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ABSTRACT

Consumer use of mobile payment technologies will have a great impact on the future of mobile commerce industries. This study identifies important factors influencing individual adoption of mobile payment technology. In finding the factors, this study extends previous studies' intention-based perspective by determining technology anxiety's moderating role in the intention-adoption relationships and includes technological and social perspectives.

Keywords

Mobile payment technology, IT adoption, TAM, technology anxiety, m-Commerce, mobile services

INTRODUCTION

Mobile commerce (m-commerce) is one of the rapidly expanding electronic commerce areas and is expected to be the second largest industry in the world by 2010 (Rao, 2000). In addition to the current voice and data-centric services, the emerging m-commerce could include mobile financial services, mobile advertising, proactive service management, location-based services, mobile auction, mobile entertainment services, and wireless data center applications (Varshney, 2003). However, m-commerce activities cannot survive without proper mobile payment (M-payment) support. M-payment is a point-of-sale payment made through a mobile device, such as a cellular telephone, a smartphone, or a personal digital assistant (PDA). Using M-payment, a person with a wireless device could pay for items in a store or settle a restaurant bill efficiently and without interacting with any staff member. The mobile payment is expected to determine the global payments landscape for years to come (Viner, 2001).

Traditional payment technologies for eCommerce, such as credit cards, store-valued card, or electronic cash, require a number of steps to complete, including payment authorization via the company's or third-party websites (Dutta, et al., 2003). The introduction of M-payment technologies provides customers alternative payment methods and processes. The changes in payment processing will influence consumers' purchase behaviors (Soman, 2001). More customers tend to use these M-payment technologies, especially for small cash transactions (micro-payments) such as transit fares or vending machines (Varshney, 2003; Mobinet5). The resulting use of M-payment technologies also impacts m-commerce companies' business practices and their performance.

This paper identifies the factors influencing the user's adoption of M-payment technologies. We extend the current intention-based model and include technological and social perspectives.

BACKGROUND

Numerous information technology (IT) adoption studies have employed intention-based models to explain how users decide to adopt a particular IT. These intention-based models have focused on individual characteristics to explain individual IT adoption behaviors, and intention is regarded as the sole determinant of individual IT adoption (von Heijden, 2003; Limayem, 2003). TAM-based studies theorize that perceived usefulness and perceived ease of use are important determinants of an individual's intention to use IT (Davis, 1989), and a significant body of research has accumulated empirical support to show that it plays a critical role in predicting and determining an individual's technology adoption behavior (Venkatesh, 2000; Venkatesh and Davis, 1996).

However, these TAM-based studies have also been criticized for their simplicity and lack of emphasis on attitudes (Legris, at al., 2003; Tylor and Todd, 1995). In response, researchers have extended their search for factors that influence intentions with empirically tested models. Straub and Keil (1997) tested TAM on different cultural backgrounds, while others tested factors such as computer self-efficacy (Venkatesh and Davis, 1996), gender (Gefen and Straub 1997), and habits (Gefen, 2003) on TAM. These intention-based IS adoption studies explain over 40 percent of the variance to individual actual use technology (Venkatesh, et al., 2003), but they also have been criticized for disregarding some significant factors influencing intention and individual IT adoption behavior (Legris, et al., 2003; Wang and Butler, 2003).

Others view intention as one of several important determinants of individual IT adoption, widening the search beyond the individual characteristics by identifying technological, social, and economic factors (Chou, et al., 2002; Wang and Butler, 2003). In unifying the existing IT adoption-related research, Venkatesh, et al. (2003) found that facilitating conditions have a direct relationship to behavioral usage. Thompson, et al. (1994) also identified several factors that have direct relationship with the use of IT.

Based on Thompson, et al.'s (1994) and Venkatesh, et al.'s (2003) extended views and other supporting studies, we identify four factors that directly influence or moderate other factors' influence on individual adoption of M-payment technology.

