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Exploring Factors Influencing the Adoption of Mobile Commerce

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Abstract

This study presents an extended technology acceptance model that integrates innovation diffusion theory to investigate what determine user mobile commerce acceptance. This paper models the factors relationships such as perceived usefulness, perceived ease of use, personal innovativeness, subjective norms, behavioral control and intention to adopt mobile commerce. The proposed model was empirically tested using data collected from a survey of mobile commerce consumers. Empirical data from regression analysis reflects users ease of use influence behavioral intention to adopt mobile commerce. The majority of positive relationships between perceived ease of use, subjective norms, behavioral control and intention to adopt are supported by empirical data. Results also reveal that behavioral control and subjective norms influence perceived ease of use which affects then their adoption intention. The paper concludes some important implications for the practitioners.

Keywords: **Mobile Commerce, Adoption, Behavioral Intention**

INTRODUCTION

Mobile commerce involves the delivery of products and services via wireless technologies to enable internet commerce activities without restrictions of time and space (Liao et al, 1999). Several independent studies have shown that mobile commerce can have an important influence on business and society in future. Mobile commerce offers very promising possibilities for a broad range of business sectors. According to Wireless week (2004), there are currently 94.9 million mobile commerce users in 2003 worldwide and the segment is expected to grow 1.67 billion by 2008. Global revenues from M-commerce are expected to reach $555 billion in 2008 (Wireless Week, 2004).

Mobile commerce was initially expected to experience a substantial growth for several reasons, i.e. rapid proliferation of mobile device adoption and the obvious advantages of anytime, anywhere connectivity. However, most m-commerce applications, excepts for very few personal applications (i.e. ring tone) have failed to meet expectations. Many factors have hindered consumer's usage of mobile commerce applications. These include cost of access, credit card security, difficult navigation and low access speed (Smith, 2001). However, today a considerable proportion of mobile commerce consists of purchase of different types of digital content that in most cases is used in the mobile phones. Customers want to personalize their mobile devices with ringing tones, screen savers, wall papers and downloading games. Getting used to buying digital content and services with the mobile devices will make it easier to adapt to mobile payment mechanism for physical goods as well in future.

The primary objective of this research is to identify the factors that can predict the intention to use m-commerce systems. An important goal through out is to develop a model capable of providing useful information to m-commerce practitioners. It will help the practitioners to understand insights and how to promote it to customers. In this research, we combined the factors from various theories to develop a proposed model for this study.

The reminder of this paper is organized as follows; section 2 presents the research model and hypotheses. Next section 3 describes the research method. Then the results are reported in section 4. Finally section 5 presents conclusions.

MODEL DEVELOPMENT

Mobile Commerce refers to any direct or indirect commercial transactions conducted through a variety of mobile devices over a wireless telecommunication. Mobile commerce applications are broadly divided into two categories: content delivery (i.e., reporting, notification, and consultation) and transactions (i.e. data entry, purchasing and promotions) Balasubramanian et al, 2002. Mobile commerce applications are becoming an important area of electronic commerce generating substantial profits. Rapidly developing technology capabilities and mobile device adoptions have increasingly led to the expectations of a mobile commerce, similar in scale to the first wave of electronic commerce experienced in the late 1990s (Mort and Drennan, 2005). Mobile services are important for firms and consumers because of ubiquitous, universal, and unison access

to information and services, and the possibility for unique and personalized exchange of information (Watson et al, 2002). Determining the factors influencing the adoption of mobile commerce will be useful the companies prioritize and allocate resources accordingly.

Based on the literature concerning technology acceptance model, theory of planned behavior and diffusion of innovation this study presents an integrated model to explore the factors which influence consumer usage intention of mobile commerce. This model provides managers to assess success for m-commerce introductions and contributes to their understanding of the drivers of acceptance in order to proactively design strategies targeted at populations of users that may be less inclined to adopt and use m-commerce systems.

