

# Mobile Commerce Adoption in China and the United States: A Cross-Cultural Study

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## Abstract

*Mobile communication technologies have penetrated consumer markets throughout the world. Mobile commerce is likely to make a strong influence on business activities, consumer behavior, as well as national and global markets. Thus the identification of factors that influence mobile commerce adoption has significant value. In a global context, this study identified nine factors affecting mobile commerce adoption based on published research in MIS. These factors were investigated in China and the United States, and a comparative examination was conducted. A survey was conducted on 190 individual mobile commerce users in China and USA. Results show that there are several significant differences among the antecedents and their impacts on consumer intention to use mobile commerce in the two cultural settings. The study provides a number of practical insights and informs vendors seeking to enter the Chinese and the US marketplace with specific information on user perspectives.*

**ACM Categories:** H.3.5 Online Information Services; K.4.4 Electronic Commerce

**Keywords:** Mobile Commerce, Technology Adoption, Cross-Culture Study, User Behavior, Behavioral Intention

## Introduction

Mobile communication technologies have penetrated consumer markets throughout the world. The global system for mobile communications (GSM) and the Internet are viewed as two dominant global communication networks. According to Internet World Stats (2007), current internet users are 1.24 billion, while the mobile phone subscribers are 2.7 billion in 210 countries and territories (Mobile World, 2007). Market research companies predict that there will be a huge market for services to be delivered to mobile users (Hage et al, 2003). According to McKinsey & Company (2005), by 2010, mobile commerce will be the second-largest industry in the world.

Soon after the turn of the century, consumer's activities started to shift from "E-decade" to "M-decade" (Wagner, 2005). The advancements in mobile technology, expanded coverage of mobile telecommunications infrastructure, and high mobile penetration rate have stimulated the growth in the use of mobile services, which were previously accomplished by traditional methods or the Internet. Mobile commerce (also called mobile e-commerce or m-commerce) is defined as "all activities related to a

(potential) commercial transaction conducted through communications networks that interface with wireless (or mobile) devices” (Tarasewich et al., 2002, p42). Mobile commerce is transforming the mobile phone from a simple voice-communication device to an advanced communication device which can provide voice, text, and video messaging, web surfing, digital imaging, entertainment, payments, banking, financial instrument trading, and shopping (Mao et al., 2005). The next generation of mobile systems will help mobile phones facilitate the delivery of rich multimedia services such as video telephony; streaming news, sports, and movies; and multimedia messaging, web browsing, and games (Subramanya and Yi, 2006).

However, technology development is seriously challenged when users are slow to adopt the new technology. Enhanced functionality and greater levels of mobile services require an in-depth understanding of consumer perceptions and behavior. Several years ago, Jarvenpaa and Todd (1997) indicated the need to research the relationship between perceived characteristics of web shopping and user intentions. Similar studies in the m-commerce context will help organizations develop appropriate strategies to promote m-commerce. Without understanding the users’ perspective, the mobile vendor cannot provide corresponding service and technology features to meet their requirements.

The global use of wireless technologies adds further complexity to issues in m-commerce. Such complexity derives from the legal, cultural, social, political, and technical differences among countries (Tarasewich et al., 2002). In an increasingly global market, vendors are faced with the challenge of offering usable and useful applications to the local users (Khaslavsky, 1998). Research has shown that cultural aspects influence the typical ways in which web applications are used within a country (Zakaria and Stanton, 2003). As mobile Internet use has spread globally, culture can have a stronger effect on the ways in which mobile Internet services are used in a country than other technology applications (Lee et al., 2004). However, most current practitioners have taken a superficial approach. For example, some practitioners have put their efforts just on language translation and other visible aspects when entering a foreign market. (de Angeli et al., 2004; Chau et al., 2002). Clearly, there is a strong need to develop an in-depth understanding of consumer characteristics and preferences from different cultures when a company begins to globalize their offerings.

Given the above background, the goal of this research is to address three questions:

- What are the factors affecting the adoption of mobile commerce, in a global context?
- What is the relative importance of these factors?
- Do the impacts of these factors on mobile commerce adoption differ in China and the USA?

## Literature Review

### Mobile Commerce Adoption

Compared to the rapid development of mobile technology and the growing market, the research on mobile commerce and its adoption is still at an early stage. There are only a limited number of studies focusing on mobile commerce frameworks, its adoption and application. Many concern themselves with technical aspects of m-commerce. According to Ngai and Gunasekaran (2007), mobile commerce research has been classified into five main streams: theory, wireless network infrastructure, mobile middleware, wireless user interface, and cases & applications. About half of the studies are related to m-commerce user behavior and diffusion.

Prior studies on m-commerce adoption are summarized in Table 1. The Technology Acceptance Model (TAM) (Davis, 1989) has been used for several years to predict the attitude and behavior of users and employees as they are introduced to new technologies. Based on TAM, modified models have been developed to measure the acceptance of users to certain types of emerging technologies and systems. There have been some single country studies on m-commerce adoption. Lu et al. (2003) studied the acceptance of wireless Internet via mobile technology (WIMT) in China and indicated that the acceptance of WIMT is related to perceived usefulness, ease of use, social influence, trust, and facilitating conditions. Rosenbaum and Kleber (2004) described ongoing research on m-commerce in Japan. Using a social informatics perspective, this research provided insights into ways the Japanese culture is changing as mobile phone technologies and m-commerce are utilized in Japanese life. Kim and Stenfield (2004) studied consumers’ mobile internet service satisfaction and their continuance intentions, and investigated the relationship between satisfaction and new technology adoption intention based on a survey of mobile Internet subscribers in Korea.

