# What are the Core Drivers in Consumer Adoption of NFC-Based Mobile Payments?: A Proposed Research Framework

Thanh-Thao T. Pham, Jonathan C. Ho
College of Management, Yuan Ze University, Chung-Li, Taiwan

*Abstract*--**The rapid evolution of mobile technologies and the increasing diffusion of smartphones have given significant opportunities for innovative companies to create new payment solutions and offer value-added services to their customers. Near Field Communication (NFC) mobile payment has been emerging as a noticeable phenomenon that can enable consumers to *turn their smartphones into digital wallets.* Although there has been a lot of coverage on consumer acceptance of mobile payments, there are only few researches providing guideline to interpret NFC-based mobile payments adoption.**

**Taking into consideration of theoretical backgrounds of innovation diffusion and specific characteristics of NFC mobile payments, this study propose a research framework to provide a profound understanding of factors facilitating or impeding the adoption of NFC-based mobile payments among Taiwanese consumers. This study expects that intention to adopt NFC mobile payments is affected by product-related factors (perceived usefulness, perceived ease of use, compatibility, perceived security and privacy risk, trialability, perceived cost of use and additional value of NFC mobile payment), trust-based factors, personal-related factors (personal innovativeness in new technologies, absorptive capacity), and attractiveness of alternatives.**

**This study will be able to advance literature on innovation adoption and facilitate technology marketers in NFC mobile payments. It provides a useful guideline to help researchers investigate of issues related to NFC mobile payments. It also bring some managerial implications by assisting relevant parties in NFC mobile payments ecosystem such as mobile network operators, card issuers, payment processing institutions, bank decision makers and merchants when devising their business strategies and marketing campaigns to facilitate NFC mobile payments.**

## I. INTRODUCTION

### *A. Motivation*

Advances in wireless technology have increased the number of people using mobile devices and facilitated the rapid development of mobile commerce. Mobile commerce has grown like no other form of retailing, and some retailers are even going one step further to make a payment via a smartphone. In other words, as mobile phone technology becomes more sophisticated, new forms of payment have since emerged within the mobile payment theme. Near Field Communication (NFC) mobile payment has been emerging as a noticeable phenomenon that can enable consumers to turn their smartphones into digital wallets. In the past, shopping in store has often been associated with either cash or credit card or debit card payment. Instead of using a traditional payment method like cash or credit or debit card, a consumer makes a payment for transport fares and for in-store purchases by using their cell phone with the aid of the NFC technology. With the advancement of mobile devices and the emergence of NFC technology, payment today is a mere wave-of-the-phone.

Traditionally, the mobile telecommunication and financial industries are completely separated, each with their own distinct and defined sectors and markets [1]. However, nowadays, there are some collaboration between Mobile Operators and Banks to offer new kind of payment services. The recent development of Near Field Communication (NFC) technology has enabled the emergence of payment services using mobile phones. Furthermore, this technological innovation initiated an ongoing evolution concerning payment transactions. Mobile devices was predicted to gradually substitute for the prevalent function of credit cards [1, 2].

According to Phneah [3], mobile payment is the fastest-growing application of near-field communications (NFC) within the Asia region, spurred on by factors such as high mobile device adoption and business maturity. There is a broad set of NFC applications today, which include identification, proximity payments, smart posters and e-tickets. Mobile payments, though, will be the "killer application" for the region. Taiwan is known as one of the four booming economies called "Asian Tigers", the advantages of convenient and secure contactless payment solutions have been taking in this island. In wake of that, six companies in which Chung Hwa Telecom plays a main role have formed a joint venture to launch a mobile wallet product in Taiwan. Particularly, MasterCard collaborated with Chunghwa Telecom, Cathay United Bank, China Trust Commercial Bank, Taishin International Bank and E-Sun bank to issue over-the-air to customers' NFC-enabled SIMs [4].

Since NFC-based mobile payment is still in its infancy [5], it will require enthusiastic consumer adoption before it can truly take off. NFC-based mobile payment renders numerous benefits including quick purchasing of products, transferring of secure information by just touching devices. Such a payment method has allowed consumers to eliminate the use of cash while providing the added values of user-friendliness and fast transaction speed. Even though NFC-based mobile payments are invested by collaboration between mobile network operators (MNOs) and banks; there is still a poor understanding of consumer motivation for using NFC-based mobile payment. In addition, the adoption of NFC mobile payment is still not widespread despite its potential as documented, as indicated by [6].

The customers still hesitate to employ NFC mobile payment method to make a purchase while the companies would like to understand and get more details about the opportunity for new way of doing business stemming from such an NFC-based mobile payment [6, 7]. In wake of that, although NFC mobile payment is emerging as a new stream of doing business and is forming a new trend of mobile payment as well, very little attention has been given to understand how to encourage and diffuse the new wave of NFC mobile payment.

Although there has been a lot of coverage on consumer acceptance of mobile payments, there are only few researches providing guideline to interpret NFC-based mobile payments adoption [6]. However, much effort has been conducted to analyze security aspects [8, 9]. There is also lack of recommendations for enhancing prospective acceptance towards NFC-based mobile payments. In wake of that, it becomes very important to understand how to encourage the adoption of NFC-based mobile payments while there are a humble number of previous studies mentioning about this issue as mentioned earlier. It's necessary to understand factors facilitating or impeding the intention to adopt NFC-based mobile payments. In wake of that, I would like to study the topic *"What are the core drivers in Consumer Adoption of NFC-based Mobile Payments?: A Proposed Research Framework"* as my term research paper.

