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DO INNOVATORS CONCERN LESS ABOUT SECURITY AND VALUE NEW TECHNOLOGIES MORE? A CASE OF MOBILE COMMERCE

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ABSTRACT

Drawing upon the literature in personal innovativeness in IT (PIIT), consumption values, and behavioral aspect of security research, this study proposed a research model to investigate the impact of PIIT on influential factors of users' attitude towards mobile commerce including perceived value added, perceived cost and security concern. The analysis of the data collected from 135 Chinese mobile consumers reveals that personal innovativeness is an important determinant of perceived value-added, perceived cost, and security concern, which ultimately lead to consumer's favorable attitude towards mobile commerce and intentions to conduct mobile commerce. This research advances our understanding of the impact of PIIT on users' perceptions on risk (perceived cost and security concern) and benefit (perceived value added) of m-commerce and notifies mobile commerce vendors to provide more innovative functions and value-added services on the mobile platform to attract more users to try out such functions and services.

Keywords: Mobile Commerce, Personal Innovativeness, Security concern, Cost, Value, Adoption

INTRODUCTION

Research has predicted the rapid adoption of mobile devices and mobile data services since a decade ago (e.g. [51]). This trend continues: in 2013, more than 1 billion smartphone units were shipped worldwide and this number has doubled since 2011 [28]. Meanwhile, data plans for mobile devices have become very affordable and commonplace [60]. Consequently, mobile commerce (m-commerce) has become an increasingly important and popular platform for businesses. In 2013, US consumers spent \$14.6 billion on mobile shopping through their smartphones, and this figure is expected to reach \$30.7

billion by 2017 [18]. In spite of such rapid growth, m-commerce still accounts for a relatively small portion of 7% Internet sales by 2016, according to [20]. Existing studies have identified barriers in the development of m-commerce including uncertain technology standards, complexities of interactive multimedia application, small user interfaces, pricing structure, and security and privacy risks which contribute to a deflated vision of m-commerce [30, 24, 43]. These barriers further motivate researchers and practitioners to develop a deeper level of reasoning and a better understanding to explain the low acceptance rate of m-commerce. Clearly, we are still in the early stage of m-commerce diffusion. It is still important and relevant to understand users' innovative propensity and

how such propensity impacts their perceptions on mobile technology and consequent usage.

M-commerce is a business innovation supported by telecommunication and information technology (IT) and allows consumers to buy goods, services, and contents online without time and space limitation by using handheld mobile devices [35]. To conduct m-commerce, consumers often use various mobile innovations such as mobile apps and mobile payment systems. Thus, being comfortable with new technologies and willing to try them out are critical in consumer's decision on m-commerce adoption. Past research pointed out that innovative consumers seem to have a propensity to respond to new stimuli and such propensity in the context of IT is conceptualized as personal innovativeness in IT (PIIT), which is defined as "the willingness of an individual to try out any new information technology" [1, pp. 206]. PIIT is a well-established, stable individual trait specific to IT [1, 56] and has been claimed as a concept having immediate relevance to consumer behavior [40] and to the acceptance of different information technologies (e.g. [3, 29, 40]). Yi and his colleagues [63] indicated that, given the diverse features and functions of a new technology, identifying a stable and invariant individual characteristic that has a persistent effect on the acceptance decisions across multiple technologies has substantial value for the successful implementation of the technology. PIIT was tested on the well-established technology acceptance model (TAM) and found to be a direct determinant on technology characteristics such as usefulness and ease of use, which in turn impact IT usage and diffusion [35, 63]. The direct influence of PIIT was also confirmed on other TAM related models such as the theory of planned behavior (TPB) and the unified theory of acceptance and use of technology (UTAUT) [29]. However, little research has investigated the direct influence of PIIT on perceived value and cost of m-commerce from the perspective of rational choice, while such value vs. cost perceptions are believed to be critical in IT adoption [58].

From utility perspectives, users are driven by values and hindered by costs. They make rational choices based on their value vs. cost perceptions on the new IT. Past research has examined the effect of perceived value added and perceived cost on m-commerce adoption from utility perspectives [36, 52]. However, in m-commerce, users have to bear possible higher security risk in addition to monetary cost due to the nature of telecommunication technology. Mobile data and transmission roam through the air and are easily intercepted [24]. This makes m-commerce extremely vulnerable to data breaches that could lead to identity theft. In 2013, more than 13 million people became the victim of identity theft [31]. Surveys

also showed that users' security concern on mobile computing is one of main factors hindering m-commerce [48]. Clearly, understanding the impact of users' security concern and how such concern as additional cost impacts users' intention to conduct m-commerce are relevant and important. Without understanding users' concern, mobile vendors cannot provide proper service and technology features to meet consumers' security requirements, which would lead to loss of consumers' trust and low rate of adoption. Little research has studied the impact of PIIT on security concern. Given the current share of m-commerce in Internet sales, we argue that at this stage innovators may play a critical role in influencing radical changes in m-commerce [63]. Therefore, examining such impact would be revealing.