Literature	Research Purpose	Methods used	Theory /constructs used	Results/Finding
Sarker and Wells (2003)	To understand mobile handheld device use and Adoption	Ongoing Exploratory Research	Individual characteristics; communication/ Task characteristics; modality of mobility; Technology Characteristics; Context →Adoption	A positive experience with the use process, reflected in favorable assessment in terms of the functional, psychosocial, and relational outcomes, influenced adoption decisions and behavior.
Malhotra and Segars (2005)	To Investigate wireless web adoption pattern in the US	Survey; Cluster analysis	Relative advantage; Behavioral Compatibility; Needs compatibility; Trialability; Complexity; ease of use; demographics→ Adoption	Providers should carefully segment their offerings and selectively roll out new services on an evolutionary rather than revolutionary track.
Wong and Hiew (2005)	Find correlations between factors affecting the diffusion of mobile entertainment in Malaysia	Survey;	Pricing issue; perceived benefit; peers, community and media; product and technological standardization; Privacy and Security Issues→ Adoption	All factors affecting adoption have significant statistical value. The success of mobile services deployment depends ultimately on the successful development and satisfaction of end user market rather than technical development.
Khalifa and Sammi(2002)	Develop and empirically test a model for explaining the role of exposure to mobile technology in the adoption of mobile commerce.	Survey	Trial, Communication, Observation→ exposure to mobile commerce; Perceived Behavioral Control, Subjective Norms; Attitude towards mobile commerce→Adoption	Empirical results confirm the hypothesized mediated and moderating effects of exposure.
Yang (2005)	Explore factors affecting the adoption of mobile commerce in Singapore	Survey	Innovativeness; past adoption behavior; knowledge; Technology Cluster; Age; Gender; Specialization→Perceived usefulness; Perceived Ease of Use→Attitude toward using mobile commerce	TAM was capable of providing an adequate explanation of consumer adoption decision making process to use the M-commerce
Lu et al (2003)	Develop the technology acceptance model for wireless internet via mobile devices (WIMD).	Literature review	Technology complexity; Individual Differences; Facilitating conditions; Social Influences; Wireless Trust Environment; →Ease of use WIMD, usefulness of WIMD→ Intention to use WIMD	Propose a framework for understanding, explaining and predicting factors that influence individual acceptance of WIMD
Kim (2005)	develop a theoretical model for the mobile Internet technology adoption decision	Survey	Overall satisfaction, perceived Benefit; Perceived Risk, Social Pressure; Tendency(Frequent Use)→Adoption	Enhance understanding about determinants of new service/technology adoption decisions
Bruner and Kumar (2003)	Understand consumer acceptance of handheld Internet devices	Experiment	Consumer visual orientation, internet device→ ease of use; Fun; Usefulness→Attitude toward act→Behavioral intention	The fun of using a device was a more powerful determinant of attitudes toward usage than the perceived usefulness of the device.

**Table 1. Literature Review on Mobile Commerce Adoption (continued)**

Literature	Research Purpose	Methods used	Theory /constructs used	Results/Finding
Gera and Chen (2003)	proposes a Wireless Technology Diffusion Model (WITD Model), to understand and predict the diffusion of wireless technologies by those who have a stake in provision of mobile services.	Case study	Relative advantage, compatibility, complexity, trialability, observability→Adoption	For a wireless application / service to be successful, perceived benefits must be matched by the actual benefits otherwise the application / service is prone to rejection as noticed
Mao et al. (2005)	Explore key factors that influence the usefulness, ease of use, and intentions to use advanced mobile phone services, such as mobile Internet access, E-Mail, and payments	Survey	Mobile phone efficacy; Personal innovativeness→ Perceived usefulness; Perceived ease of use; Price; Accessibility→Intention to use	The model has been tested and most of relationships have been supported in two cultural contexts. Differences in terms of the model in two countries have been demonstrated.
Kim et al. (2007)	Examines the adoption of Mobile Internet (M-Internet) as a new Information and Communication Technology (ICT) from the value perspective	Internet Survey	Usefulness, Enjoyment, Technicality, Perceived Fee→ Perceived Value →Adoption Intention	Developed Value-based Adoption Model (VAM) and explains customers' M-Internet adoption from the value maximization perspective
Mallat (2007)	Examines consumer adoption of mobile payment	Qualitative Method	Relative advantage, Compatibility, Complexity, network externality, cost, perceived trust and risks→Adoption	Several barriers to the adoption of mobile payments, including premium pricing of the payments, complexity of payment procedures, a lack of widespread merchant acceptance, and perceived risks.

**Table 1 (continued). Literature Review on Mobile Commerce Adoption**

### Cross-Cultural Studies of Mobile Commerce

As the use of mobile devices and Internet has spread globally, mobile technology and m-commerce usage patterns vary across different cultures. Cross-cultural issues are highly related to mobile commerce adoption. However, little research has been conducted on cross-cultural issues in the mobile environment. This might be due to the relative youth of this market (Harris et al, 2003) and the difficulties in conducting culture research (Straub et al. 2002).

Several initial endeavors have gone into describing and comparing the use of mobile technology and mobile internet in two distinct cultures. Harris et al. (2003) compared m-commerce usage in the United Kingdom and Hong Kong and found differences in these two areas with apparently similar mobile infrastructure but with markedly different cultural

profiles. Su and Adam (2004) investigated mobile use and adoption in China and the UK by drawing upon the "Individualism vs. Collectivism" cultural dimension (Hofstede 1991). Lee et al. (2004) developed metrics to measure the cultural aspects of mobile Internet use, and found culture to have a profound impact on the use of information technology in Hong Kong and Korea. Mao et al. (2005) tested an extended TAM model in the U.S. and Turkey which explored key factors that influence the usefulness, ease of use, and intentions to use advanced mobile phone services, such as mobile Internet access, e-mail, and payments.

None of the prior studies focus on the antecedents of consumer acceptance and their intentions to use m-commerce in a cross-cultural context. A variety of consumer characteristics influence the perception of barriers to the adoption of m-commerce services (Lu, et al., 2003). In a global business environment,

researchers and practitioners need to develop deeper understanding of the impact of consumer characteristics and their behavior on the acceptance of m-commerce services in different cultures.

## **Background of Mobile Commerce in China and the United States**

### **Mobile Commerce in China**

According to Kshetri and Cheung (2002), China is undergoing the mobile miracle. China is rapidly heading towards having the largest mobile communications network and business in the world for both cellular and paging operations (Lu et al, 2003). According to the Ministry of Information Industry (MII), China's telecommunication market reached \$182.4 billion in the year 2006. China has over 800 million telecom subscribers and the tele-density is 49.21 (i.e., the number of telephones per 100 individuals). Of a total 800 million telephone lines, fixed lines are around 367.81 million while the remaining subscribers are mobile users. These numbers represent an annual increase of 60 million compared to 2005.

Unlike the United States, e-commerce practices in China can hardly reach low-income earners that constitute a majority of the population, due to limited household possession of wired personal computers (Hu, 2000). However, many existing mobile users have an established comfort level with mobile device functionality. This may alleviate their reluctance to conduct m-commerce activities (Lu et al, 2003). Thus, m-commerce has a potentially exceptional future in China, driven by the need for cheaper alternatives to Internet connectivity. In fact, mobile Internet might be the way to bring e-commerce to China (Chavaja et al, 2001).

### **Mobile Commerce in USA**

According to PRECOMM (2007), the current mobile phone penetration is at about 50% in the United States, while most European and many Asian-Pacific countries have much higher penetration rates. For example, penetration currently stands at about 90% in Italy, Taiwan and Hong Kong and more than 80% in the United Kingdom, Finland, Portugal, Norway, Austria and several other countries. In the US, the revenue generated from m-commerce is \$3.3 million compared to the \$9.4 million in Asia and \$7.8 million in West Europe. Clearly, the United States is in early stages of m-

commerce development compared to Asian and European countries, although USA was a pioneer in the development of the Internet and the e-commerce era. While advanced mobile phone services are available and consumers own new generation phones, the individual acceptance of these services is not guaranteed. A more in-depth understanding of the factors influencing the adoption of mobile phone services would help U.S. businesses stimulate faster and deeper penetration and help realize the benefits of m-commerce (Mao et al, 2004).

