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Diffusion of Innovation in Asian: A Study of Mobile NFC (Near Field Communication) Payment in Korea and Thailand

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Abstract: *The NFC technology implemented on the base of contemporary mobile handsets can provide considerable benefits to end-users. However, despite high level of diffusion of mobile phones in Asia, the level of penetration of the NFC based mobile payment is low. A considerable number of trials have been initiated; however, large-scale deployment of commercial NFC services cannot be seen. This study examined the possible attributes of innovation that contribute to the adoption of innovative mobile banking services in Korea and Thailand. Diffusion of Innovation theory was utilized to study Korea and Thailand using NFC payment banking customers living in several regions of the two countries. The attributes of innovation, used for this investigation, were complexity, compatibility, relative advantage and perceived status benefits. The results reveal that only complexity had a negative relationship with intention to adopt innovative Internet banking both in Thailand but not a barrier with Korea, while other attributes of innovation show a positive relationship. Several marketing related recommendations are offered for improving the success rate for the adoption of NFC payment in both Korea and Thailand*

Keywords: *NFC (Near Field Communication), Diffusion of innovation, Korea, Japan, mobile payment.*

1. INTRODUCTION

In the past, shopping has often been associated with either cash or credit card payment. As mobile phone technology becomes more sophisticated, new forms of payment have since emerged within the mobile payment theme. Generally, mobile payment refers to the ‘‘payments for goods, services, and bills with a mobile device such as mobile phone, smart-phone, or personal digital assistant by taking advantage of wireless and other communication technologies’’ (Dahlberg et al., 2008, p. 165). Regardless of the definition, mobile payment is viewed as an alternative to the old fashioned credit card. As mobile commerce continues to gain popularity, mobile payment will eventually play an important role to facilitate transactions between consumers and merchants (Ondrus and Pigneur, 2007). The innovation within mobile payment has grown rapidly over the last decade with the introduction of various payment methods such as Wireless Application Protocol, Unstructured Supplementary Service Data, short messaging services, and General Packet Radio Service. While each individual mobile payment method provides flexibility and convenience, they are still not ideal when viewed from the traditional payment context (Chen et al., 2010). This is because the traditional mobile payment solutions are not easy to use (Ondrus and Pigneur, 2007). Leavitt (2010), for example describes the tedious process in keying in credit card numbers on the limited physical keyboards. Lee (2004) opines that for an innovation to be regarded as truly mobile, the transactions should not only take place in the virtual world but with any mobile device in a physical world. Taking into consideration of the current limitations within the traditional mobile payment solutions, this study focuses specifically on mobile credit card as another form of mobile payment. Mobile credit card in this context is referred to as a contactless credit card payment using a mobile phone with the aid of the Near Field Communication (NFC) technology. In this case, physical connection between consumer payment and the terminal reader is not required since transactions can be conducted with a simple touch or wave.

The number of smartphones is currently increasing rapidly in Asia. In addition to voice and data connectivity services, the mobile phones are used for other services. The Near Field Communication (NFC) is one of the most promising technologies able to extend capabilities of mobile phones and to enrich consumers’ experience by simplifying their everyday activities. Application of NFC in mobile payments is highly attractive because of a range of additional services like mobile ticketing, client

loyalty applications, smart advertisement, physical and logical access, and mobile wallet. This means a considerable added value for both commercial companies and end users. With the rapid diffusion of the mobility trend, banking in cyberspace is fast becoming an alternative channel to provide banking services and products. Unfortunately, the customer adoption level of NFC mobile payment service has not been very high for most banks in Korea and Thailand. Many pilot projects are being implemented all over the Asia. The most usual NFC applications are mobile payment and mobile public ticketing. In general, the consumers tend to accept these services positively. However, only a few pilots get continuation as commercially deployed services. Despite the potential added value services, a big number of pilots, and available technology, the level of NFC mobile service penetration in Asia is not very high. The main question that will be investigated in this study is: What are the factors influencing the slow rate of penetration of NFC based mobile payment in Asia?

The NFC industry is relatively new, and literature related to NFC is mainly fragmented and focused either on specific technical or specific business model issues, or on issues related to technology acceptance by consumers. In addition, many studies are focused on the analysis of successfully implemented NFC cases leaving the analysis of obstacles out of their scope. The major contribution of this study is an attempt to provide a holistic view of the obstacles slowing down the spread of the NFC payment in Asia.