Moreover, worldwide, m-commerce is growing rapidly [37], especially in those emerging economies such as China, India, and Brazil. M-commerce has the potential to exceed the success of electronic commerce given the rapid growth and penetration of mobile devices and wireless Internet services among huge populations in those countries [12]. However, compared to the growth of mobile subscribers, m-commerce activities in those emerging economies remain low [55]. Research on users' decisions to adopt m-commerce in those emerging economies would provide insight into m-commerce development for telecommunication and mobile services providers who want to enter, survive or thrive in those countries.

To fill the above mentioned gaps, this study proposed a research model in which the impact of PIIT on the trade-offs between cost and value of m-commerce is examined. The proposed model intends to answer the following three research questions: Do users with high innovative propensity in mobile technology tend to appreciate more value of m-commerce? Do users with high innovative propensity in mobile technology tend to concern less about security and be willing to take more risk to try out m-commerce? How users' perceptions on the trade-offs between cost and value of m-commerce impact their intentions to adopt m-commerce? To empirically test the research model and answer the research questions, a survey was conducted among mobile device users in a metropolitan area in China. The results of the data analysis confirmed our research model and hypotheses.

The rest of paper is organized as follows. In Section 2, the research model and hypotheses were developed based on a literature review. Section 3 discussed the research method and data collection. The results of model estimation and hypothesis test were presented in Section 4. Section 5, the last section, discussed the contributions, implications and limitations of the study. Future research directions were also pointed out in this section.

THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

M-commerce in China

China's telecommunication sector has been experiencing remarkable growth. In 2011, the telecommunication sector reached a revenue of ¥ 988 billion (\$157 billion), which was a 10% increase from the previous year [10]. Mobile phone users also increased to 1.2 billion and among them 128 million are 3G users [10]. Mobile shopping seems to have started booming in China too. Consumers spent ¥167.6 billion (\$27.5 billion) on m-commerce in 2013 and this number is expected to exceed a trillion by 2017 [11]. Parallel to this trend, many local governments are embarking on "wireless city" initiatives to rapidly increase wireless bandwidth and stimulate m-commerce [15]. As a result, more and more mobile users are becoming comfortable with mobile devices and their functionality. However, despite users' growing familiarity with m-commerce, mobile Internet users in China do spend much less than users in the US. As compared to the number of users, mobile advertising spending is also very low [55]. It seems that while mobile users may be becoming comfortable with less financially sensitive mobile activities such as listening to music, playing free games, sending emails, searching information, just to name a few, many of them still don't engage in monetary transactions [12]. Furthermore, mobile payment system development and market are still in an infant stage in China [15], though China's telecom players are putting big investment on mobile payment systems. For example, China Mobile, a telecom giant in China, spent 5.8 billion dollars to purchase 20% of Shanghai Pudong Development Bank to further expand its mobile payment market share [54]. However, the adoption rate of mobile payment is still very low, as the entire industry lacks mature business models, and most mobile payment products and services are not fully developed for commercial use [15]. Given the current state of its mobile market, it is more critical to find out factors that can alleviate users' reluctance to conduct monetary transactions on the m-commerce platform and factors that can increase users' intention to adopt m-commerce. Otherwise m-commerce potentials in China cannot be fully achieved. For this reason this study focuses on the essential factors affecting m-commerce adoption.

M-Commerce Attitude and Adoption Intention

Derived from the theory of reasoned action (TRA), the relationship between attitude and adoption intention has long been established [2]. According to TRA, favorable or unfavorable attitude is a predictive variable of behavior intention [2]. Intention indicates an individual's cognitive readiness to perform a given behavior once a favorable attitude is formed. In this study, intention to conduct m-commerce is a proxy of actual behaviors. We argue that users' favorable attitude to m-commerce will result in increased intention to adopt m-commerce based on findings in extant research (e.g. [57]). Hence:

- H1. Users' attitude towards m-commerce positively impacts their intention to conduct m-commerce.