Building on the theory of reasoned action model, Davis proposed the Technology Acceptance Model (TAM) in an effort to explain and predict the adoption and use of information technology at work in 1989. The TAM theorized that perceived usefulness and perceived ease of use were two key determinants of technology adoption. TAM suggests that user adoption of new information systems is determined by user's intention to use the system, which in turn is determined by user's beliefs about the system. According to this model, both perceived usefulness and ease of use influence the attitude of individuals towards the use of technology, while attitude and perceived usefulness of the technology predict the individual's behavior to use the technology. The TAM's basic constructs, perceived ease of use and perceived usefulness don't fully reflect the specific influences of technological and usage context factors that may alter user acceptance. This model has been widely used over the past decade as a means of predicting user's intention to use new technologies. The mobile commerce is a new way of doing business and promises delivering the business in new way. There TAM could be useful in predicting user's intention to adopt new services and applications. Theory of planned behaviour extends from theory of reasoned action by incorporating an additional construct, namely, perceived behaviour control to account for situations in which an individual lacks substantial control over the targeted behaviour. According to TPB, an individual's behaviour intention is jointly influenced by subjective norms and perceived behavioural control. Moreover, diffusion of innovation is important theory as

Prior studies have extended TAM with constructs such as perceived playfulness, perceived enjoyment and others. It is widely recognized that subjective norms and perceived behavioral control are important for understanding and predicting intentions and behavior in specific contexts.

Based on figure 1, intention to adopt mobile commerce is dependent variable, while two motivational variables serve as intermediate variables moderating independent and dependent variables. Independents variables are made up of subjective norms, personal innovativeness, and behavioral control.

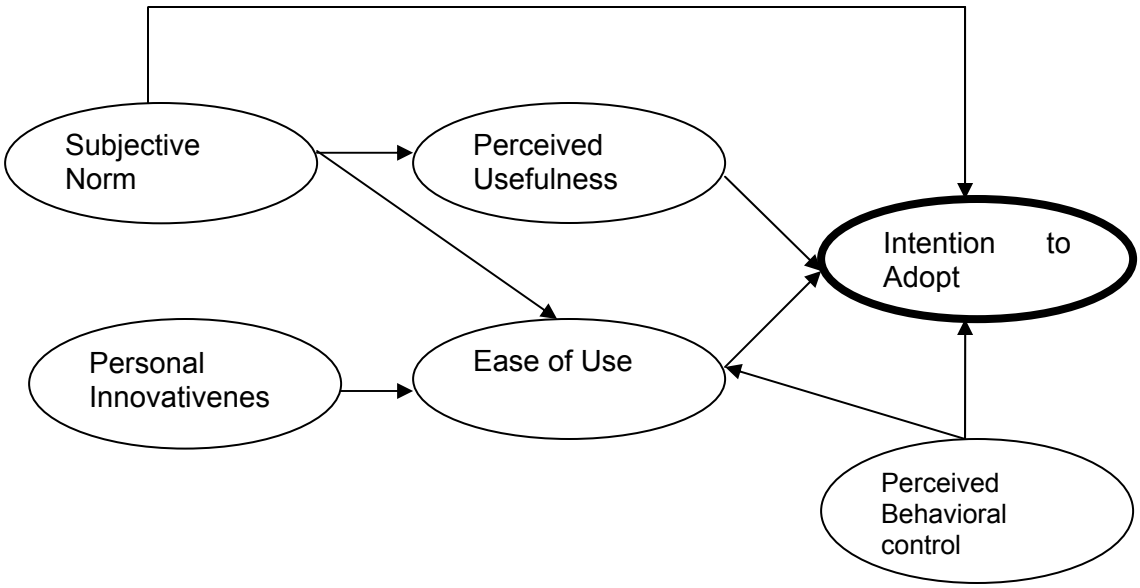

Figure 1: Conceptual Model

The rest of this section elaborates on the rationale for the constructs to be included in our research model and the hypothesized relationship among these constructs.