*B. Research Objective and questions*

As mentioned earlier, the literature reflects remarkably little effort to develop a framework for understanding the feasibility of NFC-based mobile payments from customers' perspectives. The research objective is mentioned as following:

- Proposes a research model of factors facilitating or impeding the intention to adopt NFC-based Mobile payments.

In order to achieve the research objective, there are some research questions which should be dealt with as following:

- What are the main factors affecting the intention to adopt NFC-based mobile payments? And how do these factors influence the intention?
- What are the main obstacles that need to overcome in order to speed up NFC mobile payment adoption?
- How to conceptualize the related constructs in order to facilitate the employment of proposed research model in the future research?

*C. Expected Research Contribution*

This study will be able to advance literature on innovation adoption and facilitate technology marketers in NFC mobile payments. It provides a useful guideline to help researchers investigate of issues related to NFC mobile payments. It also bring some managerial implications by assisting relevant parties in NFC mobile payments ecosystem (such as mobile network operators, card issuers, payment processing institutions, bank decision makers and merchants) when devising their business strategies and marketing campaigns to facilitate NFC mobile payments.

## II. BACKGROUND OF THE RESEARCH AND PROPOSED RESEARCH FRAMEWORK

Taking into consideration of theoretical backgrounds of innovation diffusion and specific characteristics of NFC mobile payments, this study proposed a research framework to provide a profound understanding of factors facilitating or impeding the adoption of NFC-based mobile payments among Taiwanese consumers.

Particularly, this research is based upon well-known Diffusion of Innovation theory (Rogers [10]) and consists of additional factors that are based on the specific characteristics of NFC-based mobile payments to bring a fuller understanding of factors influencing intention to adopt NFC-based mobile payments.

Diffusion of Innovation theory (DOI) has been widely used to examine factors that influence an individual to adopt an innovation or a new technology such as the use of spreadsheet software or smart card [11]. The DOI recognizes that while the technical attributes of the innovation per se may be not significant, perceptions of technology do matter and are important factors influencing technology adoption. The DOI model suggests that individuals would only choose to adopt a technology if it presents five characteristics: relative advantage, compatibility, complexity, observability, and trialability. The concept of *"relative advantage"* is similar to that of "perceived usefulness" [12-14], mentioned in Davis's [15] Technology Acceptance Model (TAM) model and perceived usefulness is used to replace relative advantage in this study. Similarly, "complexity" is replaced by "perceived ease of use" in this study. Moreover, prior researches showed that payment transactions are conducted privately [16, 17], thus observability is disregarded in the present study. However, this model still cannot bring a comprehensive view to explain the technology acceptance in terms of considering specific characteristics of NFC mobile payments. As the result, this research takes into consideration of theoretical backgrounds of innovation diffusion and specific characteristics of NFC mobile payments to develop a proposed research framework in order to understand factors encouraging or hindering the adoption of NFC-based mobile payments.

This study focuses on perceived innovation attributes, personal-related factors, trust-based factors, and attractiveness of alternatives as explanatory and predictive variables for behavioral intention to adopt NFC-based mobile payment. The research model is proposed to address this issue. All variables hypothesized in this study and natures of their expected relationships with intention to adopt NFC-based mobile payment are discussed next.

*A. Product-related factors and intention to adopt NFC-based mobile payments*

***Perceived usefulness***

The first characteristic of new technology which should be considered is perceived usefulness. Perceived usefulness refers to the degree to which an individual believes that using a particular system would enhance his or her job performance [15].

In order to persuade consumers to adopt NFC payment, this method should disclose more advantages than existing payment methods (e.g., cash, credit card or debit card payment) do. When people realize that mobile payment can deliver values that other payment services cannot offer, they may develop a positive intention to adopt the mobile payment services. According to [6, 18], the benefit of NFC payment is described in terms of quicker checkout because the transaction is conducted via a wave-of-the-phone and signature is not required.

NFC payment enables consumers to eliminate the use of cash or credit cards while offering the fast transaction speed. According to a report announced by [19], contactless payment can cut down individual transaction times by 10 to 15 seconds. This speed of service is attractive enough in busy retail environments. In addition, the speed of NFC payment was announced as six seconds faster than those conducted via PayPass cards [20]. Previous studies have concluded that customers who perceive clear benefits and usefulness offered by e-commerce or mobile payment, they are more likely to form the intention to use it [21-23]. If consumers perceive that the adoption of NFC payment can increase their efficiency in their transaction, they are more likely to use such a payment method. Hence, the following hypothesis is proposed:

***Hypothesis 1:*** The perceived usefulness of adopt NFC-based mobile payment has a positive effect on the intention to adopt NFC mobile payment.