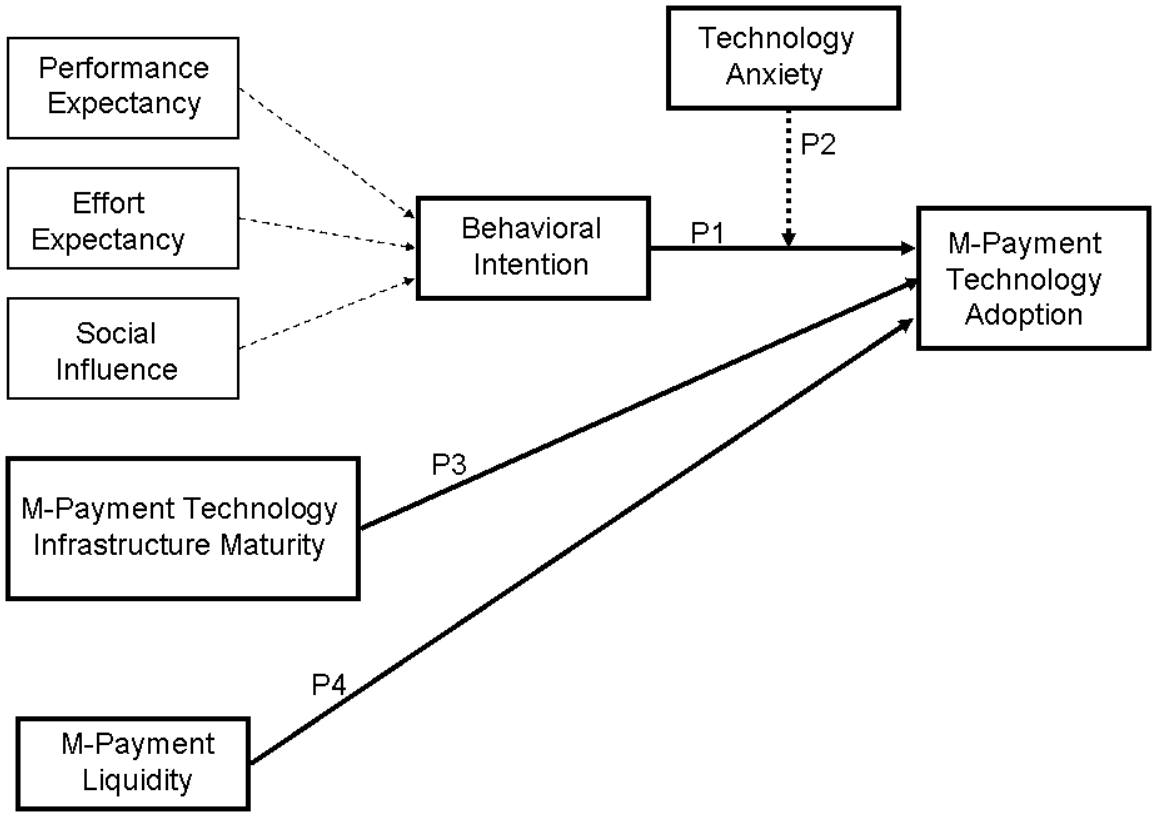

Figure 1. Research Model

Adapted from Venkatesh, V., Morris, M., Davis, G., and Davis, F. "User acceptance of information technology: Toward a unified view," MIS Quarterly (27:3) 2003, pp 425-478.

RESEARCH MODEL AND PROPOSITIONS

The four factors identified as influencing actual individual M-payment technology adoption decisions, based on previous research, include the individual's intention to adopt the technology, which is modified by the individual's anxiety about

technology. Further, the state and maturity of M-payment technology infrastructure and the overall liquidity of M-payment systems will impact adoption decisions. Figure 1 illustrates the overall research model.

Behavioral Intention

Behavioral intention is presumed to play a critical role as a determinant of actual adoption behavior in the IS reference disciplines and in IS research itself (i.e. Davis, 1989; von Heijden, 2003; Limayem, 2003), and we expect that behavioral intention will have a significant positive influence on mobile payment technology adoption.

Proposition 1: Behavioral intention positively influences mobile payment technology adoption.

Behavioral intention to adopt M-payment technologies may itself also be influenced by numerous other factors, some of which are illustrated in Figure 1. The influence of social norms, such as socio-cultural rules, and the expectations and opinions of family and friends may also generate a significant influence on an individual's behavioral intent to adopt any particular technology, as with M-payment technologies.