2. THEORETICAL BACKGROUND AND RESEARCH MODEL

2.1. Overview of NFC-Aided Mobile Credit Card

NFC has been regarded as the future of mobile payment services (Ondrus and Pigneur, 2007). Initially, the payment method was carried out for VISA and MasterCard Paypass program (Pasquet et al., 2008). Ruijun and Yao (2010) remarked that NFC can transfer data either in active or passive modes via a short range high frequency wireless communication technology. The operational distance under passive mode is 10 cm, while the inactive mode is 20 cm (Chen et al., 2010). Hence, the NFC technology enables transactions to be conducted merely by holding a mobile phone within the range of the NFC reader. The technology has since been adopted in USA, Canada, Hong Kong, Korea, Japan and Taiwan (Chen and Chang, 2011; Pope et al., 2011).

Bank Wallet is the brainchild of Korea Financial Telecommunications and Clearings Institute (KFTC) a Korean interbank clearinghouse. Storing account holder credentials on the SIM card, the Bank Wallet solution and accompanying smart phone app allows users to conduct mobile payments and P2P money transfers. Also on board is SK Telecom, a mobile operator who maintains South Korea's largest number of subscribers. SK Telecom is offering the Bank Wallet NFC solution from launch; while KT the country's second largest mobile operator has revealed plans for an April launch. In addition to in-store NFC payments, the Bank Wallet app can be used to make online purchases putting a number of local retailers on alert. In fact, the Shinsegae department store chain, Emart convenience stores and the Daegu chain of department stores are all signing up for Bank Wallet. According to KFTC, there are plans to expand Bank Wallet to include support for credit cards, membership cards and coupons, as well as cash-withdrawal, account transfer and bill pay functions.

Kasikornbank, Thailand's second largest bank, and Advanced Info Services (AIS), the country's largest telecommunications operator, have partnered with Gemalto to introduce NFC services in Thailand. Gemalto is supplying the two companies with Trusted Service Management services for the project via its TSM centre in Taiwan and is responsible for managing and preparing Kasikornbank customer data for over-the-air (OTA) personalization and provisioning services. As a first step, selected Kasikornbank customers have been invited to collect an NFC phone from their local bank and begin testing out the NFC service. Thailand state-owned telecommunications provider TOT has unveiled the launch of an near field communication (NFC) mobile payments service in Thailand in 2014.The new Just Pay service is set to include a mobile wallet, an mPOS solution and a web-based mobile customer relationship management (CRM) platform. Moreover, the mobile wallet service is set to allow users to store their payment cards to pay for utility bills and access other products and services such as promotional and discount offers from participating retailers, while the tablet-based mobile point of sale (mPOS) solution is set to allow consumers to pay retailers by tapping their phone against an NFC reader attached to the device.

2.2. Hypothesis Formulation

The DOI theory is based upon the key dimensions of diffusion, which are communication channels, innovation, social system and time. Rogers (2003) introduced the DOI model which encompasses five constructs, i.e., relative advantage, compatibility, complexity, observability and trialability. Relative advantage is similar to PU while complexity is similar to PEOU. Compatibility refers to the level in which innovation is believed to be in agreement with the present values, past experiences and the needs of prospective users. Trialability is described as the degree in which a new invention can be tested out on a limited time frame. This study was grounded in the diffusion of innovations theory and the attributes of innovation. This focuses on variables that influence the intention to adopt innovative NFC mobile payment for customers in Korea and Thailand. The attributes of innovation in this study consisted relative advantage, complexity, and compatibility (Rogers, 1995), perceived status benefits (Carolina Lopez-nicolas et al, 2008). These attributes were originally proposed in the Diffusion of Innovations theory (Rogers, 1983).

Perceived relative advantage refers to the degree to which an innovation provides more benefits than its precursor. Relative advantages manifests as increased efficiency, economic benefits, and enhanced status (Rogers, 1995). Moore and Benbasat (1991) found that perceived relative advantage of an innovation is positively related to the rate of adoption. Correspondingly, the potential of mobile banking reported obvious benefits such as immediate, convenient and affordable to customers (Laukkanen, 2007a). In general, when customers perceive clear advantages offered by mobile NFC payemnt, they are more likely to have a positive attitude toward adopting (or continuing to use) mobile NFC payment. The following hypothesis thus is proposed.

H1. The relationship between perceived relative advantage and attitude towards NFC payment innovations by Korea customers

H1-1 The relationship between perceived relative advantage and attitude towards NFC payment innovations by Thailand customers

Perceived compatibility is the degree to which an innovation fits the values, previous experiences and needs of the potential adopter (Rogers, 1995). Greater compatibility between individual needs and technological innovation is preferable, because it allows innovation to be interpreted in a more familiar context (Ilie, van Slyke, Green, & Lou, 2005). Perceived compatibility has been identified as the best perception-based indicator of attitude towards online transactions (Vijayasarathy, 2004). Therefore, this study expects that customers perceive mobile NFC payment as compatible with their lifestyle and preferences, and thus adopt a favorable attitude towards adopting (or continuing to use) mobile NFC payment. The following hypothesis is proposed.

