

DETERMINANTS OF M-COMMERCE ADOPTION: AN INTEGRATED APPROACH

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Abstract

Given the proliferation of mobile devices, m-commerce is expected to experience a substantial growth. However, most m-commerce applications except for few, have failed to meet expectations. In this study, we examine specific factors pertaining to the adoption of mobile commerce within a comprehensive framework integrating well established theories of technology adoption, i.e., the technology acceptance model (TAM) and the theory of planned behavior (TPB). More specifically, we re-conceptualize perceived usefulness to enhance the specificity of these theories to mobile commerce. The resulting model is empirically tested with mobile device users who have not adopted mobile commerce yet. The empirical results provide strong support for the integrative approach, shedding light on the significance and relative importance of specific technological characteristics. The theoretical and empirical implications of these results are discussed.

Keywords: M-commerce, Technology Acceptance Model; Theory of Planned Behavior, IT Adoption.

1 INTRODUCTION

Mobile commerce, often referred to as m-commerce, typically designates the use of wireless devices (particularly mobile phones) to conduct electronic business transactions, such as product ordering, fund transfer, and stock trading (Kalakota and Robinson 2002). M-commerce was initially expected to experience a substantial growth for several reasons, i.e., rapid proliferation of mobile device adoption (over 1.52 billion global mobile users according to some source¹) and the obvious advantages of anytime-anywhere connectivity. However, most m-commerce applications, except for very few personal applications like ring tone downloads, have failed to meet expectations (Anil et al. 2003; Liang and Wei 2004). It is therefore important to shed light on the technological characteristics affecting the adoption of m-commerce.

In this research, we integrate the theory of planned behavior (Fishbein and Ajzen 1975; Ajzen and Madden 1986) and technology acceptance model (TAM) (Davis 1989) to explain the adoption of m-commerce. Based on a belief elicitation process we identified specific m-commerce adoption drivers to account for the specificity of the artifact. As Ajzen (1991) advocates, it only at the level of specific beliefs, rather than a generic operationalization across applications, that we can learn about the unique factors that induce one person to engage in the behavior of interest. Such an approach helps us to identify the salient beliefs that are specific to the m-commerce context. The model was tested empirically through a survey administered to mobile phone users who had not engaged in m-commerce. In addition to its theoretical contributions, this study presents important practical contributions. In particular, practitioners can gain valuable insights on the driving forces of m-commerce adoption, which may guide their implementation and marketing activities.

¹ <http://www.cellular.co.za/>

The paper proceeds as follows. In the next section, we present our research model and its theoretical foundation. This is followed by a description of the empirical study designed to test the proposed model. We then discuss the empirical results and their implications.

2 THEORETICAL DEVELOPMENT

Most information systems (IS) studies on adoption and usage of information technology relied on models derived from the technology acceptance model (TAM) proposed by Davis and his colleagues (Davis 1989; Davis et al. 1989) and the theory of reasoned action (Fishbein and Ajzen 1975) and its extensions. In the past two decades, TAM attracted much attention and has been established as a parsimonious yet powerful model for explaining and predicting usage intentions and acceptance behavior (Yi and Hwang 2003). According to TAM, an individual's actual system usage is determined by behavioral intention, which is jointly predicted by perceived usefulness and perceived ease of use. Perceived usefulness is the extent to which a person believes that using the technology will enhance his or her job performance, and perceived ease of use is the extent to which a person believes that using the technology will be free of effort (Davis 1989). Behavioral intention is defined as the extent to which an individual intends to perform a specific behavior (Davis et al. 1989). TAM posits that the impact of other external variables on behavioral intention is fully mediated by these two beliefs of usefulness and ease of use. TAM has been applied extensively in the context of information technology adoption and is also used as our overarching theory for m-commerce adoption. In this context, perceived usefulness captures the perceived benefits associated with using m-commerce; while ease of use reflects the perceived efforts in using m-commerce. Consistent with the prior studies, we hypothesize that:

H₁: Perceived usefulness will have a positive effect on the individual's intention to adopt m-commerce.

H₂: Perceived ease of use will have a positive effect on the individual's intention to adopt m-commerce.

H₃: Perceived ease of use will have a positive effect on perceived usefulness.