Technology Anxiety

To solve the discrepancy of the intention-adoption relationship, one stream of research has adopted technology anxiety as another predictor of technology adoption (Meuter, et al., 2003). The technology anxiety construct was expanded from computer anxiety, which is characterized by "excessive timidity in using computers, negative comments against computers and information science, attempts to reduce the amount of time spent using computers, and even the avoidance of computers from the place where they are located" (Doronina, 1995). Technology anxiety is defined as an individual's tendency to be uneasy, apprehensive, or fearful about the current or future use of a technology (Parasuraman, et al., 1990; Allen, 2002). Technology anxiety also relates to users' general perceptions of IT use and has negative effect on the adoption (Venkatesh, 2000). A significant body of research in IS has highlighted the importance of technology anxiety by demonstrating its influence on intention (Elasmar and Carter, 1996; Hackbarth, et al., 2003; Verplanken, et al., 1997) and on IT adoption (Meuter, 2003, Parasuraman and Igbaria, 1990; Igbaria and Charkabarti, 1990). However, others have found little relationship between technology anxiety and intention in adoption (Allen and Parikh, 2002; Venkatesh, 2003).

Even though younger people are gaining greater exposure to technologies, technology anxiety is fairly common to all ages of users (e.g., Williams, 1994). Users have higher levels of anxiety for newer technologies and payment-related technologies (Plouffe, et al., 2001), even when they can see clear benefits. For example, many bank customers still prefer making deposits by placing checks into bank tellers' hands though a nearby ATM may be more convenient.

Technology anxiety is related to an individual's emotional feeling about new technologies. Users generally overcome their initial anxious feelings and develop favorable perceptions as they become familiar with technologies (Hackbarth, et al., 2003). However, when individuals have less experience with a new technology, they are expected to rely upon their general beliefs regarding technologies and technology use and, therefore, their attitude may be highly anxious. Individuals with higher technology anxiety tend to automatically avoid the use of a particular new technology (Aarts, et al., 1998).

Since M-payment is new and because it is also explicitly a payment-related technology, there initially exists a higher level of technology anxiety about its use, though levels of such anxiety vary among users. Further, the individual's level of technology anxiety influences his or her habitual behavior to use IT. Based on the results from a person's inherent perceptions, such as habits in technology use which dilute the power of intention (Verplanken, et al., 1997), technology anxiety can be considered as playing a moderating role in the intention-adoption relationship by guiding individual intention to use a technology. Therefore, technology anxiety weakens the relationship between intention and the adoption of M-payment technology.

Proposition 2: Technology Anxiety negatively moderates intention to adopt mobile payment technology

M-Payment Technology Infrastructure Maturity

M-payment technology infrastructure maturity is defined as the degree to which technical infrastructure exists to support use of M-payment technology (Venkatesh, et al., 2003). According to Venkatesh, et al. (2003), M-payment technology infrastructure includes technological capabilities designed to remove barriers to use (such as wireless infrastructure). The capabilities of wireless devices will determine the type and frequency of M-commerce (Shim and Shim, 2003). Countries

such as South Korea and Japan possess well-developed wireless infrastructure, and are enjoying the rapid growth of M-commerce with high participation rates. Since M-commerce operates in open networks, the technical provision of security is an important aspect of the infrastructure (Chou, et al., 2002). In fact, security failures reduce users' trust in M-payment technologies and hinder the adoption of these technologies.

The existence of M-commerce applications is another important M-payment infrastructural factor. M-commerce applications provide users tools and the interface to make mobile micro-payments. These applications support users in easily completing mobile transactions, and enable the consumer to spend, store, and transport a currency value. They also should support the completion of such payments, as well as providing payment acknowledgement and payment proof. They must be available 24 hours a day and 7 days a week. When M-payment technology infrastructure provides these capabilities, individuals will feel more confident in using the M-payment technologies and, therefore, there will be higher actual adoption rates.

Proposition 3: The maturity of M-payment technology infrastructure positively influences mobile payment technology adoption.