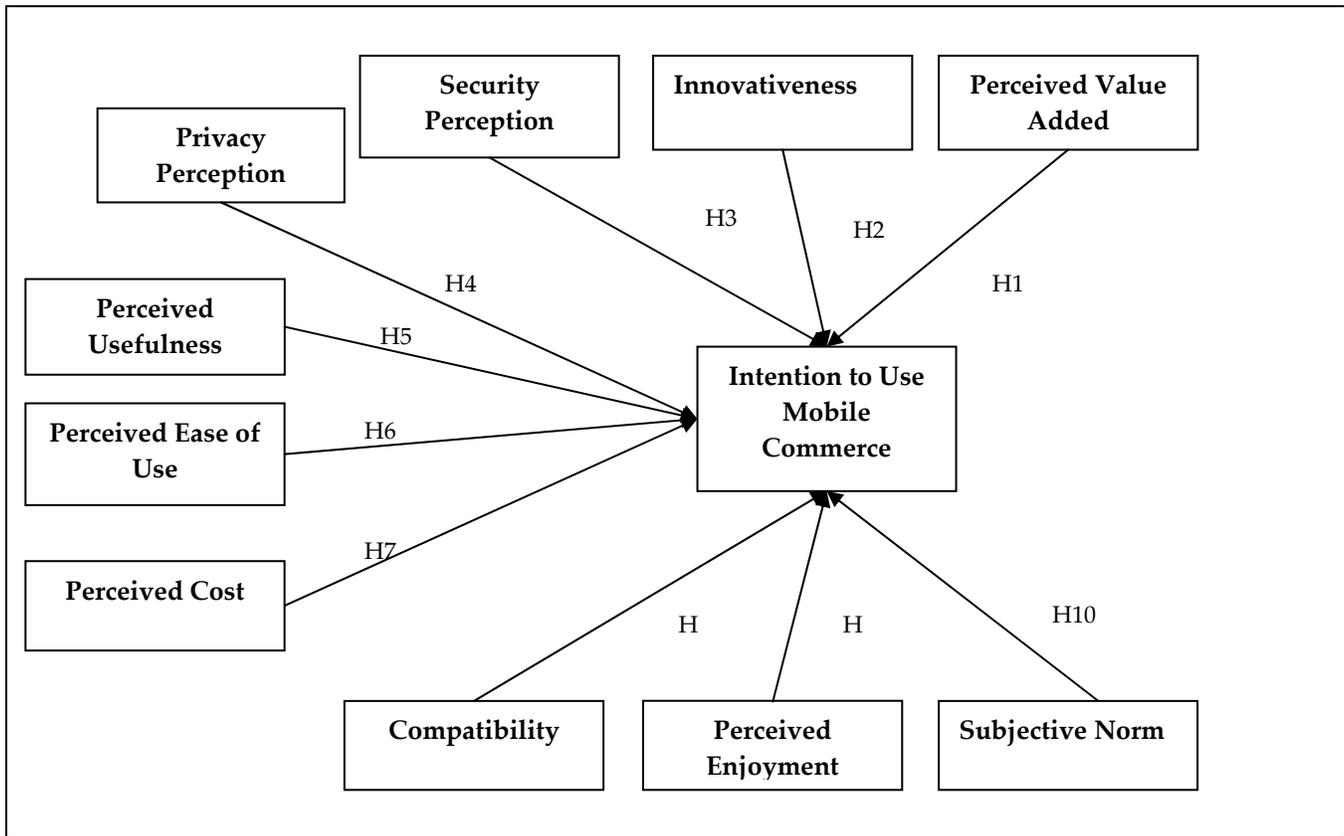
## **Research Model**

We have developed an integrative research framework (Figure 1) that identifies ten major factors as significant antecedents of consumer intention to use m-commerce. In developing the framework, we relied on several sources: the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975); the Technology Acceptance Model (TAM) (Davis 1989); various theories in information systems, social psychology, economics, and culture; and recent published literature on mobile Internet or service adoption (Lu et al, 2003; Rosenbaum and Kleber, 2004; Mao et al, 2004; Kim and Stenfield, 2004). Each construct and proposed hypotheses in the research model is described.

### **Perceived Value-Added**

There is a growing body of research pointing to the value-added element of m-commerce (Mahatanankoon et al., 2006). By definition, perceived value-added means that m-commerce creates value for customers in a different manner than conventional business; besides, it provides services and additional benefits when compared to traditional e-commerce applications (Tsalgatidou and Pitoura, 2001). In prior m-commerce literature, other words have been frequently used in describing the value-creation features, for example, flexibility, convenience, ubiquity, freedom, and new channel choice. Thus, there is a need to gain an understanding of whether the above value-creation features can be instrumental in consumer adoption and usage of m-commerce.

*Hypothesis 1: Perceived Value-added is positively associated with consumer's intention to use mobile commerce.*



**Figure 1. The Research Model**

### **Innovativeness**

Consumer innovativeness has been used to study adoption behavior of new products and services (Wood and Swait, 2002). Innovativeness is often identified as a personality construct (Hirschman, 1980; Wood and Swait, 2002) that has been employed to predict consumer innovative tendencies to adopt a wide variety of technological innovations. Citrin et al. (2000) indicate that innovativeness predicts consumer adoption of Internet shopping. Furthermore, recent studies on consumer adoption of wireless application protocol (WAP) also indicate that personal innovativeness can predict adoption of m-commerce (Hung et al., 2003).

*Hypothesis 2: Innovativeness is positively associated with consumer's intention to use mobile commerce.*

### **Security Perceptions**

Salisbury et al (2001) define perceived web security as the extent to which one believes that the World Wide Web is secure for transmitting sensitive information. With regards to security concerns of

online consumers, consumer perceptions of unsatisfactory security on the Internet continue to exist even when vendors undertake security enforcement mechanisms (Miyazaki and Fernandez, 2001; Zellweger, 1997). Udo (2001) indicates that security concern is one of the main reasons users do not purchase over the Web. In the mobile context, failing to provide a secure system of m-commerce will significantly dampen consumer adoption rates (Ghosh and Swaminatha, 2001). While many security concerns have been addressed with technological advancements, user perceptions may still exist.

*Hypothesis 3: Security Perception is positively associated with consumer's intention to use mobile commerce.*

### **Privacy Perception**

Websites usually require personal information from users for purposes such as membership, newsletter subscription, feedback forms, order forms, etc. Consumers have worried for years about how personal data is used by government and more recently, by business (Udo, 2001). In the mobile

environment, since the openness adds more risks, people would have higher demands of privacy protection.