Subjective norms

A person's subjective norm is determined by his or her perception that salient social referents think he/she should or should not perform a particular behavior (Ajzen and Fishbein, 1980, p. 302). That person is motivated to comply with the referents even if he/she does not favor the behavior. The referents may be superiors (e.g., parents or teachers) or peers (e.g., friends or classmates) (Taylor and Todd, 1995). In theory reasoned action (Ajzen and Fishbein, 1980, p.302) and theory planned behavior (Ajzen, 1991) social influence was tested as subjective norms on behavioral intention. In addition from the theory of group influence processes, an individual tends to conform to the expectations of others to strengthen relationships with group members or to avoid a punishment. Though the effect of subjective norms (SN) on intention is inconclusive, from prior research there is a significant body of theoretical and empirical evidence regarding the importance of the role of subjective norm on technology use, directly or indirectly, (e.g., Taylor and Todd, 1995; Venkatesh and Davis, 2000; Hsu and Lu, 2004). The importance of subjective norms on intention to adopt mobile services is revealed in studies that are based on the information systems perspective. The relative influence of subjective norm on intentions is expected to be stronger for potential users with no prior experience since they are more likely to rely on the reactions of others in forming their intentions (Hartwick and Barki, 1994). TAM proposes that subjective norm can influence the cognitive belief of perceived usefulness. Lewis (2003) sought to explain for perceived

usefulness from social aspects and found the expected relationship. Subjective norm many also help to shape an ease of use before any direct experience can not be exempted from social influence. If mobile services are believed hard to learn and hard to use, unavoidably it will more or less affect a member's intention toward adopting. The purpose is to predict whether social influence is an important consideration in people's intention to use the system.

H1: Subjective norm positively affects perceived usefulness.

H2: Subjective norm positively affects perceived ease of use.

H3: Subjective norm positively affects behavioral intention to adopt mobile commerce.

Personal Innovativeness

Personal Innovativeness is defined as the willingness of an individual to try out any new information systems. Leung and Wei (1998) reported that consumer innovativeness is positively related to their adoption decision of various technologies. Innovative individuals have been also found to be dynamic, communicative, curious, venturesome, and stimulation–seeking. Other diffusion studies also confirmed that innovativeness is related to consumer adoption behavior.

This construct was included in this study because it was expected to influence consumers' intention to adopt mobile commerce. It has been recognized that highly innovative individuals are active information seekers about new ideas. Drawing upon Rogers' theory of the diffusion of innovations, Agarwal and Prasad (1998) described personal innovativeness as s symbolizing the risk taking propensity that exists in certain individuals and not in others. They are able to cope with high levels of uncertainty and develop more positive intensions toward acceptance (Rogers, 1983; 1995). In the intention to adopt, most people do not have any or much knowledge on various mobile services or form clear perception beliefs. It is expected that personal innovativeness generating a strong impact on perceived usefulness and perceived ease of use, which in turn influence user intention to adopt M-commerce. Citrin et al (2000) study founds that personal innovativeness predict consumer adoption of internet shopping. Given the relative infancy of the mobile services it is appropriate to test innovativeness as an influencing variable under new circumstances. This study developed and validated the measures for personal innovativeness and, thus, made it practical to explain and predict how personal innovativeness influences mobile commerce intention to adopt.

H4: Personal innovativeness positively affects perceived usefulness.

H5: Personal innovativeness positively affects perceived ease of use.

Perceived usefulness:

The perceived usefulness of a system is defined as the extent to which individuals believe that using the new technology will enhance their task performance. There is extensive research in the IS that provides evidence of the significant effect of perceived usefulness on usage intention (Davis et al, 1989, Venkatesh & Morris, 2000). An individual evaluates the consequences of their behavior in terms of perceived usefulness

and base their choice of behavior on the desirability of the perceived usefulness. Therefore, perceived usefulness will influence their intention to accept and adopt mobile commerce, either directly or indirectly. Numerous empirical studies have provided support for the proposition that perceived usefulness is the primary predictor of information technology usage (Davis, 1989; Davis et al., 1992; Igbaria et al., 1997; Gefen and Straub, 1997, 2000; Venkatesh, 2000; Venkatesh and Davis, 2000; Gefen, 2003; Hsu and Lu, 2004). O'cass and Fenench (2003) argue that TAM is appropriate for research areas in electronic commerce applications since electronic commerce is based on computer technology. As scholars indicate that M-commerce is an extension of e-commerce, it is thus justifiable to extend TAM to examine consumer intention to adopt behavior. Based on the literature following hypothesizes are developed.

H6: Perceived usefulness positively affects the intention of users to adopt mobile commerce.