***Perceived ease of use***

Another characteristic of new technology which is mentioned in TAM model and DOI theory is perceived ease of use. Perceived ease of use is the degree to which given technology is perceived as easy to understand and operate [24]. An application or innovation perceived to be easier to use than another is more likely to be accepted by user. According to previous studies conducted by [12, 25, 26], we assume that customers who find m-commerce, mobile tagging system as easy to use will be likely to adopt NFC mobile payment. The following hypothesis is thus proposed:

***Hypothesis 2:*** The perceived ease of use has a positive effect on the intention to adopt NFC mobile payment.

***Compatibility***

Compatibility refers to how well a technology fits an individual's working style, lifestyle, values and needs [10, 27]. Compatibility is posited as one of the main determinants for the innovation spread process with the high compatibility perceived by the individuals leading to the speedy adoption of any new ideas or technologies in general and mobile payment in particular. Prior research showed that over two-third of the mobile financial transaction services failed to meet the needs of customers since traditional channels did not offer the ubiquity provided by a mobile channel [28, 29].

Several researchers posited that compatibility is one of most significant indicators of adoption [11, 28, 30]. Regarding NFC mobile payment systems, the greater the compatibility of new payment services with users' general habits and their ways to use services with the mobile phone is, the more likely consumers form the intention to adopt it. In other words, when a user can well integrate the new payment services into his or her daily life, the compatibility of NFC mobile payment with the individual's existing lifestyle and habits is expected to have impact on his or her intention to adopt it. Thus, proposed hypothesis is given as below:

***Hypothesis 3:*** An individual's compatibility with using NFC payment to make a purchase has a positive effect on the intention to adopt NFC mobile payment.

***Perceived risk & perceived cost of using NFC mobile payment***

Due to the higher levels of uncertainty which are associated with services, services are considered to be more risky than products. Prior research revealed that perceived risk was considered as a major factor in causing consumers not to adopt an innovation in general and mobile commerce in particular [21, 23]. As shown by Lu et al. [22], approximately 75% of consumers today worry about security and transaction risks. In order to adopt mobile payment services, users have to evaluate the uncertainty and risk related to the adoption of the technology. Perceived risk refers to the subjective expectation of a loss or sacrifice in using a risky technology [31]. Tan and Teo [17] concluded that risk was introduced as an additional dimension in studying diffusion and adoption. If potential customers who perceive NFC payment as a risky activity, they are not willing to adopt NFC payment. Along with perceived risk, consumers were concerned with costs when using mobile payment services [28, 30, 32]. Those researches showed that perceived risk and perceived cost are two major barriers to adopt new technology. In this study, perceived cost is defined as the extent to which an individual believes that using NFC mobile payment will cost money. Based on that, the following hypotheses are proposed:

***Hypothesis 4:*** Perceived risk of using NFC payment has a negative effect on the intention to adopt NFC mobile payment.

***Hypothesis 5:*** Perceived cost of using NFC payment has a negative effect on the intention to adopt NFC mobile payment.

***Trialability***

Trialability is defined as the degree to which mobile banking might be experimented on a limited basis [10].

Rogers [10] suggests that the trialability contributes to achieving some sort of comfort among the customers and the users who may later become more willing to adopt this innovation. Tan and Teo [17] concluded that if the user got the chance to experiment with a new technology, this would reduce his feelings of fear concerning the usage of this technology. Thus, proposed hypothesis is given as below:

***Hypothesis 6:*** Trialability has a positive effect on the intention to adopt NFC mobile payment.

**Additional value of NFC mobile payment**

According to bankingtech [33], the capacity for NFC mobile payments is not in and of itself a solution to a customer problem. Customers currently enjoy a variety of ways to pay for goods, the majority of which are well-known and trusted by consumers. Customers are unlikely to switch to NFC mobile payments unless additional services add value, and give them a reason to do so. Promotion of discounts and offers through customers' mobile phones for payments using NFC could provide one means of delivering this added value, appealing customer to convert to new payment method. As shown by Card Technology Today [34], real-time e-coupon download and customization towards their personal shopping habits are additional values as major advantages of NFC mobile payment. In this research, we assume that if consumers perceive that NFC mobile payment will offer additional values when doing transaction, they are more likely to use this payment method. Therefore, we hypothesize that:

***Hypothesis 7:*** Additional value of NFC payment has a positive effect on the intention to adopt NFC mobile payment.

*B. Personal-related factors and intention to adopt NFC-based mobile payments*

Interest in the individual differences is growing in the user behavior studies of mobile payment [30, 35]. In this study, we will test two individual difference constructs, namely personal innovativeness in new technologies and absorptive capacity, which have been deemed important in information system and mobile service literature. From the perspective of mobile commerce, it seems that individual differences have been generally expected to be related to m-commerce usage [36].

***Personal innovativeness in new technologies***

The study investigates two additional factors: personal innovativeness and absorptive capacity. First of all, personal innovativeness is a key individual difference characteristic influencing the adoption of an innovation, and relates to the users' willingness to embrace a new information technology [37]. Personal innovativeness was defined in the domain of information technology as "the willingness of an individual to try out any new information technology", according to Agarwal and Prasad [25]. Highly innovative users are more willing to integrate new technologies into their daily routine by confronting with the uncertainty of innovative technologies [38] since they are risk-takers and have high levels of self-confidence about their online purchase behaviors. They are information explorers actively seeking new ideas and accepting the associated dangers and uncertainties [37]. According to Yang et al. [30], difference in consumers' personal innovativeness should be taken into account to facilitate the adoption of mobile payment services. Prior researches showed that innovative users are more likely to explore and adopt different mobile payment services [26, 35]. In wake of that, this study argues that individuals with a higher level of innovativeness with respect to new technologies are expected to increase intention to adopt NFC mobile payment. Hence, we propose the following hypothesis:

***Hypothesis 8:*** Personal innovativeness positively affects intention to adopt NFC mobile payment.

***Absorptive capacity***

Over the last two decades, the researchers have paid considerable attention on the concept of absorptive capacity in the literature. Absorptive capacity was firstly introduced by Cohen and Levinthal [39]. Based on the work of that, many studies employed this concept when doing researches in strategic innovation, organizational learning and information technology [40, 41]. Absorptive capacity was defined originally as a firm's ability to identify the value of new, external information, assimilate it, and apply it for commercial purposes [39]. Although the definition differs slightly among researchers, we rely on the definition of user absorptive capacity mentioned by Park et al. [40] and Suh et al. [42]. In those studies, user absorptive capacity refers to the ability of an organizational member to value, assimilate, and apply new knowledge. In wake of that, user absorptive capacity is classified into three interrelated components. The first component is a person's capacity for understanding external knowledge. The user can use prior related knowledge to facilitate this acquisition phase. Second, a user's capacity for assimilating knowledge is the user's ability to internalize new knowledge into his or her task. Finally, a user's knowledge utilization capacity is the ability of individual to apply the new knowledge to the task.

Absorptive capacity is not only applied in researches at organizational level but this concept also used to study users' adoption of new technology. Particularly, Lee et al. [43] showed that an individual's absorptive capacity directly affect the intention to use mobile financial services. Based on that, we would like to apply the concept of absorptive capacity to NFC-based mobile payment adoption. In this paper, we argue that the ability of a person to recognize the value of NFC mobile payment, assimilate it, and apply it to make a payment is critical to his or her intention to adopt NFC mobile payment. In other words, we assume that if individuals have prior knowledge of mobile applications and payment and have ability to apply that knowledge in NFC mobile payment, they can more easily understand NFC-based

mobile payment technology and more likely to accept NFC mobile payment. Thus, it leads to the hypothesis as following:

***Hypothesis 9:*** Absorptive capacity positively affects intention to adopt NFC mobile payment.

*C. Trust-based factors*

Trust has long been considered as a catalyst in consumer-marketer relationships since it can facilitate successful transactions [44]. Consumers' perceived trust in e-payment systems refers to consumers' belief that e-payment transactions will be processed in accordance with their expectations [45, 46]. Kim et al. [47] showed that increases in trust will directly and positively affect purchase intentions. According to Kim et al. [47] and Lee [48], trust is especially important element influencing consumer behavior in uncertain environments such as electronic commerce. Unless service providers make customer trust, it is exceedingly difficult to attain widespread acceptance of a new technology or service. In wake of that, we expect that trust is also likely to be a critical factor affecting NFC mobile payment adoption. Based on the arguments above, we propose the following hypothesis:

***Hypothesis 10:*** Customer trust positively affects intention to adopt NFC mobile payment.

*D. Attractiveness of Alternatives*

Attractiveness of alternatives is defined as the extent to which customers perceive that viable competing alternatives are available in the marketplace [49]. Prior studies found that attractiveness of alternatives has negative effect on behavioral intention to use a technology or service [5, 49, 50]. Since NFC mobile payment solutions are still in their infancy, established substitutes with strong network externalities (e.g., cash, credit card or debit card) may be a big barrier to their adoption [5]. In wake of that, we expect that users' comparative recognition in substitutes of NFC mobile payment can affect the intention to adopt NFC mobile payment. If alternatives have relative advantage in making a payment compared to NFC mobile payment, users are likely to choose and stay in the attractive alternatives. Conversely, if existing substitutes lack necessary appeal to attract and keep customers' loyalty, there is a chance for NFC mobile payment to fill in a gap. The following hypothesis is therefore proposed:

***Hypothesis 11:*** Attractiveness of alternatives negatively affects intention to adopt NFC mobile payment.

The proposed research model is developed based on these hypotheses to illustrate the relationship between the independent variables and the dependent variables *(As seen in Fig. 1)*.