*Hypothesis 4: Privacy Perception is positively associated with consumer's intention to use mobile commerce*

### **Perceived Usefulness**

Borrowed from TAM (Davis et al., 1989), perceived usefulness (PU) refers to a "prospective user's subjective probability that using a specific application will increase his or her ... performance." This is an important belief identified as providing diagnostic insight into how user attitude toward using and intention to use are influenced. Furthermore, perceived usefulness has a direct effect on intention to use over and above its influence via attitude. It has been proven that perceived usefulness or benefits play a crucial role in the adoption of technology (Iacovou et al., 1995).

*Hypothesis 5: Perceived Usefulness is positively associated with consumer's intention to use mobile commerce*

### **Perceived Ease of Use**

Again from TAM, perceived ease of use (PEOU) is an important determinant of user satisfaction (Baroudi et al. 1986). It refers to "the degree to which the prospective user expects the target system to be free of effort." This internal belief ties to an individual's assessment of the mental effort involved in using a system. For mobile phone users, the ease to use is a crucial factor as many of the users are common citizens not necessarily adept in technology.

*Hypothesis 6: Perceived Ease of Use is positively associated with consumer's intention to use mobile commerce*

### **Perceived Cost**

Depending on the provider, there are different rates, plans, extra charges for going beyond maximum minutes, and other subscription costs. Unlike voice services, advanced mobile phone services typically involve paying usage based fees. For example, rather than a flat rate, a customer may pay for services based on the frequency of e-mail or text messaging use. "*An inappropriate and unacceptable mobile Internet service charge is undoubtedly a key predictor of mobile users' overall service usage and satisfaction.*" (Kim and Steinfield, 2004, pg. )

*Hypothesis 7: Perceived Cost is positively associated with consumer's intention to use mobile commerce*

### **Compatibility**

Gera and Chen (2003) defined compatibility as the degree to which an innovation is consistent with existing facilities and practice. Compatibility implies whether a user perceives an application/service to be compatible with his/her needs or lifestyle. Malhotra and Segar (2003) defined two types of compatibility: behavioral compatibility and needs compatibility. For behavioral compatibility to be achieved, the innovation must be consistent with adopters' existing values and past experiences related to the current technology. The higher the compatibility, the lower the perceived behavioral change required by the adopters. Needs compatibility is associated with the ability of the innovation to meet the needs of the adopters. In m-commerce, both behavioral and needs compatibility of consumers could be a very significant indicator of their intention to use mobile commerce.

*Hypothesis 8: Compatibility is positively associated with consumer's intention to use mobile commerce*

### **Perceived Enjoyment**

Igbaria et al (1996) defined enjoyment as the intrinsic reward derived through the use of the technology or service studied. Enjoyment and fun have been shown to be significant antecedents of attitude toward using technology-based self-services (Dabholkar, 1996). Dabholkar (1996) found a strong positive effect of enjoyment of using self service technology on perceived overall service quality. Enjoyment captures the hedonic dimension of consumption and can be measured as the extent to which consumers find the service to be enjoyable, fun and pleasant to use. In mobile context, Nysveen et al (2005) addressed that perceived enjoyment stands out as an important motive for using experiential mobile services.

*Hypothesis 9: Perceived Enjoyment is positively associated with consumer's intention to use mobile commerce*

### **Subjective norm**

Subjective norm refers to the perceived social pressure to perform a certain behavior (Ajzen 1991). A number of studies confirm that subjective norms affect on-line shopper's behavior (Chen and Dhillon 2003; Shim et al. 2001). Empirical support for the relationship between social norms and IT/IS acceptance has been found (Venkatesh and Davis 2000). Davis (1989) indicated that in some cases

people might use a system to comply with others' mandates rather than their own feelings and beliefs. Venkatesh and Davis (2000) later extended social influence to include subjective norm and image. Image is derived from the research on diffusion of innovations. Moore and Benbasat (1991) defined it as "the extent to which the use of an innovation is perceived as enhancement of one's status in a social system." As per Lu et al. (2003), "73% of the executive class in big cities of China owned mobile phones as early as in 1998, not only for its convenience but also as a symbol for social status" (Samson and Hornby, 1998).

*Hypothesis 10: Subjective Norm is positively associated with consumer's intention to use mobile commerce.*

### **Intention to use mobile commerce**

In our study, we use intention to use m-commerce as a surrogate measure for actual use, as has been done in many prior studies. As per the Theory of Reasoned Action (Fishbein and Ajzen 1975), intention to use is also a consequent of the attitude toward m-commerce adoption.

M-commerce encompasses many more activities than merely online purchasing. We consider different kinds of mobile commerce activities, such as mobile internet browsing, mobile online shopping, mobile banking, and mobile entertainment. One of the major wireless applications is web access for retrieval of real-time information such as weather reports, sport scores, flight and reservation information, navigational maps, and stock quotes (Ghosh and Swaminatha, 2001). Mobile online shopping is defined as buying goods and services through wireless handheld devices such as mobile telephones and personal digital assistants (PDA) (Bhuyan, 2005). Wong and Hiew (2005) defined mobile entertainment as any type of leisure activity consumed on mobile devices that utilizes the wireless telecommunication network which incurs a cost upon usage and interacts with service providers. Mobile entertainment comprises of a range of activities including downloading ring tone, logo, music and movie, playing games, instant messaging, and accessing location-based entertainment services. Current mobile financial applications include mobile banking and a variety of micropayment solutions. Today, mobile payments are mainly used to pay for popular mobile content and services since there are few alternative payment solutions available.]

## **Methodology**

A survey methodology was used for the study. An instrument was developed, tested and administered to a sample of the population. Details follow.

### **Measures**

A questionnaire was developed in English based on the research model and an exhaustive literature review. The items were simple statements for which the participants were asked to indicate their opinions on a 1-7 Likert scale ranging from "strongly disagree to strongly agree." A score of 4 represents neutrality, higher than 4 represents a positive value and below 4 represents a negative value. All items were generated from a literature review on m-commerce and key word searches of the words: m-commerce, wireless internet, technology acceptance, innovation adoption. Existing items were used in as much as possible, including survey instruments available on the AIS website. Demographics and measurement items for variables of experience and frequency of use were adopted from previous studies related to TAM.

### **Pretest**

The instrument was tested on several college students who were experienced mobile/electronic commerce users. The aim of the pretest was to assess the feasibility of the instrument and gain qualitative feedback. Based on this feedback, changes were made to the layout of the survey form and wording and phrasing of some questions.