According to the theory of reasoned action (TRA) (Fishbein and Ajzen 1975), behavioral intentions are formed based on the individual's attitude towards the behavior and on perceived subjective norms. Attitude reflects the individual's feelings of favorableness or un-favorableness towards performing a behavior. Subjective norms capture the individual's perceptions of the influence of significant others (e.g., family, peers, authority figures, and media). Ajzen and Madden (1986) developed the TRA further into the Theory of Planned Behavior (TPB) by adding the construct of "perceived behavioral control" as a determinant of both intention and behavior. TPB allows the prediction of behaviors over which people do not have complete volitional control. Self-efficacy reflects perceptions of internal constraints or an individual's estimate of his/her ability to cope with a situation, and outcome expectancy. It is an integral component of perceived behavioral control. Accordingly, we hypothesize that:

H₄: Subjective norms will have a positive direct effect on the individual's intention to adopt m-commerce.

H₅: Self-efficacy will have a positive direct effect on the individual's intention to adopt m-commerce.

Recently, considerable research has been done to explore the role of subjective norms and perceived behavioral control in TAM. Subjective norms have been identified as a major predictor for perceived usefulness (Venkatesh and Davis 2000); while computer self-efficacy has been proposed as an important determinant of ease of use (Venkatesh and Davis 1996). According to Venkatesh and Davis (2000), the direct effect of subjective norms on perceived usefulness is realized through the internalization process whereby people incorporate the important referents' opinions into their own belief structure, especially when usage is voluntary. Using m-commerce is usually voluntary and in public, making the effect of subjective norms on perceived usefulness more salient. Therefore, we hypothesize that:

H₆: Subjective norms will have a positive effect on the individual's perceived usefulness of m-

commerce.

Davis et al. (1992) argue that perceived ease of use is related to feelings about self-efficacy. Self-efficacy refers to individual's judgment of his/her ability to use the technology effectively (Bandura 1991). Prior to direct experience with the target technology, individuals anchor -specific perceived ease of use of a new technology to their general beliefs regarding other technologies and their use (Venkatesh 2000). The causality between self-efficacy and ease of use has been demonstrated in several studies. For example, Venkatesh and Davis (1996) examined six different systems and their findings support the hypothesis that an individual's perception of a particular system's ease of use is anchored to his/her general computer self-efficacy at all times. Agarwal et al. (2000) further distinguished between general computer self-efficacy and application-specific self-efficacy. Their results showed a stronger relationship between specific computer self-efficacy and ease of use. Consistent with prior studies, we hypothesize that:

H₇: An individual's perceived self-efficacy will have a positive effect on perceived ease of use.

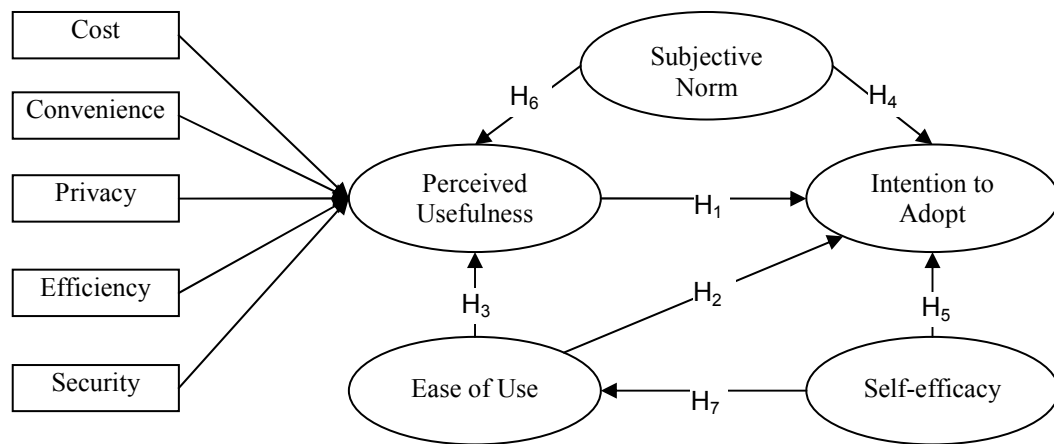


Figure 1. Theoretical Model

Figure 1 presents our research model. As recommended by Ajzen (1991), researchers to consider salient beliefs that are specific to the context, as it is only at the level of specific beliefs that we can learn about the unique factors that induce one person to engage in the behaviour of interest. He further argued that these salient beliefs must be elicited from the respondents themselves, or in pilot work from a sample of respondents that is representative of the research population. Accordingly, we identify specific considerations that constitute the perceived usefulness of m-commerce through belief elicitation process which will be explained in the methodology section. Five factors, i.e., cost, convenience, privacy, efficiency and security, were identified as the components of perceived usefulness.