Security Concern in M-commerce

Mobile communication is extremely vulnerable to security risks [24]. Currently, security countermeasures are reactive: the focus of them is to detect errors, frauds and data breaches, and then patch up vulnerabilities after a security incident [14]. Many mobile applications (apps) transmit data without encryption and unencrypted data is very easily intercepted during data transmission. Additionally, since the mobile app platform in general is open, mobile devices and apps have a high chance to be infected by malware. Consequently, how to build users' trust and confidence under the lax security of m-commerce is challenging for mobile businesses. In reality, security concern has been a major hurdle to m-commerce in many countries [48]. And without exception, Chinese users face the same Internet security issues. In 2010 in China, 1.75 million phishing websites were detected, and more than 44 million Internet users fell victim to them, causing a loss of 20 billion Yuan (about \$3 billion) [9]. Clearly, facing such a serious security issue, it is important for this study to understand Chinese users' security concern and consequent impact on m-commerce diffusion in China. Security concern is defined herein as users' extent of worry and fear about breaches of data confidentiality, integrity and authentication when using IT [7, 17]. Security concern is a type of psychological anxiety and fear pertaining to security issues. Past research has found that users' security concern impacted their protective behaviors on the Internet [7]. In the context of workplace, security concern about security breaches was found to have a significant impact on employees' favorable attitude towards compliance of security policy in organizations [25]. Moreover,

consumers' concern about how their personal data is safely handled impacted their trust in the Web [19]. Consumers expect security protection from m-commerce vendors and service providers and demand their privacy and security to be protected when they use mobile devices for m-commerce activities. Udo [59] indicated that security concern is one of the main reasons that users hesitate to perform transactions over the mobile Web. In m-commerce, failing to provide a secure system of m-commerce will significantly hamper m-commerce adoption [24].

In current study, we argue that users' worry and fear about possible data breaches and identity theft via mobile communication can transform their favorable attitude towards m-commerce to less favorable and to unfavorable [48]. Those who concern more about security issues in the m-commerce platform in general have strong psychological anxiety and fear which result in less favorable attitude towards m-commerce. Along this line of reasoning, past research has found that users' favorable attitude towards e-commerce is negatively associated with their security concern (e.g. [22]). Following the above logic, we thus hypothesize:

H2. Users' security concern negatively impacts their attitude towards m-commerce.

Cost vs. Value Perceptions of M-commerce

From utility perspectives, trade-offs between cost vs. value of a product/service are the basis for consumers to make rational consumption choices [64]. In order to conduct m-commerce, in addition to device cost and access cost, users have to pay for data plan cost, making m-commerce more expensive than electronic commerce (e-commerce) [62]. The service marketing literature indicates that service costs include monetary costs and non-monetary costs [47, 64]). The monetary costs are usually measured as the price customers actually pay [61], whereas non-monetary costs reflect sacrifices that customers make for service use such as time, effort, and other unsatisfactory costs [5, 47, 64]. When it comes to making consumption choices, cost represents the perceived cost. Many issues large or small such as slow connection, unsmooth surfing, software glitches, bad software design and so forth could change users' cost perception [62]. Past research has found that users' perceived cost played a negative role in their adoption decisions, especially for users in developing countries [12]. Past research also indicated that using a strategy of low price changes users' cost perception which in turn increases their adoption of m-commerce [62]. It follows that high perceived cost in m-commerce could ultimately change users' favorable

attitude, especially when they perceive that the cost of an alternative channel is cheaper. Hence we hypothesize:

H3. Users' perceived cost of m-commerce negatively impacts their attitude towards m-commerce.

Consumers form their value perceptions about a product/services based on their overall assessment of the utility of the product/service [64]. This value assessment is based on consumers' rationality on the intrinsic and extrinsic values of the product/service. The value assessment plays a critical role in consumers' decisions on whether or not they would interact and experience with the product/service [64]. Extant research has found that perceived value is an antecedent of various behaviors and behavioral intentions [58].

Obviously, mobile communication platform provides many convenient, unique functions to users. Value of m-commerce can be created through various service features such as portals, e-mails, short messaging, video and audio clips, and web-mediated applications using the 3G/4G spectrum [39]. Using the mobile platform, mobile users have no space and time limitation on engaging in m-commerce activities. Moreover, innovative, new functions are constantly added to this platform. Companies large or small often launch mobile apps to not only enhance users' experience with m-commerce but also provide new features specifically designed for the mobile platform. Mobile users could enjoy convenience, efficiency, time-saving, and even playfulness by using those apps. We argue that those unique functionalities on the mobile platform facilitate users' positive value assessment of m-commerce and such positive value assessment will lead to users' favorable attitude towards m-commerce.