H2. The relationship between perceived compatibility and attitude towards NFC payment innovations by Korea customers

H2-2. The relationship between perceived compatibility and attitude towards NFC payment innovations by Thailand customers

Taylor and Todd (1995) suggested that the different dimensions of attitudinal belief towards an innovation could be measured using the five perceived attributes (relative advantage, compatibility, complexity, trialability and observability) of the innovation. Tornatzky and Klein (1982) found that compatibility, relative advantage, and complexity had the most significant relationships with adoption across a broad range of innovation types. In the past, mobile devices were regarded as a luxury item, but now the perception of luxury is related more to the use of new mobile services than to the devices (N.Ngai, A. Gunasekaran, 2007). This could be true for advanced mobile services, where services like TV not only enhanced the customer's status. This also supports the hedonic benefits perceived by customers. Overall, this suggested that customers would have a more positive attitude towards mobile NFC payment innovations. Thus:

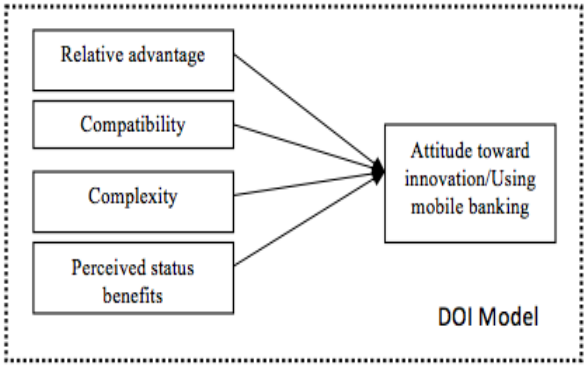
H3. The relationship between perceived complexity and attitude towards NFC payment innovations by Korea customers

H3-3. The relationship between perceived complexity and attitude towards NFC payment innovations by Thailand customers

H4. The relationship between perceived status benefits and attitude towards NFC payment innovations by Korea customers

H4-4. The relationship between perceived status benefits and attitude towards NFC payment innovations by Thailand customers

Several testable statements, or hypotheses, can be drawn from the theoretical framework. The proposal research model include three constructs of the individual differences (see Figure 1).



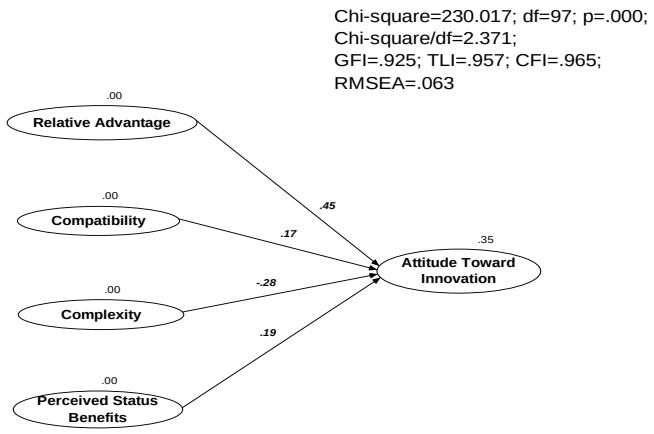
3. RESEARCH METHODOLOGY

Descriptive research and survey research technique were applied in Korea and Thailand separately for this study. In Korea, the data was collected by distributing the questionnaires to Internet banking customers of a leading private commercial bank in Korea. Three different sampling procedures were used to select the branch, number of customers and the actual customers. The data was collected from ten different branches in Seoul with 40 customers being selected from each branch (300 total respondents). This represented a diverse sample of the population of Seoul city.

In Thailand, the data was collected from 300 Thai customers who are using banking services in each of four regions of the country (central Thailand, northeast Thailand, northern Thailand, and southern Thailand). Likewise, the sample, selected from Thailand, represented a diverse group of banking customers from various geographic and demographic backgrounds. The questionnaire for this study consisted of six parts. The first part contained screening questions which confirmed that the right target population was chosen. In the second part, respondents were asked to rate their perceptions about the complexity. In the third part, respondents were asked to rate their perceptions about the compatibility. In the fourth part, respondents were asked to rate their perceptions about the relative advantage. In the fifth part, respondents were asked to rate their perceptions about the perceived status benefits. The method of a 7- point Likert scale was implemented, ranging from strongly disagree (1) to strongly agree (7). The last part consisted of close-end-questions for demographic factors.

4. RESULT

The results indicate that all most null hypotheses are rejected. Thus, there is a relationship between the attributes of innovation: complexity, compatibility, trialability, and relative advantage and the intention to adopt Internet banking service in India and Thailand.