3 METHODOLOGY

To test the research model, we conducted a cross-sectional survey study in Hong Kong which has one of the most vibrant mobile telecommunications markets in the world with a mobile phone service penetration rate of 96% in 2003². A questionnaire was developed, pre-tested and then administered to a random sample of mobile service subscribers. Out of 220 distributed questionnaires 202 were returned. Giving gift coupons to the respondents helped obtain such a high response rate (over 91%). All targeted participants had mobile phones but had not adopted any m-commerce service yet, as

² <http://www.cecid.hku.hk/downloads/pastevents/eReadiness%20of%20HK.pdf>

verified in the survey itself. The demographic profile of the respondents is described in Table 1. The mobile devices of most participants (77.2%) were not Wireless Application Protocol (WAP) enabled. ANOVA was used to test the gender and age differences and no significant results were observed.

Mobile phones	WAP Enabled	22.8%
	Without WAP	77.2%
Gender of respondents	Male	53.5%
	Female	46.5%
Age of respondents	18~30	63.8%
	31~40	32.7%
	>40	3.5%
Educational background of respondents	Undergraduate	49.5%
	Graduate	50.5%
Years of experience with Internet	0-2 Years	24.8%
	3-4 Years	48%
	>4 Years	27.2%

Table 1. Demographic profile of respondents.

3.1 Measures

The specific considerations that constitute the perceived usefulness of m-commerce were identified through a belief elicitation process and used them as formative measures for perceived usefulness. An online belief elicitation process was conducted with forty mobile device users who had not adopted m-commerce. The selected subjects were invited to participate in asynchronous online focus group discussions. They were asked to specify the perceived usefulness of using m-commerce. Based on the results of the belief elicitation process, we ended up with five major factors that across different m-commerce services, i.e., cost, convenience, privacy, efficiency and security. The other theoretical constructs were operationalized using validated scales from prior research. Measures for perceived ease of use were adapted from the scales developed by Davis (1989) and Davis et al. (1989). The measurement of subjective norms and behavioral intention were adapted from the scales used by Taylor and Todd (1995). Self-efficacy was measured with the scales adapted from Marakas et al. (1998). To control for the m-commerce product effect, all items were tailored into one widely provided service, m-payment. This service can be supported regardless of availability of WAP.

3.2 Data Analysis

The analysis of the data was done in a holistic manner using the Partial Least Squares procedure (PLS), because it allows for the simultaneous usage of reflective and formative measurements and is able to model latent constructs under conditions of non-normality and small to medium sample sizes (Chin et al. 2003). We conducted tests of significance for all paths using the bootstrap re-sampling procedure (Cotteman and Senn 1992) and the standard approach for evaluation that requires path loadings from construct to measures to exceed 0.70. For checking internal consistency, we relied on composite reliability measures (ρ) and on the average variance extracted (AVE) as suggested by Fornell and Larcker (1987). We tested the discriminant validity by comparing the square root of the AVE for a particular construct to its correlations with the other constructs (Fornell and Larcker 1987) and by examining cross-loadings of the constructs.

4 RESULTS AND DISCUSSION

We relied on Harman's single-factor, a widely used method, to check for common method variance that may threaten the internal validity (Podsakoff and Organ 1986). According to this approach,

common method variance is present if a single factor accounts for the majority of the covariance in the dependent and independent variables. An exploratory factor analysis did not reveal any dominant factor, implying that common method variance was not a problem in this study.

4.1 Measurement Model

The measurement model for reflective constructs was assessed by examining internal consistency as well as convergent and discriminant validities (Hulland 1999). As indicated in Table 2, the composite reliability scores of the reflective constructs (ρ) exceeded the threshold of 0.70, indicating internal consistency (Nunnally 1978). The AVE scores for the four reflective constructs were much higher than the generally recognized cutoff value of 0.5, demonstrating convergent validity. In addition, all reflective items were significant at the 99% level with high loadings (all above 0.70), providing additional evidence for convergent validity (Barclay et al. 1995). In the case of formative measures, the weight of each item was used to assess the significance and the magnitude of items contributing to the overall factor. All five measures of perceived usefulness were found to significantly contribute to the formation of the construct (see Figure 2). Table 3 presents the discriminant validity statistics. The square roots of the AVE scores (diagonal elements) were all higher than the correlations among the constructs, demonstrating discriminant validity. Furthermore, all items loaded higher on their respective constructs than on others, providing additional support for discriminant validity.

Measurements	Loadings	Std. Error	T-Stat.
Item1	0.882	0.016	55.61
Item2	0.908	0.013	72.07
Item3	0.911	0.013	68.54
Item1	0.789	0.038	20.54
Item2	0.896	0.017	52.39
Item3	0.899	0.013	68.01
Item1	0.873	0.027	32.34
Item2	0.675	0.080	8.43
Item1	0.760	0.051	14.97
Item2	0.888	0.013	63.79

Table 2. Measurement model.