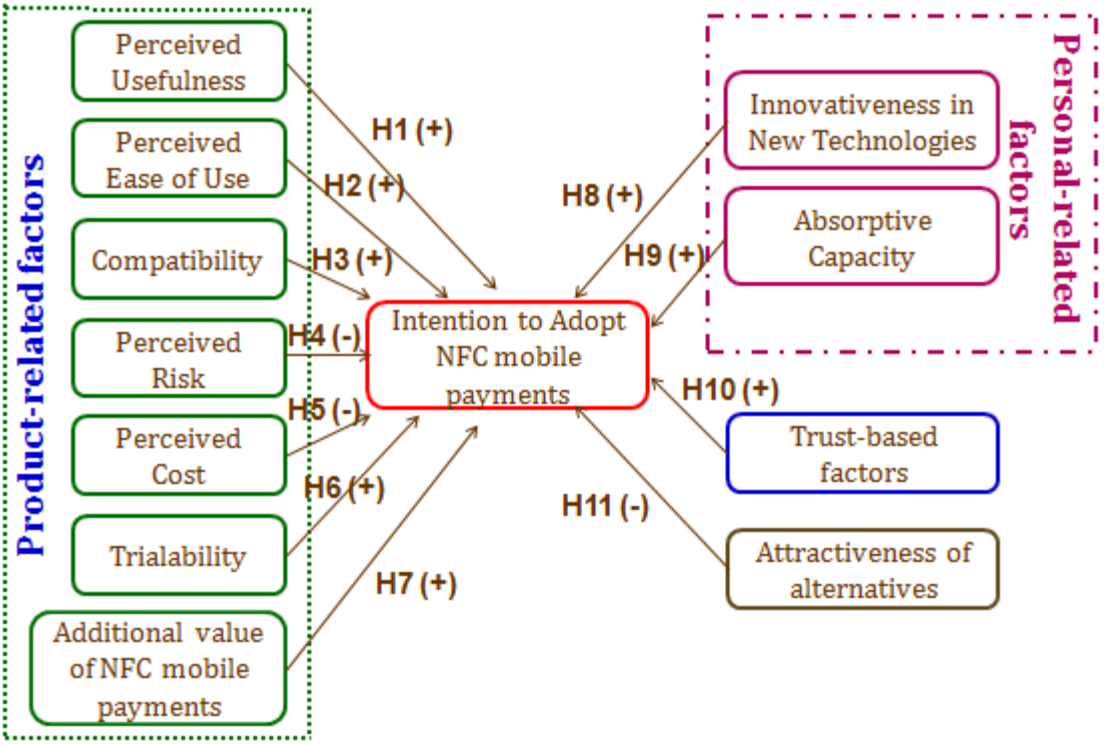


Figure 1 Proposed research framework

## II. METHODOLOGY

### ➢ Data collection

First of all, the research design is employed in this paper is exploratory research in which the major emphasis is on gaining ideas and insights. As mentioned earlier, there are only few studies providing guideline to interpret NFC-based mobile payments adoption and lack of recommendations for enhancing prospective acceptance towards NFC-based mobile payments. In wake of that, exploratory research can be conducted to provide a better understanding of a situation. We would like to do some analyses about the specific characteristics of NFC-based mobile payment to recommend some new factors or important issues which should be concerned in this kind of mobile payment method. Through literature searches and analysis of NFC mobile payment context as the exploratory research, we proposed a research framework to provide a profound understanding of factors facilitating or impeding the adoption of NFC-based mobile payments among Taiwanese consumers which can be employed to conduct a survey research to test the proposed research model in the future work.

Secondly, a paper-based survey will be conducted to collect the data from informants. As the paper focuses on NFC-based mobile payments, the respondents should own at least a mobile phone and a band account. Sensibly, these individuals are more likely to adopt NFC-based compared to those who do not own and use mobile phones and band account. Using a self-administered questionnaire, this study will use convenience method to contact with diverse respondents groups comprising of various ethnics, ages, and backgrounds. This allows wider presentation in terms of customer segmentations, thus providing a better picture with regards to multi-faceted customer segmentations. The participants will be asked to describe their level of agreement to each statement by circling their response in the questionnaire. Sampling method used in this study is a combination of convenience, judgment and snowball sampling.

### ➢ Instrument Development

Regarding the operationalization of each construct, multi-item scales for the 12 constructs were primarily adopted from previous studies with wording changes as required to adjust them to NFC-based mobile payment context *(As shown in Table 1)*. The scale items are measured on a five-point Likert scale ranging from strongly disagree (1) through neutral (3) to strongly agree (5).

TABLE 1 MEASUREMENT ITEMS

| Constructs or Statements | Adopted from: |
|---|---|
| **Perceived Usefulness:** | Tan et al. (2013); Mallat et al. (2009); Tan and Teo (2000); Davis (1989) |
| I perceive that my purchase would be more quickly using NFC payment | |
| I perceive that my purchasing tasks would be more easily using NFC payment | |
| NFC payment would enhance my effectiveness in purchasing. | |
| NFC payment would enhance my efficiency in making a purchase | |
| NFC payment would enable me to make better decisions in making a purchase. | |
| Overall, I would find NFC payment useful. | |
| **Perceived Ease of Use:** | Tan et al. (2013); Luarn and Lin (2005); Davis (1989) |
| Learning to use NFC payment would be easy for me. | |
| NFC payment would be easy to understand. | |
| Getting the information I want from NFC payment would be easy. | |
| It would be easy for me to become skillful at using NFC payment. (Knowing shortcut keys or advanced options) | |
| I would find NFC payment easy to use. | |
| **Compatibility:** | Yang et al. (2012); Tan and Teo (2000) |
| Using NFC payment would be compatible with my lifestyle. | |
| Using NFC payment would fit well with the way I like to manage my finances. | |
| Using NFC payment to make a purchase would fit into my working style. | |
| **Perceived Risk:** | Brown et al. (2003); Tan & Teo (2000) |
| I think using NFC payment for conducting transaction would have a potential risk. | |
| Information concerning my transactions via NFC payment would be known to others. | |
| My savings would be in jeopardy if I use NFC payment to purchase. | |
| Information concerning my transactions via NFC payment could be tampered with by others. | |
| **Trialability:** | Brown et al. (2003); Tan & Teo (2000) |
| I want to be able to test NFC mobile payment first. | |
| I want to be able to use it on a trial basis first to see what it can do. | |
| I want to see a trial demo first. | |
| **Perceived cost:** | Yang et al. (2012); Lu et al. (2011); Luarn & Lin (2005); |
| It would cost a lot to use NFC mobile payment. | |
| There are financial barriers (e.g., having to pay for handset and communication time) to my using NFC mobile payment. | |
| **Additional value of NFC payments:** | Bankingtech (2013); Card Technology Today (2007) |
| Using NFC mobile payment would help me easily keep up-to-date promotion of discounts and e-coupon. | |
| Using NFC mobile payment would facilitate the customization towards my personal shopping habits. | |