### **Pilot study**

A pilot study was conducted at a major university in the United States. Sixteen American students and faculty were asked to complete the questionnaire. At the same time, the questionnaire was distributed to fourteen international students in China. The respondents gave verbal and written feedback. The instrument was finalized after making minor changes based on the feedback.

### **Data Collection**

The finalized questionnaires were distributed to undergraduate and graduate students in a large University in the east part of the United States. A total of 89 respondents filled the questionnaire in the US sample. The English version questionnaire was translated into Chinese-Mainland version. The Chinese version questionnaire was distributed through an email mailing list compiled by one of the

investigators of this study. This list included people in several large cities in China where m-commerce is being used and promoted by vendors. One hundred and nine responses were collected from the Chinese sample. After removing some bad data, we finally have 84 responses from the US and 106 from China, providing a total of 190 usable responses for data analysis.

Among those who participated in the study, 116 respondents were male (61.1%) and 74 were female (38.9%). Approximately 79% of respondents are between the ages of 18 to 25. Half of the respondents are college students. About 59% respondents' income level is less than US\$1,000. Detailed information about respondents from both counties is displayed in Table 2.

According to Ahuja, et al. (2003), students and non-students demonstrate identical patterns of online purchasing behavior. A number of e-commerce researchers (Pavlou et al, 2006; Kim et al, 2007; Nicolaou and McKnight, 2006) have utilized students as subjects. Kim et al (2007) indicated that "students do represent a disproportionately large segment of the broader online population." In line with the accepted IS research tradition, we have used both

students and non-students in our study to achieve generalizability.

## Analysis and Results

### Sample Validation: Comparison of Culture dimensions

Hofstede (1991) defines culture as "the collective programming of the mind which distinguishes the members of one group from people from another."

During 1978-83, Hofstede conducted detailed interviews with hundreds of IBM employees in 50 countries. As a result of this research he derived an index model that identifies five distinctly different macro cultural level cultural dimensions: (1) Power Distance, (2) Uncertainty Avoidance, (3) Masculinity-Femininity, (4) Individualism-Collectivism, plus (5) Long-Term Time Orientation. The definition of each culture dimension and Hofstede' scores are listed in Table 3.

Culture is an important variable affecting the usage pattern of m-commerce users. We adopted Lee et al (2004)'s instrument to measure Hofstede' five culture dimensions for our sample.

Measure		Total		China		US	
		Value	Frequency	Value	Frequency	Value	Frequency
Gender	Male	116	61.1%	74	69.8%	41	48.8%
	Female	74	38.9%	32	30.2%	43	51.2%
Age	18-25	150	78.9%	74	69.9%	76	90.5%
	26-35	35	18.4%	31	29.2%	4	4.8%
	36-55	3	1.6%	1	0.9%	3	3.6%
	>55	2	1.1%	0	0%	1	1.2%
Education	Some college	94	49.5%	13	12.2%	81	96.4%
	Bachelor	57	30.0%	55	51.9%	2	2.4%
	Master	35	18.4%	34	32.1%	0	0%
	Ph.D.	4	2.1%	4	3.8%	1	1.2%
Income Level	<\$1,000	112	58.9%	53	50.0%	59	70.2%
	\$1,000--\$3,000	58	30.5%	43	40.5%	15	17.9%
	\$3,000--\$5,000	7	3.7%	6	5.7%	1	1.2%
	>\$5,000	13	6.8%	4	3.8%	9	10.7%

Table 2. Descriptive Statistics of Respondents Characteristics

Culture Dimensions	Definitions	Scores from Hofstede Study		Current Study: Test of Difference between China and US	
		USA	China	T-Statistics	P-value
<b>Power Distance</b>	“the extent to which a society accepts and expects the fact that power is distributed unequally”	40	80	-2.650	0.009
<b>Uncertainty Avoidance</b>	“The degree of how societies accommodate high levels of uncertainty and ambiguity in the environment”	46	40	1.906	0.05
<b>Individualism-Collectivism</b>	“The individual's relationships with other individuals”	91	20	2.985	0.003
<b>Masculinity—femininity</b>	The distribution of roles between the genders to the extent that it is characterized by male or female characteristics	62	66	1.579	1.113
<b>Long-term time orientation</b>	long-term time orientation are posited to place great significance on the values of thrift, persistence, and long-term alliances.	29	118	-1.235	0.218

**Table 3. Comparison of Hofesde’s Score of Culture Dimensions**

Consistent with Hofestede, we found that there are significant differences between Chinese and US consumers’ perceptions of mobile commerce on three dimensions: uncertainty avoidance (significance level < 0.05), power distance (significance level < 0.01), and individualism-collectivism (significance level < 0.01). These results validate our samples in both countries and strengthen further analysis. The matching of the samples to generally accepted values of the three culture dimensions in the two countries suggest that we can attribute any differences in our results to these cultural dimensions.

**Testing the Measurement Model**

We performed both exploratory and confirmatory factor analyses. The confirmatory factor analysis results are reported later. An exploratory factor analysis of the 190 responses resulted in the originally postulated eleven factors: Perceived Value-added, Innovativeness, Security Perceptions, Privacy Perceptions, Perceived Usefulness, Perceived Ease of Use, Perceived Cost, Compatibility, Perceived Enjoyment, Subjective Norms and Behavioral Intentions. Table 4 shows the factor loadings.

Based on the results of the exploratory factor analysis, items that loaded less than 0.50 or cross-loaded were discarded. Reliability was assessed using internal consistency scores, calculated by the composite reliability scores (Werts et al. 1974). Internal consistencies of all variables, except

security, are acceptable since they exceed .70 (Table 5). Therefore, we removed the security construct from further analysis. Better measurement items need to be developed in the future for the security construct.

Structural equation modeling (SEM) was further used to analyze the data for the measurement model as well as the structural model. The software used was PLS-Graph, since Partial least square (PLS) places minimal restrictions on measurement scales, sample size, and residual distributions (Chin et al. 2003). Results of confirmatory factor analysis from PLS-Graph are reported in Table 6. All items loaded very well on their respective factors. The loading of each item on its respective construct was very high (>0.7), when the items were allowed to simultaneously cross-load on other constructs.

According to Chin (1998) and Pavlou et al. (2006), “Convergent validity and discriminant validity can be inferred through PLS analysis when (1) loadings are much higher on their hypothesized factor than on other factors (own-loadings are higher than cross-loadings), and (2) when the square root of each construct’s average variance extracted (AVE) is larger than its correlations with other constructs.” The item loadings and the AVE for each construct are shown in Table 6. The square roots of all AVEs are above 0.75 which are much larger than all cross-correlations. The above tests demonstrate adequate convergent and discriminant validity.