A Structural Equation Model (SEM) was used to assess the theoretical model. SEM is a multivariate technique combining aspects of multiple regression and factor analysis to estimate a series of interrelated dependences relationships simultaneously. SEM provides researchers with a comprehensive and powerful tool for assessing and modifying theoretical model (Anderson & David, 1988). Basically, SEM can do two things. First, a series of separate, but interdependent multiple regression equations can be estimated simultaneously, which cannot be done in a single multiple regression. Second, SEM possesses the ability to represent unobserved concepts in the model and account for measurement error in the estimation process (Hairet et al., 2010).

The result of model fit (RMSEA, GFI, TLI, CFI, and Chi-square/df) indicates that the model is at acceptable fit (RMSEA <0.08; GFI, TFI, CFI> 0.90; Chi-square/df<3.0) (Hair et al, 2010). This indicates that the calculated measurement results are reliable for hypothesis testing.

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Attitude Toward_Innovation	<---	Relative Advantage	.363	.045	8.131	***	H1
Attitude Toward_Innovation	<---	Compatibility	.122	.035	3.443	***	H2
Attitude Toward_Innovation	<---	Complexity	-.200	.037	-5.442	***	H3
Attitude Toward_Innovation	<---	Perceived Status_Benefits	.179	.057	3.159	.002	H4

Detail Relationship:

Attitude Toward_Innovation	<---	Relative Advantage	.534	.047	9.245	***	H1	**Accepted**
Attitude Toward_Innovation	<---	Compatibility	.178	.036	3.514	***	H2	**Accepted**
Attitude Toward_Innovation	<---	Complexity	.055	.039	1.101	.271	H3	**Rejected**
Attitude Toward_Innovation	<---	Perceived Status_Benefits	.154	.056	2.408	.016	H4	**Accepted**

The positive relationship between perceived relative advantage and intention to use mobile banking mainly because they perceived the online system would enhance their efficiency in checking information and interact with banking service. The relative benefits perceived by the citizens is by using the mobile banking service, they would eliminate the need to visit the service provider by banking office. In short, it may include greater convenience and accessibility, reduced waiting time and faster response. Customers, who have more positive beliefs about the perceived relative advantage of mobile banking, formed more favorable attitude toward innovation mobile banking. If customers find mobile banking, they become more willing to use them to conduct banking transactions. Moreover, customer perceptions about the compatibility of mobile banking with their experiences, ability, and needs appear to be a predictor of attitude. This finding implies that customers who enjoy conducting mobile banking transactions may find mobile banking congruent with their lifestyle and preferences. Therefore, to keep and attract customers, it is imperative that mobile banking firms do not ignore the compatibility of mobile banking (and related services) with individual lifestyle and preferences.

The relationship between perceived complexity and intention to use mobile banking service can be explained as the more unfriendliness or uncomfortable of mobile-services provided by the bank. Citizens' willingness to use mobile banking service will be affected if the online system was perceived to be too complicated and difficult to understand and take too much time in checking security of information input or transfer money. Based on the analysis, complexity no influence on mobile banking service (CPL ---> AT, t =1.101, p > 0.05) that H3 not supported. This finding implies that customers feel complexity to use the system but for citizens, the complexity of mobile banking is not a barrier. It reflects the reality in Korea society existing. When customers using mobile banking, they are perceived value of advantage, compatibility and benefits more than complexity and that why mobile banking will boom in Korea very close time in the future.

5. CONCLUSION AND RECOMMENDATIONS

Based on the research findings, the perceived complexity of Internet banking services should be reduced as much as possible, so that the willingness to try and then adopt Internet banking will increase. The designers should pay attention to creating an easy-to-use system. It is essential to provide a well- designed web site to attract customers. The more complex that Internet banking is to understand and use, the slower will be its adoption rate. So banks must reduce the complexity so that it can draw more customers to Internet banking service.

From the research findings, compatibility has a positive relationship with the intention to adopt Internet banking. Therefore, banks should start advertising their Internet banking service to their existing customers who have Internet access. It would be wise for banks to promote the message that Internet banking is a safe and secure way to do transactions and that many types of financial transactions can be done through securely via the Internet. During the study many consumers reported that they felt that their transactions would be unsafe and vulnerable to misuse if they used Internet banking. Therefore, it is a high priority for banks to address these security concerns and to educate the customers about being secure Internet transactions.

Banks should also promote the advantages of using Internet banking. Some of the advantages of using Internet banking service include: saving time, anytime anywhere banking, tracking and getting accurate account details whenever they are needed. Customers will save time by reducing the trip to the banks. Customers will be able to do transactions even on bank holidays, weekends and night time. Thus, these advantages of the Internet banking service, relative to the traditional service, should be marketed effectively by the banks in order to increase the intention to adopt Internet banking service.

The most critical issue for the bank managers is to find out how to survive in the competitive market. The results of this study provide banker marketers in Korea and Thailand with a strategy for rethinking how to build, maintain, and enhance customer relationships, while promoting Internet banking to the mass market.

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