H4. Users' perceived value added from m-commerce positively impacts their attitude towards m-commerce.

Personal Innovativeness in IT

The concept of PIIT is based on the innovation diffusion theory (IDT) [45] and is conceptualized as a personal trait. According to the IDT, people have predisposed individual differences in interpreting new ideas and innovations. Some individuals by nature are more willing to explore innovations while others are precautious about risks associated with innovations and not to adopt them until they get mature and established [45, 63]. Agarwal and Prasad [1] argued that the construct of PIIT is similar to a psychological and cognitive force that propels an individual's willingness or interest in seeking out novel stimulations. In the arena of IS, PIIT is defined as the willingness of an individual to try out any new infor-

mation technology. Past research focused on the predictive effect of PIIT on innovation characteristics such as systems characteristics of usefulness and ease of use and demographic variables such as education and gender [63]. However, PIIT as a predictive variable on individuals' risk perception such as security concern has not been studied.

Consumers' innovativeness plays an important role in technology adoption and diffusion. During this adoption process, consumers face a dilemma between desirable and undesirable consequences of adoption and hence face a risky decision [26, 38]. Based on the theory of risk, consumers' perceived risks are related to an expectation that there will be a high potential of losing money or personal information due to adoption. Using an innovative technology or service, consumers may encounter unexpected, undesirable consequences. The expectation of undesirable consequences results in high risk perceptions [21, 26]. In general, when an innovation rapidly advances and brings out new technologies and functionalities, it is also associated with soaring risks. Individuals who possess the trait of PIIT can endure such risks and are likely to hold persistent, strong beliefs in the innovation. Moreover, individuals with elevated PIIT normally feel efficacious and confident in the innovation. Their cognitive process on the innovation is based on their intuition and vision. They welcome radical changes brought by the disruptive innovation, often perceive less current risks of the innovation, and foresee a brighter future of it [63]. Not surprisingly, some researchers view that PIIT is a symbol of risk-taking propensity. On the other hand, people with low level of PIIT are very cautious about innovations. They need well-established references to make their adoption decisions [63]. They usually take an over-rational attitude towards an innovation and worry more about the risk associated with it [35].

M-commerce is driven by mobile technology which brings constant changes and innovations. For example, more and more m-commerce activities are conducted via mobile apps installed on smart devices. While existing apps and smart devices keep updating their functionality, new apps and devices are constantly launched to the mobile app market. Although vendors and developers claim those apps and devices are secure to use, in reality, the security of them may often not be fully tested and verified. Thus we consider the m-commerce platform as an agile platform constantly loaded with new innovations. Past research has found that innovators tend to foresee the bright side of technology and have less psychological anxiety and fear about the dark side of it [63]. Moreover, innovators with elevated PIIT worry less about risk, uncertainty and imprecision associated with the innovation

[1]. By the same token, when facing constant changes and innovations on the mobile platform, users with high level of PIIT would have less anxiety about risk and security of those changes and innovations. They also have less unnecessary worries about security issues because they are in general efficacious in the innovation they are interested in. Follow the above logic, we hypothesize:

H5: Users' the level of PIIT is negatively associated with their security concern on m-commerce.

Innovations are often associated with soaring risk and cost. However, innovative people tend to actively seek knowledge about the innovation they are interested in and develop efficacy and expertise in the innovation [32]. As they develop in-depth, subjective understanding of the innovation, they perceive less risk and cost of it [49]. Moreover, since they tend to become efficacious in the innovation they are interested in, their cost perceptions are less impacted by extrinsic, non-monetary costs such as technology complexity and effort and time of learning.

Mobile devices and technology are still relatively expensive, especially to people in developing countries. People with high level PIIT often are willing to pay a premium to try out new mobile gadgets because the joy and stimulation from trying out offset the cost, thus reducing their cost perception. For this reason, we propose:

H6: Users' level of PIIT is negatively associated with their perceived cost of m-commerce.

Past research has confirmed that PIIT is a predictive variable of system characteristics such as usefulness and ease of use [29, 35, 63]. This indicates that individuals with high level of PIIT not only have an open mind towards new ideas and experiences, but also understand and appreciate the values of them [36]. They perceive high in performance improvement, efficiency, convenience, enjoyment, and even social image that an innovation could bring to them [29, 35]. Innovative people seek adventure, stimulation, uniqueness from innovations. They tend to enjoy, embrace, and value changes brought by innovations [32, 49]. Therefore, they tend to put high values on innovations.