M-Payment Liquidity

M-payment liquidity refers to the number and type of concerned economic agents who accept and use M-payment technologies (Chou, et al., 2002; Panurach, 1999). One of important feature of e-commerce technologies such as electronic payment system, electronic data interchange (EDI), and supply chain management is that multiple groups must jointly adopt the system in order for it to succeed (Plouffe, 2001). Mobile payment systems especially require the participation of at least one financial institution (3rd party) in addition to payers and payees. Therefore, the adoption of a payment system that represents a certain financial network is dependent on the number of participants in the system – the greater the number of participants, the greater the payment method's utility to each member of the network. This is so-called positive network effect (Katz and Shapiro, 1994). As use of such payment schemes becomes more widespread, network effects increase the utility of the scheme for users (Neuman and Medvinsky, 1995). Customer survey data consistently show that widespread acceptance of the system by its participants is a very important factor in payment adoption (Panurach, 1999).

In addition to the number of participants, the type of products and services providers also has impact on the adoption of M-payment technologies. The Mobinet5 survey shows that more than 40 percent of mobile phone users want to use their mobile phones for small cash transaction such as transit fares or vending machines. Well-established small transaction market for mobile transactions in addition to various service providers and content providers are essential to reach high actual usage rate. The demand for mobile services need not be driven solely by needs ('pull'), and it can actually be accelerated by creating a perceived need or interest with marketing. (Kearney). The small amount of charge on the episode of the soap of SBSi, a Korean Broadcast company, and mobile transportation pass in Korea show the positive impact of creating need to actual usage of mobile payment (e.g., DTI, 2002). Therefore market liquidity of mobile payment implies that customers use it because most sellers accept it.

Proposition 4: The level of M-payment liquidity positively influences mobile payment technology adoption.

METHODOLOGY

To test these propositions, a study of perceptions by current M-commerce users will be conducted. The data will be collected from mobile service users in the age group of 20 to 40 in metropolitan cities of South Korea and the U.S. Two metropolitan cities for each country in which high penetration rates of the mobile Internet service had been reported were chosen for this survey. Seoul and Taegoo will represent South Korea, and Boston and Washington, D.C. will represent the U.S.A. A survey of two metropolitan cities in South Korea will be conducted in two "sister universities" (of the authors' US institution) in South Korea in the summer of 2004 with a survey of about 200 undergraduate and graduate business students. The data for the U.S. will be collected using a similar convenience sampling method, from two urban universities with student populations that subscribe to mobile services. Except for any culturally-determined differences, the samples will have comparable characteristics, such as age, income, and education.

A current search of existing instrument items will identify validated items that may be adapted for this study, and complete details of the instrument will be presented at the conference. Higher levels of actual adoption are expected (in 2004) in South Korea than in the US, due to that country's lead in implementing the required systems. Behavioral intent measures will be adapted from a plethora of published TAM-related research articles. Similarly, items to measure technology anxiety will be

adapted from existing literature. In addition, proxy measures for M-payment technology infrastructure maturity and for M-payment liquidity will be established, using high-quality third party (existing) data concerning the "state-of-the-art" of the technological environment and of M-payment liquidity, as reported by industry and government sources.

This instrument will be pilot tested, then validated, and the eventual precise research hypotheses will be tested to establish greater understanding of the role of consumer's perceptions of these key variables in determining the overall success of M-payment systems.

CONCLUSION AND IMPLICATIONS

As mobile commerce becomes rapidly growing business activity, industries begin to introduce their customers to new payment methods using mobile payment technologies. This study identifies important factors influencing individual adoption of mobile payment technology. In finding the factors, this study extends previous studies' intention-based perspective by determining technology anxiety's moderating role in the intention-adoption relationships and includes technological and social perspectives. The goal of this study is to highlight the importance of mobile payment technology, provide a foundation built on IT adoption research, and provide a theoretical basis for future research on individual adoption of mobile payment technologies. Through this foundation, the scope of IT adoption models can be extended and empirically tested to better enable IS researchers and practitioners to understand the interplay of individual, technological, and social factors in the use of IT.

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