	I	SN	SE	EU
Intention to Adopt(I)	0.901			
Subjective Norms (SN)	0.661	0.863		
Self-Efficacy (SE)	0.649	0.650	0.780	
Ease of Use (EU)	0.651	0.753	0.623	0.826
Diagonal elements are square roots of the AVE.				

Table 3. Correlations between latent constructs.

4.2 Structural Model

The results for the PLS analysis of the structural model are presented in Figure 2. The path coefficients are specified next to the corresponding links between the various constructs (oval shapes) and the weights of specific perceived consequences are specified above the associated formative items (rectangles). The model explained 61.7% of the variance in m-commerce adoption intention, providing a good explanatory power. Except for the hypotheses 2 & 4, all other hypotheses were supported.

Perceived usefulness was found to be the most important factor for predicting behavior intention with a significant path coefficient of 0.516. This implies that the individual's adoption decision is mainly determined by the utilitarian values associated with m-commerce. Such utilitarian values are derivatives of the technology characteristics. The effect of subjective norms on behavioral intention was found to be fully mediated through perceived usefulness, providing additional support for TAM's underlying assumption. With a significant path coefficient of 0.468, subjective norms constitute an important factor influencing perceived usefulness, which was realized through internalizing the social influences into the user's own usefulness perceptions, and/or identification (relying on using m-commerce to conform to a certain image). The insignificant direct effect of subjective norms on behavioral intentions can be explained by the voluntary nature of m-commerce usage (e.g., Davis et al. 1989; Venkatesh and Davis 2000).

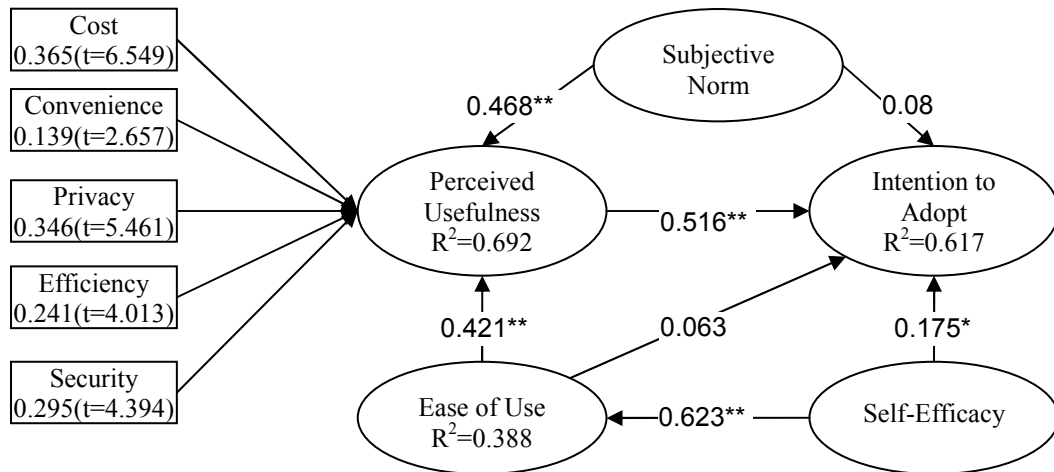


Figure 2. Structural Model

Prior studies based on TAM did not examine the direct link from self-efficacy to behavioral intention assuming the full mediation of perceived ease of use (e.g., Venkatesh 2000). Others reported partial mediation (e.g., Yi and Hwang 2003). Our study, on the other hand, suggests that when self-efficacy was included in the model, the direct effect of ease of use on intention was no longer significant, an important deviation from TAM. Only the indirect effect, mediated through perceived usefulness ($\beta=0.421$; $p<0.01$) remained. Such results provide strong support for our integrative approach, i.e., augmenting the TAM model with the self-efficacy construct proposed by the TPB.

The examination of the weights of the formative measures of perceived consequences reveals important drivers for m-commerce adoption. Price/cost was perceived to be the most important driver of m-commerce adoption, with a weight of 0.365 ($p<0.01$). The price of m-commerce services seems to be of utmost importance to potential adopters. An implication of this result is that m-commerce providers need to pay particular attention to their pricing strategy. The second important driver was privacy with a weight of 0.346 ($p<0.01$). The issue of privacy is more salient in m-commerce than in e-commerce, as mobile service providers have access to more sensitive information related to personal interactions (e.g., phone calls and SMS) and physical location (e.g., global positioning system). With more private information exposed to service providers, m-commerce customers require more assurance of privacy protection and more control over the information that can be released. As personal information is important for delivering customized/personalized services, some individuals may be willing to give up more privacy than others. Since privacy protection seems to be critical for potential adopters, m-commerce providers should give strong assurances of privacy and more importantly empower their customers with more control over the level of privacy exposure. Several online-privacy principles that are relevant to m-commerce are summarized in (Coursarls et al. 2003). Although not as important as cost and privacy, security (0.295; $p<0.01$) and efficiency (0.241; $p<0.01$) had significant effects with moderate magnitudes. The significance of security indicates that potential