Perceived Ease of Use

Perceived ease of use is an individual's assessment of the extent to which interaction with a specific information system or technology is free of mental effort (Davis, 1989). The perceived ease of use for a system is defined as the degree to which an individual believes that using a particular technology will be free of effort. The results of many of the prior empirical studies have demonstrated that perceived ease of use has a positive correlation with behavioral intention, both directly (Davis, 1989; Gefen and Straub, 1997, 2000; Venkatesh, 2000; Venkatesh and Davis, 2000; Gefen, 2003). This construct is posited to inforluence behavioral intentions to use through two casual pathways: a direct effect as well as an indirect effect through perceived usefulness. A few empirical studies tested ease of use as a predominant determinant tested ease of use as predominant determinant of intention to adopt (e.g. Agarwal and Karahanna, 2000). Some found that this construct exerting a mediation effect. It is one of the major behavioral beliefs influencing user intention to technology acceptance in both original and the revised TAM models and it gas been included in this study to determine this influence the mobile commerce intent as well.

H7: Perceived ease of use has a positive effect on the intention to use mobile commerce.

Perceived Behavioral Control

According to the theory of planned behavior, perceived behavioral control is defined as individual perceptions of how easy or difficult it is to perform a specific behavior. Behavioral control has been shown to have an effect on key dependent variables such as intention and behavior in a variety of domains (Ajzen 1991). A significant body of research in information systems and psychology has highlighted the importance of computer anxiety by demonstrating its influence on key dependent variables for example, intention (Elasmar & Cartar, 1996), suggested that knowledge gained from past behavior would help to shape intention. In IS research, Mathieson (1991) found that control was a significant determinant of intention to adopt technology. In general, perceived control is composed of elements of individual constraints that are related to the individual user's economy, experience, and skill in using a service.

Taylor and Todd (1995) found a similar pattern of results. However, the effect of control on intention over and above what is explained by the TAM constructs of perceived ease of use and perceived usefulness is not known. As mentioned earlier, the final model of TAM excludes the attitude construct and helps understand the explanatory power of perceived ease of use and perceived usefulness on intention. Another point related to control is worthy of note-in IS research, perceived ease of use has been seen to be a determinant of attitude consistent with TPB (see Davis et al. 1989, Taylor and Todd 1995), while internal and external control have been related to perceived behavioral control in TPB. The current work relates control to perceived ease of use, thus departing from the basic framework of TPB. However, such "crossover effects" have been observed in prior research (Venkatesh and Davis 1996).

H8: Perceived Behavioral Control positively affects perceived ease of use.

H9: Perceived Behavioral Control positively affects behavioral intention to adopt mobile commerce

METHODOLOGY

As to research aims to both measure the constructs and their relations to test the research model, we conducted a cross-sectional survey study. A questionnaire was developed, pre-tested and then administered to university students. Over 50% of the students had at least one graduate degree and were enrolled in a second degree. On average, the students had over 3 years of working experience.

Instrument Development

The instrument gathered information about the demographic characteristics of respondents, and the research constructs (refer to table 2), namely perceived usefulness, perceived ease of use, personal innovativeness, subjective norms and behavioral control. The constructs in the model are opertationalized from existing measures developed and employed in previous research. Five-point Likert scales with end points of “strongly disagree” and “strongly agree” were used to examine participant’s responses to these statements. Subjective norms were measured using three items that were almost identical to the items used by Bhattacherjee (2000). The measure of behavioral control and personal innovativeness was almost identical to the measure applied by Bhattacherjee (2000) and Taylor and Todd (1995). The usefulness construct using five items and ease of use using four items were adapted from Davis (1989) and Legris (2003) original items. Demographics questions were adapted from (Yang, 2005). The demographics characteristics were measured in terms of gender, age, and educational level.

Reliability

Descriptive statistics, scale reliability analyses, factor analysis and regression analysis was performed in SPSS (v.14.0). The instruments were initially examined to establish the reliability of scales. The Cronbach’s alpha coefficients range from 0.709 to 0.881 that exceed recommended value of 0.50 (Hair et al, 1998). These values show good internal

consistency among scales employed for the present study. These alphas equal to 0.709, 0.801, 0.783, 0.881 and 0.901 for perceived usefulness, perceived ease of use, subjective norms, perceived behavioral control and personal innovativeness, respectively. Although the alpha coefficient for Usefulness seems to be low, Ajzen and Fishbein (1975) point out that the homogeneity of belief sets should not be overestimated because "people are deliberately promoted by the nature of belief questions to think about consequences, referents, or resources that are a mix of facilitators and inhibitors of the behavior at hand". Therefore, this construct was accepted for further analysis.

