance et al., 2008).

*Table 1. Reliability and convergent validity statistics (all the factor loadings are significant at 0.001 levels)*

Construct (no. of items)	$\alpha$	Composite reliability	Minimal. factor loading	AVE
Financial risk (4)	0.926	0.947	0.901	0.819
Psychological risk (3)	0.935	0.958	0.926	0.885
Privacy risk (4)	0.952	0.965	0.916	0.874
Perceived benefit (4)	0.946	0.961	0.902	0.861
Perceived value (4)	0.927	0.948	0.889	0.820
Intention to use (3)	0.955	0.971	0.951	0.917

*Table 2. Discriminant validity (The bold diagonal are the square roots of the AVEs of the individual constructs; off diagonal values are the correlations between constructs)*

Construct	FR	PSR	PRR	PB	PV	INT
Financial risk (FR)	0.904					
Psychological risk (PSR)	0.611	0.940				
Privacy risk (PRR)	0.777	0.643	0.934			
Perceived benefit (PB)	0.170	0.031	0.206	0.861		
Perceived value (PV)	-0.114	-0.118	-0.083	0.507	0.905	
Intention to use (INT)	-0.257	-0.208	-0.213	0.394	0.593	0.957

As shown in Table 1, all the factor loading values are above the threshold of 0.7 while the Cronbach's alpha values are all over the 0.9. The composite reliability values (CR) and average extracted variance (AVE) of all the constructs satisfy the recommended level of .8 and .5 respectively, thereby indicating good internal consistency. As shown in Table 2, the square roots of AVE of all constructs are greater than the correlation estimate with the other constructs. This reveals that each construct is more closely related to its own measures than to those of other constructs, and discriminant validity is therefore supported. Harmon's one-factor test is applied to test common method bias in the study (Podsakoff and Organ, 1986). No factor is found to account for the majority of the covariance in the variables. In addition, a low correlation is found between variables, such as perceived value and perceived privacy risk, suggesting that data does not suffer from common method bias.

### 3.2 Results

The results of model validation are graphically presented, as shown in Figure 2. Against expectations, only financial risk, as a first order reflective construct, is found to significantly load on perceived risk (loading = 0.792, p-value < 0.01). The research model is well supported as all the hypotheses are found to be validated. Specifically, perceived risk negatively relates to perceived value ( $\beta = -0.197$ , p-value < 0.001) and intention to use ( $\beta = -0.228$ , p-value < 0.001). As a product of perceived benefit ( $\beta = 0.532$ , p-value < 0.001), perceived value is found to significantly influence intention to use alike ( $\beta = 0.47$ , p-value < 0.001). Further, perceived benefit is found to be a significant antecedent of intention to use as well ( $\beta = 0.185$ , p-value < 0.001). The model is found to interpret 29.5 percent of the variance of perceived value, 41.2 percent of intention to use.



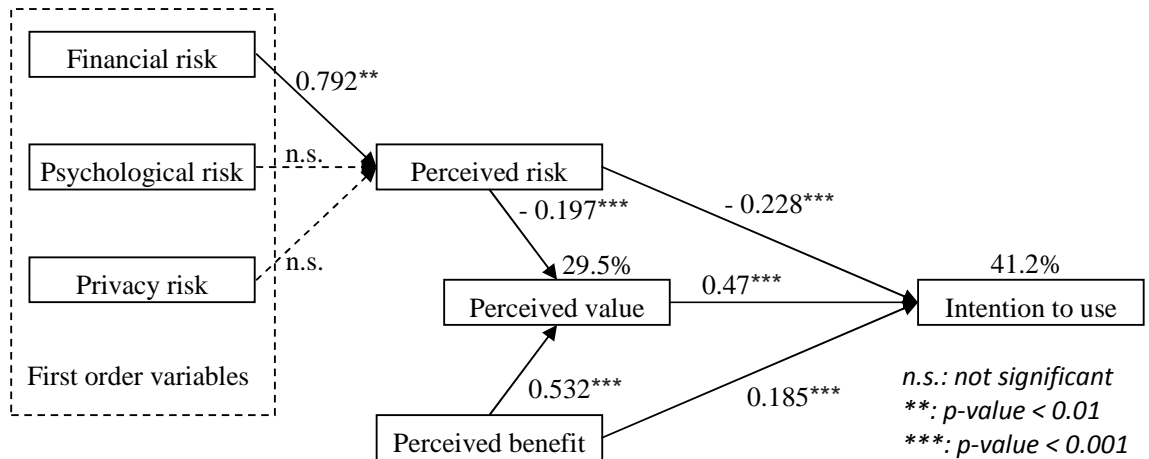


Figure 2. Results

## 4 Discussion and conclusion

Based on the perceived risk theory and risk-benefit analysis literature, the study contributes to IS literature by introducing a unified risk-benefit analysis framework to interpret commerce-related information technology acceptance. Specifically, the framework takes consumers' both positive and negative perceptions on technology use into account, which further helps to understand how consumers evaluate the overall desirability of adopting a particular technology. While major adoption models (i.e. TAM) only take the beneficial sides of using an IT into account, the proposed framework, grounded by perceived risk theory, helps to provide a more complete view by taking the negative effects of IT use into account as well. Note that, as a parsimonious framework, the model also contributes to a useful basis for extension, such as including more risk and benefit facets into account by measuring perceived risk and benefit as a second order variable or as a mediator. Further, whilst various prior studies suggest a direct impact of perceived risk and perceived benefits on technology adoption (Dardis and Stremel, 1981; Harford, 2006; Horton et al., 2011; Wu and Wang, 2005; Lu et al., 2005), the model also suggests an indirect impact mediated by perceived value. Moreover, the model is applied to interpret the adoption of an emerging IT innovation—mobile payment. All the hypotheses are found to be well supported; this not only contributes to a living instance underpinning the validity of our model, but also helps enrich our understanding on mobile payment acceptance in particular. The results also show that perceived risks and benefits are significant determinants of consumers' adoption of mobile payment.

Specifically, the results indicated that the perceived financial risk is now the most important sources of risks that affect mobile payment adoption. Perceived privacy and psychological risks don't contribute to overall perceived risk. For practitioners, the findings suggest that it is important to reduce the risk associated with finance security while Chinese consumers seem to not consider much on privacy and psychology issue in formulating their adoption intentions. On the other hand, if consumers are aware of the benefits of using the mobile payment, it is more possible for them to have a positive evaluation on the value of technology use, and therefore more willing to use the technology. Consistent with expectations, consumers are found to consider both the positive (perceived benefit) and negative (perceived risk) sides of using mobile payment and evaluate the overall value or desirability of technology acceptance. For practitioners, the results indicated that mobile payment service providers should alleviate consumers' perceived risk while convince users with various possible benefits of using the new payment approach in facilitation of a fast adoption of the technology among consumers. Further, even if current use of mobile payment is a somewhat risky activity, it is possible that some

consumers are still willing to adopt the technology, if they can witness enough benefits of technology use.

## 5 Limitations and future research

The research is based on studying Chinese users. So audience should be cautious with the generalization of results with consumers from different cultural background. Also, the research did not include the actual use of the technology into account; it can be another limitation of the present study, but also a possible avenue for future research. Our future research will include more risk and benefit facets measured in the survey into the construct and seek to explore how these facets affect the mobile payment acceptance.

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