	Factor										
	1	2	3	4	5	6	7	8	9	10	11
P1	.458										
P2	.847										
P3	.924										
P4	.643										
S1		.415									
S2		.812									
S3		.653									
S4		-.053									
I1			.675								
I2			.694								
I3			.487								
I4			.865								
PVA1				.710							
PVA2				.853							
PVA3				.711							
PVA4				.530							
PVA5				.483							
PU1					.624						
PU2					.690						
PU3					.825						
PU4					.699						
PU5					.756						
PEOU1						.597					
PEOU2						.601					
PEOU3						.599					
PEOU4						.530					
PEOU5						.472					
PC1							-.072				
PC2							.341				
PC3							.671				
PC4							.874				
COM1								.473			
COM2								.579			
COM3								.540			
PE1									.656		
PE2									.715		
PE3									.696		
PE4									.716		
PE5									.502		
SN1										.740	
SN2										.866	
SN3										.700	
BI1											.712
BI2											.723
BI3											.538
BI4											.529

**Table 4. Factor Loadings for Exploratory Factor Analysis**

Variables	Reliability	Variables	Reliability
Privacy	0.8197	Perceived cost	0.8023
Security	0.4798	Compatibility	0.8682
Innovativeness	0.7790	Perceived Enjoyment	0.9101
Perceived of Value added	0.8590	Subjective Norms	0.9148
Perceived Usefulness	0.9070	Behavior intentions	0.8202
Perceived Ease of Use	0.9034		

**Table 5. Results for Reliability Test**

Construct	Items	Loadings	AVE	Square root of AVE
Privacy	P1	0.8246	0.732	0.8556
	P2	0.9209		
	P3	0.7994		
Innovativeness	I1	0.8639	0.720	0.8485
	I2	0.8984		
	I3	0.7797		
Perceived Value-Added	PVA1	0.8474	0.789	0.8883
	PVA2	0.9161		
	PVA3	0.8998		
Perceived Usefulness	PU1	0.8569	0.778	0.8820
	PU2	0.8929		
	PU3	0.8654		
	PU4	0.9116		
Perceived ease of use	PEOU1	0.8889	0.858	0.9263
	PEOU2	0.9623		
Perceived cost	PC1	0.8859	0.834	0.9132
	PC2	0.9396		
Perceived enjoyment	PE1	0.8681	0.782	0.8843
	PE2	0.9201		
	PE3	0.8472		
	PE4	0.9000		
Compatibility	COM1	0.8700	0.799	0.8939
	COM2	0.8924		
	COM3	0.9191		
Subjective Norm	SN1	0.9140	0.851	0.9225
	SN2	0.9418		
	SN3	0.9108		
Behavioral Intentions	BI1	0.8440	0.590	0.7681
	BI2	0.8767		
	BI3	0.5822		
	BI4	0.7343		

**Table 6. Item loading from Confirmatory Factory Analysis and AVE for principal constructs**

### Testing mean values

To compare the two cultural groups: China and USA, t-tests were conducted. The results are summarized in Table 7.

These results show that there are significant differences in consumers' perceptions of cost, enjoyment, and subjective norm between China and USA. The values of perceived security, perceived enjoyment, and subjective norms of USA are higher than China whereas the mean value of the perceived cost is higher in China than USA.

### The Structural Model

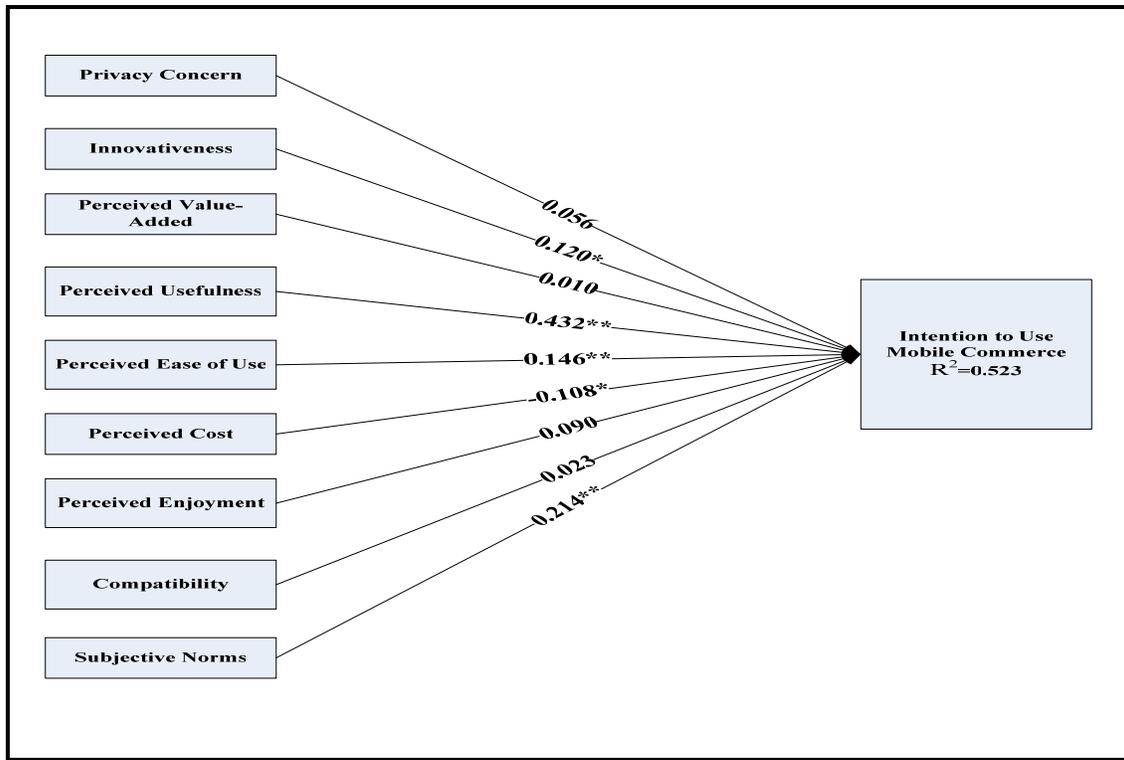
Two SEM analyses were conducted to compare the path coefficients of the structural model for the Chinese sample and the USA sample (Figures 2 and 3). Hypotheses are tested in both China model (Hypotheses a) and US model (Hypotheses b).

In the China model, innovativeness, perceived usefulness, perceived ease of use, perceived cost, and subjective norms significantly influence consumers' intention to use mobile commerce. Among these, perceived usefulness, perceived ease of use and subjective norm are more strongly correlated to consumers' intention ( $p < 0.01$ ). Thereby, H2a, H5a, H6a, H7a, H10a are supported in China model. All antecedents combined explain 52.3% of consumer intention in the China model.