adopters of m-commerce are concerned about the safety of exchanged information regardless of the level of privacy involved. In addition to e-commerce security measures associated with data transmission (e.g., encryption) and storage (e.g., firewalls), mobile commerce security should also include mobile devices, which can store highly sensitive data. This necessitates good mechanisms to authenticate a particular user to a particular device (Ghosh and Swaminatha 2001). Additionally, efficiency of navigation and efficiency of transaction processing are important for e-commerce applications in general (Limayem et al. 2000). Navigational efficiency, however, is particularly important for m-commerce, as the restrictive visual interface is usually regarded as a major impediment for m-commerce adoption (Lee and Benbasat 2003). One way to address this challenge is to leverage multi-media input/output components, e.g., speech interfaces (Fan et al. 2005). Finally, convenience (0.139; $p < .05$), although with the smallest magnitude, was nonetheless significant. Although e-commerce in general is claimed to break the temporal and geographical barriers, it is only m-commerce that is truly anytime and anywhere. In addition to those location-based services, Dholakia et al. (2003) further suggest that m-commerce can be customized based on users' prescribed or self-ascribed roles (professional and on duty, or private and off duty) and the stance (in terms of time commitment and busyness).

5 CONCLUSION AND IMPLICATIONS

This study is motivated by the contradiction between the high penetration rate of mobile devices and the low adoption rate of m-commerce. To understand the drivers for m-commerce adoption, we extend the TAM model by incorporating the direct and indirect effects of two TPB constructs, i.e., subjective norms and self-efficacy. We also use formative measures for perceived usefulness to account for the specificity of the artifact. Based on the belief elicitation process suggested by Ajzen (1991), we identify five expected benefits that are perceived to be important by potential m-commerce adopters, i.e., cost, convenience, privacy, efficiency and security. We tested the research model with a survey study involving 202 mobile device users who had not adopted m-commerce yet. The empirical results indicated an important role of perceived usefulness and self-efficacy in influencing intentions to adopt m-commerce. The full mediation assumption of TAM was empirically valid only for perceived usefulness. Both subjective norms and self-efficacy are confirmed as important additions to TAM. Furthermore, all identified consequences are significant, revealing specific drivers of m-commerce adoption.

This research entails important theoretical and practical implications. On the theoretical side, we demonstrate the need to develop TAM further by including the effects of social influence and individual characteristic variables. TAM postulates that perceived usefulness and ease of use fully mediate such variables. Our study demonstrates the need to include self-efficacy, as its effect on intention does not seem to be fully mediated by ease of use in the context of m-commerce. Future research is needed to elaborate further possible contextual contingencies that affect the explanatory power of TAM and the TPB.

We also show the usefulness of accounting for the specificity of the IT artifact in general and m-commerce applications in particular. Perceived usefulness encompasses pragmatic considerations that may influence the individual to adopt or not adopt the behavior. Knowing that a user who believes in the usefulness of using m-commerce is more likely to adopt it is not sufficient, as it provides little guidance for system development and deployment. We still need to drill down to understand the significance and relative importance of specific characteristics of the artifact from the stakeholders' perspective. In this study, we account for the specificity of the IT artifact by decomposing perceived usefulness into specific considerations that are relevant to m-commerce adoption. Such an approach presents a major advantage. Indeed, the significance and magnitude of the formative measures show which characteristics of m-commerce are adoption drivers.

The results of our research also entail important practical implications. By identifying the major driver for m-commerce adoption, our results can help managers to prioritize their m-commerce initiatives and to allocate resources accordingly. Furthermore, the specific consequences identified through the belief elicitation process and validated through the empirical study provide important guidelines for

m-commerce providers. For instance, potential adopters of m-commerce are highly sensitive to the issues of cost and privacy. Such results imply that m-commerce providers need to reduce transactional costs, increase the flexibility of their pricing schemes, and protect users' privacy and account for such factors in developing their marketing strategy.

Although our findings strongly support the proposed model, there is still room for improvement and further investigation. Our study should be replicated in different contexts for further validation and exploration of possible moderating effects. For instance, the relative importance of specific usefulness factors may vary for different m-commerce services. Future research should also follow a longitudinal approach and investigate the relationship between intention and actual behavior.

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