Factor Analysis

An exploratory factor analysis was conducted on the different measures to purify the instrument. The data from respondents were examined using principal component method. A five factor solution resulted from principal component analysis with varimax rotation, with six Eigen values greater than 1 are shown in table 1. The items with factor loading of less than 0.5 on each factor or above 0.5 on additional factors were deleted to purify the measure. The results confirmed the existence of five factors with eigenvalues greater than 1.0 that accounted for 60 percent of the total variance. Table 3 shows the four items measuring ease of use construct with factors loading values ranging between .533 and .877 formed factor 1. Personal innovativeness items formed factor 2 and the factors loadings ranges between .597 and .881. Three items relevant to behavioral control with a factor loading between .608 and .725 formed factor 3. Fourth factor also had three distinct items related to subjective norms clearly formed with factor loadings ranging between .608 and .751. Perceived usefulness construct's all the items grouped in factor five with a factor loading values ranging between .539 and .739. The results show that all items used to operationalize for this study loaded onto a single factor.

Table 1: Measurement properties for multi-item construct (Factor loadings and descriptive statistics)

Items	1	2	3	4	5	Mean	SD
Using M-commerce makes me save time					.739	4.37	.89
M-commerce contributes to the betterment of life					.573	3.78	.71
It is fashionable and trendy to use M-commerce					.662	3.61	.87
M-commerce would not lead to an invasion of personal privacy					.672	3.5	.89
It is safe to make purchase using M-commerce					.539	3.21	1.13
Learning to use M-commerce is easy to me	.690					4.06	.985
It is easy to make M-commerce do what I want it to	.877					3.91	1.08
My interaction with M-commerce is clear and understandable	.822					3.69	1.15

M-commerce is compatible with existing technology	.533					3.61	.791
People important to me think I should use M-commerce				.751		3.58	1.05
It is expected that people like me to use M-commerce				.627		3.93	1.07
People I look up to expect that I use M-commerce				.608		3.39	.97
I feel free to use the kind of M-commerce transaction I like to			.763			4.02	1.07
Doing M-commerce is entirely within my control			.708			4.06	.935
I have the necessary means and resources to use M-commerce			.768			4.06	1.0
I am very curious about how things work		.597				3.85	.925
I like to experiment with new ways of doing things		.766				3.95	.961
I like to take a chance		.880				3.95	.961
I like to be around unconventional people who dare to try new things		.850				3.76	1.03
I often seek out information about new products		.881				3.85	.92

RESULTS AND DISCUSSION

To test the research model for this study, a cross-sectional survey was conducted. A questionnaire was developed, pre-tested and then administered mainly to students. Over 44% of respondents have a graduate degree and 35% of them are holding management position. 93 % of have been using mobile phones for above 4 years for various applications. All the respondents are using the mobile devices to send receive SMS and send/receive multimedia messaging service to enhance their mobile communication capabilities. 55.8% respondents are using mobile devices for financial applications to interact with banks and stock exchange brokers. 27% of respondents said they are using mobile devices for entertainment services, shopping services (buy cinema tickets etc.) and for locator services.

Table 2. Demographic profile of respondents

Gender of respondents	Female Male	67.4% 32.6%
Age of Respondents	Under 20 20 to 29 30 to 39 40 to 49	2.3 76.7 16.3 4.7
Educational Background	High School Certificate Undergraduate	55.6 44.4
Occupation category	Upper/Middle Management Trained Professional	34.9 9.3

	Consultant/researcher Administrative/support staff Faculty Full time Student Others	2.3 2.3 4.7 41.9 4.7
Years of use of mobile devices	1 to 2 years 3 to 4 years More than 4 years	2.3 4.7 93.0

To test the hypotheses proposed above, multiple regression analyses are conducted on the constructs using perceived usefulness, perceived ease of use, subjective norms, perceived behavioral control, personal innovativeness and intention to adopt mobile commerce. Results suggest that factors identified are capable of providing an adequate explanation of consumer adoption decision making process to the mobile commerce.