| | |
|---|---|
| Overall, using NFC mobile payment would bring additional value when doing transaction. | |
| **Innovativeness in New Technologies:** | Yang et al. (2012); Rogers (1995) |
| If I heard about a new information technology, I would look for ways to experiment with it. | |
| Among my peers, I am usually the first to try out new information technologies. | |
| In general, I am hesitant to try out new information technologies. ® | |
| I like to experiment with new information technologies. | |
| **Absorptive Capacity:** | Lee et al. (2012); Cohen and Levinthal (1990); and Park et al. (2007) |
| I have the necessary knowledge to understand NFC mobile payment services. | |
| I have the technical competence to absorb NFC mobile payment services. | |
| I have a clear understanding of the goals, tasks, and responsibilities of mobile payment services like NFC mobile payment. | |
| I have information on state-of-the art of mobile financial services. | |
| I have the capability to achieve the objectives of tasks by using NFC mobile payment. | |
| I can apply the knowledge derived from mobile payment to perform tasks using NFC mobile payment. | |
| **Trust:** | Changsu Kim et al. (2010) |
| I trust each participant involved in process of making purchase via NFC payment | |
| I trust the security mechanisms of process of making purchase via NFC payment | |
| I trust the process of making purchase via NFC payment | |
| I trust the information provided during the process | |
| **Attractiveness of alternatives:** | Jones et al. (2000); Kim et al. (2011) |
| If I need to change payment services, there are other good services to choose from. | |
| I would probably be happy with other payment methods than NFC payment. | |
| Compared to NFC payment, there are other payment methods with which I would probably be equally or more satisfied. | |
| Compared to NFC payment, there are not very many other payment methods with which I would probably be equally or more satisfied. ® | |
| **Intention to Adopt NFC payment:** | Tan and Teo (2000); Kim et al. (2008) |
| I intend to make a purchase via NFC payment in the near future. | |
| I intend to increase my use of NFC payment to make a purchase in the near future. | |
| I will recommend others to use NFC payment to make a purchase if it is provided. | |

In order to ensure the content validity, the questionnaire is modified and pretested on five academician and ten practitioner customers. They are required to assess the terminology, clarity of instructions and response format. The further problems with the measures and response format thus can be detected. The questionnaire is revised to make it clearer and a main survey will be conducted.

## IV. IMPLICATIONS AND CONCLUSION

There are some research contributions of this study for both researchers and practitioners. This study will be able to advance literature on innovation adoption and facilitate technology marketers in NFC mobile payments.

### *A. Theoretical Implications*

From the theoretical perspective, this study has contributed to the existing literature by identifying the key factors affecting NFC mobile payment which has been paid little attention by current scholars. Taking into consideration of theoretical backgrounds of innovation diffusion and specific characteristics of NFC mobile payments, this study proposed a research framework to provide a profound understanding of factors facilitating or impeding the adoption of NFC-based mobile payments among Taiwanese consumers. The research expects that intention to adopt NFC mobile payments is affected by product-related factors (perceived usefulness, perceived ease of use, compatibility, perceived security and privacy risk, trialability, perceived cost of use and additional value of NFC mobile payment), trust-based factors, personal-related factors (personal innovativeness in new technologies, absorptive capacity), and attractiveness of alternatives. In wake of that, we believe that the study will bring a comprehensive understanding about how to encourage and facilitate NFC-based mobile payment adoption. It provides a useful guideline to help researchers investigate of issues related to NFC mobile payments. The proposed research framework can be adopted to conduct a survey research to test, verify the hypotheses in the future work.

### *B. Managerial Implications*

It will also bring some managerial implications by assisting relevant parties in NFC mobile payments ecosystem such as mobile network operators, card issuers, payment processing institutions, bank decision makers and merchants when devising their business strategies and marketing campaigns to facilitate NFC mobile payments.

Since NFC mobile payment solutions are still in their infancy, the study implies that customers are unlikely to adopt NFC mobile payments unless service providers shed some light on the outstanding characteristics and differentiation of NFC-based mobile payment. The marketers should emphasize what NFC-based mobile payment can offer uniquely and better than established substitutes. From the perspective of mobile commerce, it seems that individual differences have been generally expected to be related to NFC mobile payment acceptance. In this study, we will test two individual difference constructs, namely personal innovativeness in new technologies and absorptive capacity, which have been deemed important in information system

and mobile service literature. Based on that, we suggest that marketers and service providers should classify the market into different segmentations, customize, promote and offer services to suit the specific needs of consumers.

## REFERENCES


[1] Zea, O. M., D. Lekse, A. Smith, and L. Holstein, "Understanding the current state of the NFC payment ecosystem: A graph-based analysis of market players and their relations," *Enfoque UTE,* vol. 3, pp. 13-32, 2012.