As mentioned before, the mobile platform is an agile platform with innovations constantly being added, such as new mobile apps and new gadgets. This platform could become a "playground" for innovative people to seek joys and advantages, thus increasing their value perception. Therefore, we propose:

H7: Users' level of PIIT is positively associated with their perceived value added from m-commerce.

Research Model

In sum, drawing upon the literature in personal innovativeness in IT (PIIT) [1, 63], consumption values [58, 64], and behavioral aspect of security research [6, 7], our research model (Figure 1) proposes that PIIT is a predictive factor impacting users' cost vs. value perceptions and security concern of m-commerce. Meanwhile, their

cost vs. value perceptions and security concern together impact their attitude towards m-commerce, and their favorable attitude in turn increases their intention to use m-commerce. The model emphasizes the effect of PIIT on users' utilitarian perceptions and consequent effect of their perceptions, and investigates the determinants of users' intention to conduct m-commerce from a utility perspective.

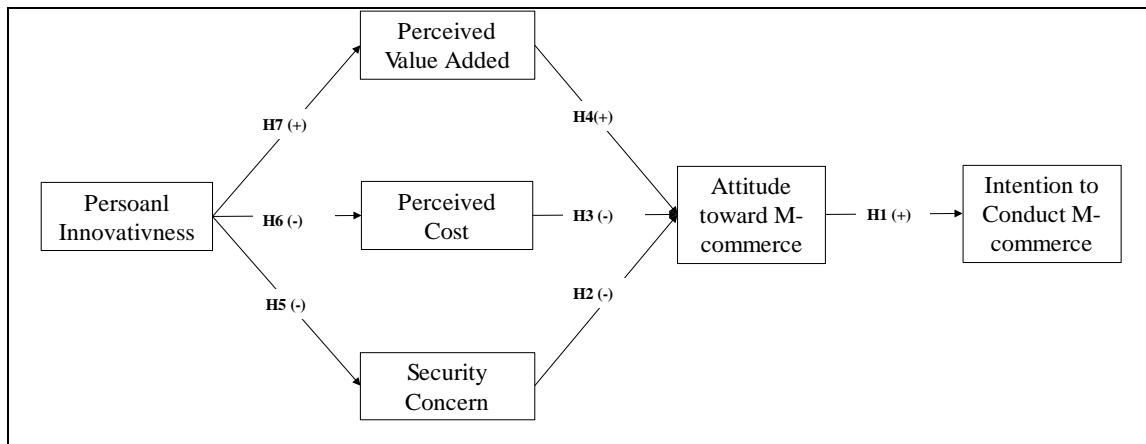


Figure 1: Research Model

RESEARCH METHOD

A survey approach was utilized to empirically test the research model and hypotheses. A survey instrument based on the guidelines suggested by IS literature (e.g. [53]) was developed. Most constructs in the survey instrument were adopted from previous studies and adapted to this study to ensure the validity of the instrument.

Items for intention to conduct m-commerce were based on TAM literature (e.g. [29]) and developed by this study. Items for attitude towards m-commerce were adapted from Bagozzi et al. [4]. Items for security concerns were adapted from Chellappa [6]. Survey items to measure perceived cost were adapted from Mao et al. [36]. Items to measure perceived value added were adapted from Siau et al. [52]. Items to measure PIIT were adapted from Yi et al. [63] and Mao et al. [36]. A 7-point Likert scale ranging from 'strongly disagree' to 'strongly agree' was employed for each item of the constructs in the instrument. All measurement items were reflective. Multi-item scales were used to ensure the reliability and validity of the measurement. Several one-item demographic varia-

bles such as age and gender were also added into the survey instrument.

We conducted pilot tests on the survey questionnaire using several experienced m-commerce users and several college students. We then modified and refined the questionnaire based on the feedback from the pilot tests. The survey was conducted in a metropolitan area in China where the number of mobile users has been growing. 200 survey questionnaires were distributed by one of the researchers via emails to students and employees in several organizations including a university, a company, and a governmental agency. 141 out of the 200 questionnaires distributed were responded, resulting in a response rate of 70.5%. By dropping six questionnaires with most survey questions unanswered, we had a total of 135 usable responses in our sample which was used for the data analysis reported in the next section. Table 1 shows the results of the demographic statistics of the participants. The results show that the sample distribution in gender was relatively even and there was a good distribution in age too. Nonresponse bias was assessed by testing the mean differences of principal constructs cross different demographic groups [41]. The results showed that there are no significant mean differences between the groups in each comparison (P<0.05).