In the USA model, consumer privacy perceptions, innovativeness, perceived usefulness, perceived enjoyment, and compatibility have significant impact on consumers' intention to use mobile commerce. Except for innovativeness, all other factors are correlated at the stronger 0.01 p level. Thus, H2a, H4a, H5a, H8a, H9a are supported in the USA model. The antecedents altogether explain 38.7% of the variance in the USA model.

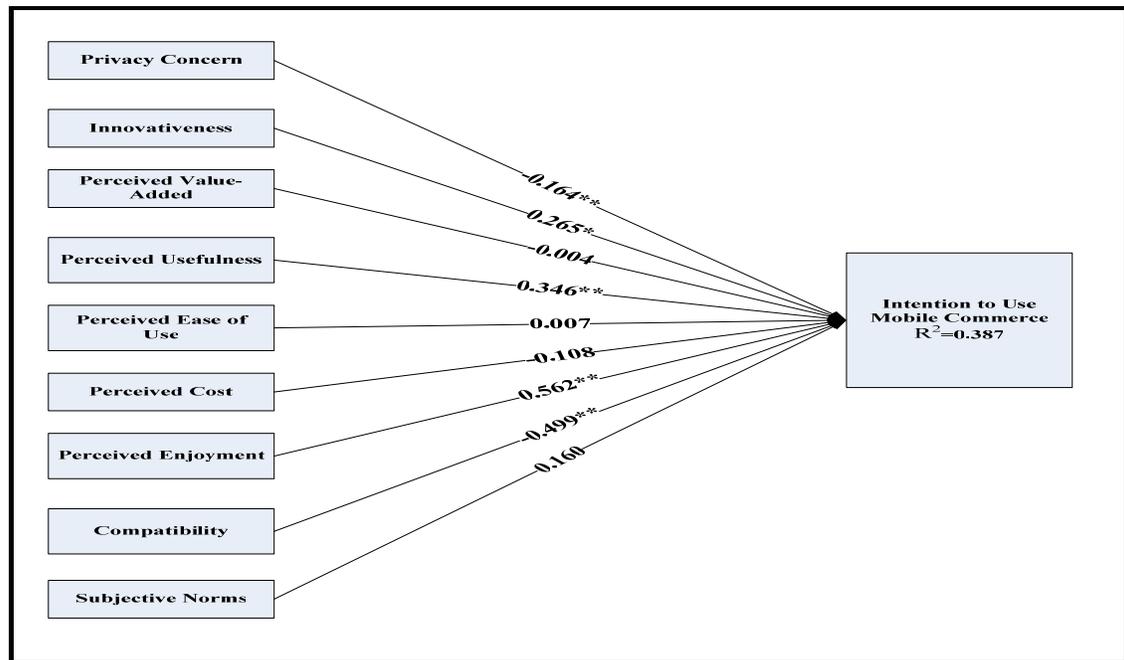
Construct	GROUP	N	Mean	Std. Deviation	Std. Error Mean	T-Statistics	P-value
Privacy	China	106	5.5692	1.48217	.14396	.705	.482
	US	84	5.4222	1.35769	.14814		
Innovativeness	China	106	4.4044	1.21306	.11782	-1.448	.149
	US	84	4.6578	1.17738	.12846		
Perceived Value-added	China	106	5.4065	1.15169	.11186	-1.143	.254
	US	84	5.6071	1.26233	.13773		
Perceived Usefulness	China	106	4.9555	1.13740	.11047	.354	.724
	US	84	4.8916	1.35100	.14741		
Perceived Ease of Use	China	106	4.5868	1.22039	.11853	-1.339	.182
	US	84	4.8333	1.30876	.14280		
Perceived Cost	China	106	5.1698	1.25109	.12152	2.271	.024
	US	84	4.7744	1.11225	.12136		
Compatibility	China	106	4.4969	1.28339	.12465	-1.522	.130
	US	84	4.7816	1.27818	.13946		
Perceived Enjoyment	China	106	3.9405	1.13649	.11039	-3.753	.000
	US	84	4.6139	1.33523	.14569		
Subjective Norms	China	106	3.7515	1.30853	.12710	-2.672	.008
	US	84	4.2819	1.42016	.15495		
Behavior Intentions	China	106	4.4164	1.16031	.11270	.014	.989
	US	84	4.4137	1.45799	.15908		

**Table 7. US-China Construct Comparisons**



\* p < 0.05, \*\* p < 0.01

Figure 2. The China Model



\* p < 0.05, \*\* p < 0.01

Figure 3. The USA Model

Hypothesis	Path Descriptions	Path coefficients	Support?
H1a	Perceived Value added→Intention to use	0.010	No
H2a	Innovativeness→Intention to use	0.120	Yes
H3a	Security Perception→Intention to use	Removed	---
H4a	Privacy Perception→Intention to use	0.056	No
H5a	Perceived Usefulness→Intention to use	0.432	Yes
H6a	Perceived Ease of Use →Intention to use	0.146	Yes
H7a	Perceived Cost→Intention to use	0.108	Yes
H8a	Compatibility→Intention to use	0.023	No
H9a	Perceived Enjoyment→Intention to use	0.090	No
H10a	Subjective Norm→Intention to use	0.214	Yes

**Table 8 Results of Hypotheses Tests for China model**

Hypothesis	Path Descriptions	Path coefficients	Support?
H1b	Perceived Value added→Intention to use	0.004	No
H2b	Innovativeness→Intention to use	0.265	Yes
H3b	Security Perception→Intention to use	Removed	---
H4b	Privacy Perception→Intention to use	0.164	Yes
H5b	Perceived Usefulness→Intention to use	0.346	Yes
H6b	Perceived Ease of Use →Intention to use	0.007	No
H7b	Perceived Cost→Intention to use	0.108	No
H8b	Compatibility→Intention to use	0.499	Yes
H9b	Perceived Enjoyment→Intention to use	0.562	Yes
H10b	Subjective Norm→Intention to use	0.160	No

**Table 9 Results of Hypotheses Tests for US model**

The summary of hypotheses tests are displayed in table 8 and table 9.

## Discussion

Based on various theories in information systems, social psychology, economics, and culture, we proposed, operationalized, and empirically tested a comprehensive model that explains consumers' intention to adopt mobile commerce in two distinct cultural contexts: China and United States. We found several interesting results as discussed below.

### Comparative Examination of Constructs

There are many similarities in the average construct values in China and USA. We could not detect any statistically significant differences between US and Chinese consumers along the dimensions of privacy,

innovativeness, perceived value-added, usefulness, ease of use, and compatibility in the m-commerce environment. In other words, they regard these characteristics of m-commerce at about equal level, since there was no significant difference in their behavioral intention to use m-commerce services. This is remarkable given the economic status of the two countries and the recognized cultural differences.