[2] Wilcox, H. (2011, Jan. 27, 2014). *NFC Mobile Payments to Drive Contactless Transactions to Reach Nearly $50 billion Worldwide by 2014*. Available: http://juniperresearch.com/viewpressrelease.php?pr=246

[3] Phneah, E. (2012, Dec. 27, 2013). *Mobile payments top NFC application in Asia*. Available: http://www.zdnet.com/mobile-payments-top-nfc-application-in-asia-2062305176/

[4] NFCworld. (2013, Nov. 5th, 2013). *Chunghwa launches NFC payments in Taiwan*. Available: http://www.nfcworld.com/2013/05/29/324283/chunghwa-launches-nfc-payments-in-taiwan/

[5] Amoroso, D. L. and R. Magnier-Watanabe, "Building a Research Model for Mobile Wallet Consumer Adoption: The Case of Mobile Suica in Japan," *Journal of theoretical and applied electronic commerce research,* vol. 7, pp. 94-110, 2012.

[6] Tan, G. W.-H., K.-B. Ooi, S.-C. Chong, and T.-S. Hew, "NFC mobile credit card: The next frontier of mobile payment?," *Telematics and Informatics,* 2013.

[7] Shatskikh, A., "Consumer acceptance of Mobile Payments in Restaurants," Master, Department of Hospitality Administration, College of Hospitality and Technology Leadership University of South Florida, Graduate School Theses and Dissertations, 2013.

[8] Madlmayr, G., J. Langer, C. Kantner, and J. Scharinger, "NFC Devices: Security and Privacy," *Third International Conference on Availability, Reliability and Security,* pp. 642-647, 2008.

[9] Rehman, S. u. and J. Coughlan, "An Efficient Mobile Payment System Based On NFC Technology," *World Academy of Science, Engineering and Technology,* vol. 78, pp. 1695-1698, 2013.

[10] Rogers, E. M., *Diffusion of Innovations: Third Edition*. New York: Free Press, 1983.

[11] Mallat, N., M. Rossi, V. K. Tuunainen, and A. Öörni, "The impact of use context on mobile services acceptance: The case of mobile ticketing," *Information & Management,* vol. 46, pp. 190-195, 4// 2009.

[12] AL-Majali, M. and N. Kamariah, "Modeling the antecedents of internet banking service adoption (IBSA) in Jordan: A Structural Equation Modeling (SEM) approach," *Journal of Internet Banking and Commerce,* vol. 16, pp. 1-15, 2011.

[13] Moore, G. C. and I. Benbasat, "Development of an instrument to measure the perceptions of adopting an information technology innovation," *Information Systems Research,* vol. 2, pp. 192-212, 1991.

[14] Taylor, S. and P. A. Todd, "Understanding information technology usage: a test of competing models," *Information Systems Research,* vol. 6, pp. 144-176, 1995.

[15] Davis, F. D., "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly,* vol. 13, pp. 319-339, 1989.

[16] AL-Majali, M., "The Use of Theory Reasoned of Action to Study Information Technology in Jordan," *Journal of Internet Banking and Commerce,* vol. 16, pp. 1-11, 2011.

[17] Tan, M. and T. S. H. Teo, "Factors Influencing the Adoption of Internet Banking," *Journal of Association for Information Systems,* vol. 1, pp. 1-42, 2000.

[18] Zmijewska, A., "Evaluating wireless technologies in mobile payments – A customer centric approach," in *Proceedings of the fourth International Conference on Mobile Business (ICMB)*, ed Sydney, Australia, 2005.

[19] VeriFone, "A Cashless Future on the Horizon," http://www.verifone.co.uk/media/1420610/VeriFone_Cashless_Future_Contactless.pdf2010.

[20] Finextra. (2004, Jan. 27). *Motorola and MasterCard to trial contactless mobile payments*. Available: http://www.finextra.com/news/fullstory.aspx?newsitemid=12684

[21] Brown, I., Z. Cajee, D. Davies, and S. Stroebel, "Cell phone banking: predictors of adoption in South Africa— An exploratory study," *nternational Journal of Information Management,* vol. 23, pp. 381-394, 2003.

[22] Lu, Y., S. Yang, P. Y. K. Chau, and Y. Cao, "Dynamics between the trust transfer process and intention to use mobile payment services: A cross-environment perspective," *Information & Management,* vol. 48, pp. 393-403, 12// 2011.

[23] Safeena, R., N. Hundewale, and A. Kamani, "Customer's Adoption of Mobile-Commerce: A Study on Emerging Economy," *International Journal of e-Education, e-Business, e-Management and e-Learning,* vol. 1, pp. 228-233, 2011.

[24] Lin, H.-F., "An empirical investigation of mobile banking adoption: The effect of innovation attributes and knowledge-based trust," *International Journal of Information Management,* vol. 31, pp. 252-260, 6// 2011.

[25] Agarwal, R. and J. Prasad, "The antecedents and consequents of user perceptions in information technology adoption," *Decision Support Systems,* vol. 22, pp. 15-29, 1998.