Table 1: Sample Demographics

Variable	Value	Frequency	Percentage
Gender	Male	77	57%
	Female	58	43%
Age	18–25 years old	49	36.3%
	26–35 years old	44	32.6%
	36–55 years old	39	28.9%
	>55 years old	3	2.2%
Education	High school	10	7.5%
	Some college	18	13.5%
	Vocational school	17	12.8%
	Bachelor	52	39.1%
	Master	30	22.6%
	PhD	6	4.5%
Occupation	Full-time employee	61	46.2%
	Part-time employee	5	3.8%
	Self employed	3	2.3%
	College student	36	27.3%
	Other	27	20.4%
Years of Mobile Device Experience	<1 year	7	5.2%
	1 to 3 years	38	28.1%
	4 to 7 years	68	50.4%
	8 to 11 years	18	13.3%
	>11 years	4	3.0%

DATA ANALYSIS AND RESULTS

Partial least squares (PLS), a component-based technique for structural equation modeling, was used for the data analysis. Given the sample size of this study, PLS is suitable since it is less restricted in sample size, measurement scales and residual distributions [8]. The Smart-PLS software package (version 2.0.M3) [44] was used to test both the measurement model and the structural model. We first examined the construct reliability and validity to

ensure the measurement quality of the constructs in our model. As shown in Table 2, the reliability of the constructs is established because (1) Cronbach's α values are greater than 0.70 except for the value for perceived cost (however, it is still in an acceptable range), (2) average variance extracted (AVE) values ranging from 0.61 to 0.85 are greater than 0.5, and (3) composite factor reliability (CFR) values ranging from 0.86 to 0.93 are above 0.5 [23, 50, 53].

Table 2: Inter-Correlation Matrix and Reliability Tests

	Inter-Construct Correlation matrix						AVE	CFR	Cronbach's α
	1	2	3	4	5	6			
1. Attitude	.84						.71	.88	.79
2. Intention	.48	.85					.72	.93	.90
3. PIIT	.54	.45	.82				.68	.86	.76
4. Perceived Values	.57	.39	.32	.88			.78	.92	.86
5. Perceived Cost	.67	.37	.48	.48	.83		.68	.81	.54
6. Security Concern	.38	.22	.33	.24	.28	.78	.61	.86	.79

Note: Bold font values on the diagonal of the correlation matrix indicate the square root values of AVEs.

The convergent validity is demonstrated when the items are significantly loaded to the latent construct as intended with a weight greater than 0.70. All loadings ranging from 0.71 to 0.93 are greater than 0.70 and loaded to the construct as intended, thus establishing the convergent validity of the constructs [23, 53]. The discriminant validity of the constructs is also established because (1) as shown in Table 2, the square root of AVE for each construct on the diagonal of the inter-construct correlation matrix is greater than the correlations between the construct and other constructs, and (2) the factor analysis results show that the factor loadings on the intended construct are much higher than the loadings on other constructs [23, 53]. Two steps were adopted in this study to investigate common method bias. Firstly, we integrated several reverse-scored items in our survey to reduce acquiescence problems [34]. Secondly, we conducted Harman's one-factor test according to Podsakoff and Organ [42]. The results demonstrated that each of the principal constructs explains almost equal variance. Thus, common method bias does not significantly affect the results of this study. In sum, the above tests demonstrate adequate construct reliability and validity, allowing us to test the structural model and hypotheses.

We used the bootstrapping resampling procedure in PLS to estimate the structural model and summarized the results of the hypothesis test in Figure 2. The coefficients and corresponding significant levels were reported on the solid line paths and R-square values were shown in the construct boxes. All seven proposed hypotheses were significant at the 0.001 level. The results strongly support the research model. As hypothesized, the negative associations between PIIT and security concern was confirmed with a path coefficient of -0.33, indicating that users with higher level of PIIT worry and fear less about security

issues in m-commerce (H5). The negative association between PIIT and perceived cost was also confirmed with a path coefficient of -0.48 (H6). This result indicates that users with higher level of PIIT perceive lower cost in using m-commerce psychologically and cognitively. Meanwhile, H7, proposing the positive relationship between PIIT and perceived value added, was supported with a path coefficient of 0.32. This result shows that the more innovative a user is, the more s/he would appreciate new functions and stimulations offered by m-commerce. Furthermore, PIIT explained 11% variance of perceived value added, 23% variance of perceived cost, and 11% variance of security concern.