The results of the model tested for this study show that perceived usefulness, perceived ease of use, subjective norms, behavioral control and personal innovativeness contribute significantly ($F = 15.21$; $p < .001$) and predict 68% of variations in user's intention. Properties of the casual paths, including standardized path coefficients, t values and variance explained, for each equation in the hypothesized model, are presented in table 3. Hypothesis H1, H2, H3, H4, H5 were supported in that perceived ease of use, subjective norms and perceived behavioral control all had a significant effect on behavioral intention.

Table 3: Summary of research findings

Hypothesis	**Beta value**	**Finding**
H1: Subjective norm → perceived usefulness.	0.25**	Supported
H2: Subjective norm → perceived ease of use.	0.30***	Supported
H3: Subjective norm → behavioral intention	0.30***	Supported
H4: Personal innovativeness → perceived usefulness.	0.10	Not supported
H5: Personal innovativeness → perceived ease of use.	0.05	Not supported
H6: Perceived usefulness → behavioral intention	0.20	Not supported
H7: Perceived ease → behavioral intention	0.21**	Supported
H8: Perceived behavioral control → perceived ease of use.	0.19***	Supported
H9: Perceived behavioral control → behavioral intention	0.20***	Supported

Table 3 illustrates that hypotheses (1-3, 7-9) were significantly supported. However, the remaining three hypotheses, including of H4, H5 and H6 are not supported in this study. The findings can be summarized as follows; first it indicates that the perceived ease of use, subjective norm and perceived behavioral control affects the intention to adopt mobile commerce. These findings are consistent with previous studies. Our findings show that perceived usefulness has no significant effect on behavioral intention to use mobile commerce. This finding was in accord with the results of (Jackson et al, 1997; Lucas and Spitler, 1999) and their studies did not find any significant impact of perceived

usefulness on intention to adopt new technology. The results corresponds to the prior research in current environment the users do not find certain mobile commerce applications useful due to the other alternatives. However, none of these studies examined this construct in the context of non-work related individual intention to adopt new innovation.

User's intention to adopt mobile commerce is affected significantly by subjective norms, perceived ease of use and perceived behavioral control. Perceived usefulness and personal innovativeness does not influence directly and indirectly on behavioral intention. However, perceived behavioral control has been found to significantly influence behavioral intention to adopt mobile commerce. Furthermore, the results also show that the perceived ease of use and perceived behavioral control directly influence the intention to adopt which is consistent with previous studies. Perceived behavioral control is found to influence directly on intention to use and perceived ease of use. Mobile applications service providers may offer free use of service for a period that would enable the users to learn the service, thus increasing their perceived control.

Another finding from this study is that the subjective norms directly and indirectly influences the intention to adopt mobile commerce. Subjective norms are often used to explain the rapid adoption of technology and the results of this study reveal a significant and effect of normative pressure to use. This emphasizes the importance of managers to consider the social context in which the mobile commerce is used (Nyseen, 2005). Social influences also help to shape an individual's estimation of his or her confidence in or ability to use a system well.

CONCLUSION

The purpose of this article has been to explore factors that influence the intention of users to adopt mobile commerce. For this purpose a simple model based on technology acceptance model, theory of panned behavior and diffusion of innovation was developed and measured. The empirical results significantly verified the hypothesis between subjective norms, perceived usefulness, and perceived ease of use, personal innovativeness and perceived behavioral control. The results suggest that subjective norms, perceived usefulness, perceived ease of use and behavioral control are strong determinants of intention to adopt mobile commerce. The study has revealed that subjective norms and perceived behavioral control impact perceived ease of use and intention to adopt mobile commerce. We suggest that marketing strategist seek to produce peer impact rather than rather than external impact. An emphasis on friends who have adopted mobile commerce would be better than individuals with high level of personal innovation. The managers can also prioritize and allocate resources accordingly. Moreover, mobile commerce service providers can emphasize on differentiation to make application more useful and easier to use than their competitors.

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