[26] Cheng, Y.-H. and T.-Y. Huang, "High speed rail passengers' mobile ticketing adoption," *Transportation Research Part C: Emerging Technologies,* vol. 30, pp. 143-160, 5// 2013.

[27] Agarwal, R. and J. Prasad, "The role of innovation characteristics. and perceived voluntariness in the acceptance of information technogies," *Decision Sciences,* vol. 28, pp. 557-582, 1997.

[28] Hanafizadeh, P., M. Behboudi, A. Abedini Koshksaray, and M. Jalilvand Shirkhani Tabar, "Mobile-banking adoption by Iranian bank clients," *Telematics and Informatics,* vol. 31, pp. 62-78, 2// 2014.

[29] Hourahine, B. and M. Howard, "Money on the move: opportunities for financial service providers in the 'Third Space," *Journal of Financial Services Marketing,* vol. 9, pp. 57-67, 2004.

[30] Yang, S., Y. Lu, S. Gupta, Y. Cao, and R. Zhang, "Mobile payment services adoption across time: An empirical study of the effects of behavioral beliefs, social influences, and personal traits," *Computers in Human Behavior,* vol. 28, pp. 129-142, 1// 2012.

[31] Sweeney, J. C., G. N. Soutar, and L. Johnson, "The Role of Perceived Risk in the Quality-Value Relationship: A Study in a Retail Environment," *Journal of Retailing,* vol. 75, pp. 77-105, 1999.

[32] Luarn, P. and H.-H. Lin, "Toward an understanding of the behavioral intention to use mobile banking," *Computers in Human Behavior,* vol. 21, pp. 873-891, 2005.

[33] bankingtech. (2013). *NFC mobile payments: overcoming the barriers for banks*. Available: http://www.bankingtech.com/151452/nfc-mobile-payments-overcoming-the-barriers-for-banks/

[34] CardTechnologyToday, "Taiwanese survey reveals mobile payment preference over cards," *Card Technology Today,* vol. 19, p. 16, 7// 2007.

[35] Cheah, C. M., A. C. Teo, J. J. Sim, K. H. Oon, and B. I. Tan, "Factors Affecting Malaysian Mobile Banking Adoption: An Empirical Analysis " *International Journal of Network and Mobile Technologies,* vol. 2, pp. 149-160, 2011.

[36] Kim, C., M. Mirusmonov, and I. Lee, "An empirical examination of factors influencing the intention to use mobile payment," *Computers in Human Behavior,* vol. 26, pp. 310-322, 5// 2010.

[37] Rogers, E. M., *Diffusion of Innovations: Fifth Edition*. New York: Free Press, 2003.

[38] Rogers, E. M., *Diffusion of Innovations: Fourth Edition*. New York: Free Press, 1995.

[39] Cohen, W. M. and D. A. Levinthal, "Absorptive capacity: a new perspective on learning and innovation," *Administrative Science Quarterly* vol. 35, pp. 128-152, 1990.

[40] Park, J.-H., H.-J. Suh, and H.-D. Yang, "Perceived absorptive capacity of individual users in performance of Enterprise Resource Planning

(ERP) usage: The case for Korean firms," *Information & Management,* vol. 44, pp. 300-312, 4// 2007.

[41] Zahra, S. A. and G. George, "Absorptive capacity: A review, reconcepualisation, and extension," *Academy of Management Review,* vol. 27, pp. 185-203, 2002.

[42] H-J, S., P. J-H, Y. H-D, and S. K-S., "Individual absorptive capacity and the performance of using ERP: knowledge transfer perspective," *Korean Manag Rev,* vol. 34, pp. 651-681, 2005.

[43] Lee, Y.-K., J.-H. Park, N. Chung, and A. Blakeney, "A unified perspective on the factors influencing usage intention toward mobile financial services," *Journal of Business Research,* vol. 65, pp. 1590-1599, 11// 2012.

[44] Schurr, P. H. and J. L. Ozanne, "Influences on exchange processes: Buyers' preconceptions of a seller's trustworthiness and bargaining toughness," *Journal of Consumer Research,* vol. 11, pp. 939-953, 1985.

[45] Mallat, N., "Exploring consumer adoption of mobile payments - A qualitative study," *Journal of Strategic Information Systems,* vol. 16, pp. 413-432, 2007.

[46] Kim, C., W. Tao, N. Shin, and K.-S. Kim, "An empirical study of customers' perceptions of security and trust in e-payment systems," *Electronic Commerce Research and Applications,* vol. 9, pp. 84-95, 1// 2010.

[47] Kim, D. J., D. L. Ferrin, and H. R. Rao, "A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents," *Decision Support Systems,* vol. 44, pp. 544-564, 2008.

[48] Lee, T., "The Impact of perceptions of interactivity on customer trust and transaction intentions in mobile commerce," *Journal of Electronic Commerce Research,* vol. 6, pp. 165-180, 2005.

[49] Jones, M. A., D. L. Mothersbaugh, and S. E. Beatty, "Switching barriers and repurchase intentions in services," *Journal of Retailing,* vol. 76, pp. 259-274, //Summer 2000.

[50] Kim, H.-W., Y.-S. Jeon, and S. Choi, "Attractiveness of Alternatives in Information Systems Continuance: A Case of Wimax," presented at the The 11th International DSI and the 16th APDSI Joint Meeting, Taipei, Taiwan, 2011.