The results supported H2 with a path coefficient of -0.17. Therefore the proposed negative relationship between security concern and favorable attitude towards m-commerce was confirmed. As hypothesized, there was a negative association between perceived cost and positive attitude towards m-commerce with a path coefficient of -0.48 (H3). The results confirm that users' negative perceptions had negative impact on their favorable attitude towards m-commerce. Moreover, the positive association between perceived value added and positive attitude towards m-commerce was significant with a path coefficient of 0.29 (H4). This association confirms our argument that value appreciation of m-commerce is a key factor to increase users' favorable attitude towards m-commerce. Perceived value added, perceived cost, and security concern together explained 56% variance of attitude towards m-commerce. Finally, H1, hypothesizing the relationship between attitude towards m-commerce and intention to conduct m-commerce, was supported with a path coefficient of 0.48, while attitude towards m-commerce explained 23% of variance of intention to conduct m-commerce.

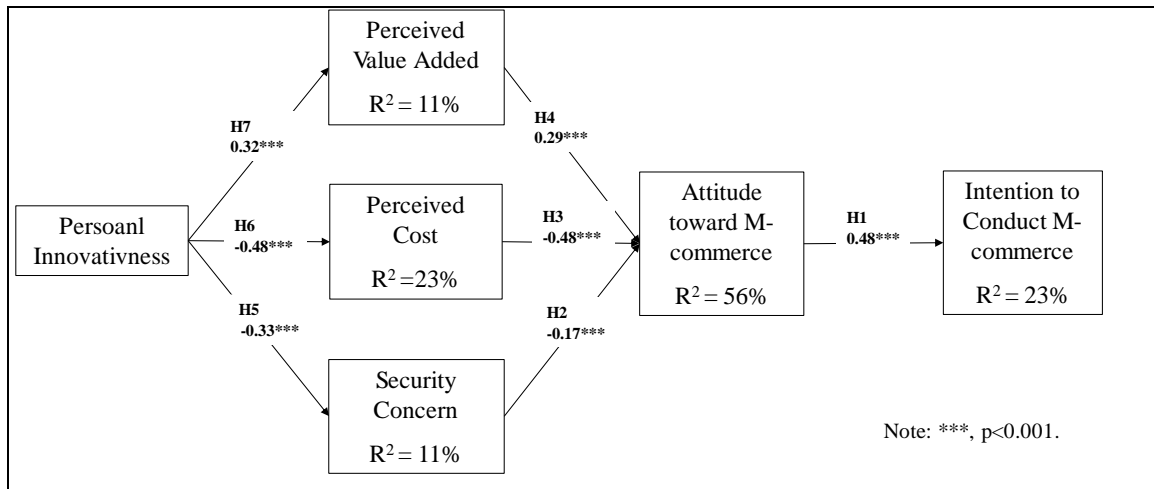


Figure 2: Results of Model Estimation

DISCUSSION AND CONCLUSION

Drawing upon the literature in personal innovativeness in IT (PIIT) [1, 63], consumption values [58, 64], and behavioral aspect of security research [6,7], this study proposed a research model to investigate the impact of PIIT on influential factors of users' attitude towards m-commerce including perceived value added, perceived cost, and security concern. The model also investigated the path between users' attitude towards m-commerce and their intention to conduct m-commerce. Using the survey data collected from a metropolitan area in China, we confirmed all seven hypotheses proposed in the research model.

First, PIIT was found to have a significant, negative impact on security concern. The findings indicate that innovative users have less unnecessary anxiety and fear about security issues in m-commerce. This means that users' innovativeness is an important determinant of how users perceive about the security attributes of mobile computing and m-commerce. The findings indicate that cultivating and boosting users' innovativeness are important to motivate users to try out innovations in mobile computing and eventually to conduct m-commerce.

Moreover, our results point out that users' innovativeness is an important determinant of how users perceive about the cost of conducting m-commerce. The more innovative the user is, the more likely s/he is to perceive lower cost about adopting m-commerce. In other words, it seems that users with higher level of PIIT may be more willing to pay a price premium to try out innova-

tions in m-commerce. Based on our findings, we argue that it is important to direct management attention to capitalizing users' innovative propensity when promoting m-commerce. Furthermore, perceived cost is rather psychological and thus lowering consumers' perceived cost could be an important marketing strategy in raising revenue, since it might help to increase demand of m-commerce [16]. Our findings also indicate that cultivating and boosting consumers' innovativeness is an important means to lower their psychological, perceived cost of conducting m-commerce.

Our results also indicate that innovative users are able to appreciate higher values from m-commerce. Past research has found that users with a high level of PIIT value high on technology characteristics such as usefulness and ease of use [63]. Our findings indeed go further to show that innovative users not only understand more about technology characteristics but also foresee higher technology values. Summarizing the above findings, we argue that innovative propensity has a salient impact on users' assessment of risk (perceived cost and security concern) and benefit (perceived value added) of innovations. In general, cultivating and boosting users' innovativeness to increase their benefit perceptions and lower their risk perceptions are beneficial for promoting m-commerce.