There are significant differences in consumers' perceptions of cost, enjoyment, and subjective norm between China and USA. The values of perceived enjoyment, and subjective norms of the US sample are higher than those of the Chinese sample. In USA, the playfulness of the mobile commerce services and social influences are given higher values. On the other hand, the Chinese consumer has high concern for cost. A plausible explanation is the lower income level of the consumers, especially the younger generation in China which is less than 100 dollars per

month. Currently the price for mobile web access is 200 Chinese RMB (\$27) per month. This expense is not affordable for many people in China. On the other hand, m-commerce devices are affordable for a majority of the American consumers.

### **Path Analysis**

In China, our model was able to explain 52.3% of the variance in the consumer behavioral intention. The relationships of the TAM model are supported by our study. Both perceived usefulness and perceived ease of use have significant impact on consumers' intention to use mobile commerce (Venkatesh et al, 2000). Additionally, our study added perceived cost and subjective norm as important antecedents of Chinese consumers' intention. These findings suggest that the Chinese people consider the functional characteristics and expenses before deciding to use mobile commerce.

In USA, the model explained 38.7% of the variance and provided different sets of relationships compared to the China sample. Consumer privacy perceptions, innovativeness, perceived usefulness, perceived enjoyment, and compatibility are highlighted as influencing intentions to use. It appears that consumers in USA emphasize the personal and hedonic characteristics of mobile commerce in their intention to use. There was a lack of support for one of the TAM relationships, i.e., the impact of perceived ease of use. However, there are several studies in the past which have failed to establish this relationship. For an experienced society such as in the US, perhaps ease of use is no longer as important determinant of use and is possibly taken for granted.

### **Comparative Analysis of Relationships**

There are significant differences in the factors affecting consumers' adoption of m-commerce in two distinct cultural contexts. According to Hofstede (1991) and earlier findings, consumers in low uncertainty avoidance cultures like USA would have more willingness to embrace technology innovations, whereas in high uncertainty avoidance culture such as China, consumers would feel threatened by uncertain or ambiguous situations, and are likely to refrain from such technologies. Innovative people are more likely to embrace new and sometimes unproved ideas and technologies. Thus, innovativeness is a very important indicator of consumer intention to use mobile commerce in US. Its relationship to intention to use was stronger in US than in China.

The Hofstede study also suggests that consumers from an individualistic country will use mobile services to showcase their individuality and opt to use services that are more personalized while consumers from collectivistic states may tend to use services which will enable them to feel better connected to other people. We found this is true in both China and USA. In USA, privacy, compatibility, and perceived enjoyment are significant indicators when people focus on individualistic needs, values, and goals. In China, people's intention to use is influenced by subjective norm which reflects their collectivistic orientation and the need to conform with friends, family and associates.

Some differences found in US and China can be attributed to the disparity in economic environments. While price did not affect the American consumers, perceived high cost of mobile commerce did lead to a low level of intention to use for Chinese consumers. In fact, high cost may well be the key obstacle to adopt mobile commerce in China.

### **Implications**

The contributions of this study for practitioners is to help mobile business vendors identify and target groups of consumers who have a strong intention to adopt new applications and services in m-commerce. The idea of whether m-commerce should be provided to all customers for all products and services is too broad for developing effective marketing strategies. Corporations continue to evaluate how individual products and services should be offered for specific consumer groups based on their individual characteristics (Frolick and Chen, 2004). Our study demonstrates that various factors need to be considered to find target mobile consumers in the two different cultures.

Our study provides managers of m-commerce services seeking to enter the Chinese and US marketplace specific information about users' intention to use m-commerce services based on individual characteristics. It informs managers' decisions on delivering targeted campaigns and specific m-commerce services for the Chinese and US consumers. Conversely, for those with low intention to use, the implication for the business is to determine if alternative pricing strategies or new functions should be used.

The common factors to m-commerce usage in both nations are personal innovativeness and perceived usefulness. Besides these factors, the unique factors in China, where developers and practitioners

have some influence, are the cost of the service and peer influences. In USA, these factors include privacy, compatibility, and perceived enjoyment. Web vendors would be well advised to develop their offerings and programs in relation to these factors and target their marketing campaigns accordingly.

In fact, compared to other shopping media, mobile commerce provides consumer a great degree of convenience and may be a significant motivating factor. Today, consumers have gained more flexibility and empowerment by using the mobile device in which they can compare various prices for the product and conclude the purchase at anytime and anywhere (Loewe & Bonchek, 1999). However, in China, e-commerce development is still in early stages and consumers are more familiar with traditional offline shopping. This requires that business vendors create more convenient and secure mobile shopping channel to help customers establish the comfortable experience of mobile commerce.

For academics, this study contributes to the literature on m-commerce adoption by identifying characteristics of the m-commerce consumers in China and U.S. and their intentions to adopt m-commerce services. Besides, the comparison of the Chinese and the US marketplace would be very useful for researchers to localize m-commerce strategy recommendations.

This study also provides light on future research directions. While we had to disregard the "security" construct because of measurement issues, future research should develop a sound operationalization and consider it explicitly. One of our research agenda is to expand the current study based on marketing research and trust issues in m-commerce adoption, and to focus specifically on customers who have low intentions to adopt m-commerce. In the same light, the comparison of perceived critical success factors identified by successful m-commerce adopters and less successful adopters would give interesting insights. Another interesting line of work would be to validate our results in other cross-cultural contexts, such as less developed countries and closed economies.

### Limitations

Some limitations are noted. The validity of our results depends on the sampling of the surveyed subjects. We used student data to inform our analysis. The sample in USA is a convenience sample, while the China sample represents a larger segment of the population. Nevertheless, students

are known to be more open to the kind of innovations found in mobile phone services and are the first to adopt such innovations. In addition, the generalizability of the results may be limited due to the sample size, although the size is comparable to many prior studies.

### Conclusions

This study identified various factors affecting mobile commerce adoption based on existing literature in IS and other disciplines, and developed a comprehensive model of mobile commerce adoption. After developing and validating a research instrument, the model was applied in two different cultural contexts: China and the USA. We found that the US and Chinese m-commerce consumers were similar in their perceptions of privacy, innovativeness, value-added, usefulness, ease of use, and compatibility. However, the values of perceived enjoyment, and subjective norms of the US sample are higher and the Chinese consumer has high concern for m-commerce costs.

In China, both perceived usefulness and perceived ease of use have significant impact on consumers' intention to use m-commerce. Additionally, cost and subjective norm are important antecedents of Chinese consumers' intention. In USA, consumer privacy, innovativeness, perceived usefulness, perceived enjoyment, and compatibility are highlighted as influencing intentions to use. We argue that many of these differences can be explained by cultural and economic factors. The findings of this research contribute to both theory and practice. Besides future extensions in research, IT firms and vendors can utilize our findings to fine tune their m-commerce offerings to the needs of specific populations.

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