Furthermore, our findings regarding the negative impact of users' security concern on their attitude towards m-commerce are in line with some findings in previous research. For example, security concern was found to be a deterrent factor in various technology adoption behaviors such as taking proactive security countermeasures [7] and Internet banking use [33]. Therefore, while directing man-

agement attention to enhancing security technology and building secure mobile computing architecture, firms need to study the source of users' security concern and alleviate their security concern in order to cultivate their favorable attitude towards m-commerce. This is particularly essential in China given that China is still lacking laws and regulations in dealing with security and privacy issues in m-commerce transactions.

Our findings confirm that users are value-driven [64]. The trade-off between value and cost is a determining factor in users' attitude towards m-commerce which in turn impacts their intention to conduct m-commerce. Obviously, to promote m-commerce, firms need to provide users more innovative functions in m-commerce services. On the other hand, users are also cost-sensitive. Thus lowering the cost of conducting m-commerce for users will foster their favorable attitude towards m-commerce. However, both perceived value added and perceived cost are psychological, and changeable via external controls. Thus firms may use marketing strategies, such as providing bundle services and loyalty programs, to manipulate users' perceptions on value and cost, and thus increase their favorable attitude towards m-commerce. Additionally, past research has found that Chinese consumers are more rational and cost-sensitive in dealing with transactions than Western consumers [13]. Seeking deals may be an important reason for Chinese consumers to engage in m-commerce. As such, it becomes even more critical for m-commerce companies to use marketing and pricing strategies to change users' value and cost perceptions on m-commerce in China.

This study has implications for both research and practice. Academically, this study advances our understanding of the impact of PIIT on users' perceptions on risk (perceived cost and security concern) and benefit (perceived value added) of m-commerce. This study also sheds new light on the influential factors of behavioral attitude: there is an indirect association between PIIT and individual adoption behaviors via perceived cost and value, and security concern. Furthermore, the proposed theoretical model advances our understanding of the antecedents of behavioral intention in m-commerce by exploring factors not included in TAM, UTAUT, and their variants. Particularly, when studying innovation diffusion and technology adoption, researchers need to consider not only technology characteristics but also individual innovativeness.

Practically, this study informs those companies, who are already in or seeking to enter the Chinese m-commerce market, of Chinese user-specific information. In particular, management may pay special attention to Chinese users' security concern. A strategy of providing

Chinese users free security software may help users to ease their security concern and consequently more actively engage in m-commerce. Indeed, some Chinese companies already adopted this strategy. ICBC bank, the largest bank in China, issues its customers a free u-shield (a USB security device) to alleviate its customers' security concern and promote online/mobile banking (www.ICBC.com.cn). Aside from cyber security, m-commerce companies should provide more innovative functions and value-added services on the mobile platform to attract users to try out such functions and services.

Our findings further indicate the importance of personal innovativeness for mobile business that introduces new products. Innovative individuals always look for stimulations, uniqueness, novelty, and are not easily influenced by others' opinions [46]. In the context of m-commerce, it means that innovative consumers are willing to try new services or explore new functions of existing services, without well-established references. As suggested by [27], innovative consumers are the best choice for new service/product trials since they will not be easily discouraged by the risk and complexity associated with a new service/product. They often share their usage experience with others, influence their friends in choosing a new service/product, and could help vendors attract more consumers to the service/product. Therefore, if m-commerce vendors can identify and satisfy the needs of innovative consumers, they will be able to more accurately predict acceptability of their new services/products and save time and cost in marketing.

On the other hand, m-commerce companies should be aware of the role of cost perception in m-commerce among Chinese users and may develop special marketing strategies targeting the Chinese m-commerce market. Finally, it will be advantageous for m-commerce companies to study the relationship between the Chinese culture and PIIT among Chinese mobile users and find a way to boost PIIT among them. This undertaking might facilitate the growth of m-commerce in China.

This study also has some limitations which may be addressed in future research. Our sample size is relatively small and the data was collected from one metropolitan area in China. A future research to duplicate this study among different cultural environments and populations might mitigate this limitation. Common method bias (CMB) might be another limitation of this study since we collected the data via a signal survey, even though cautions were taken. A future longitudinal study might mitigate this limitation. Another fruitful future study direction is to investigate how to cultivate and boost PIIT to effectively promote innovation diffusion among m-commerce user populations.

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