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Factors of Adoption Intention for Near Field Communication Mobile Payment

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ABSTRACT

Near field communication mobile payment (NMP) is simple to use and beneficial to consumers, yet its adoption among consumers in Malaysia is still at the beginning stage and the adoption rate is relatively lower compared to other countries in the world. The aim of this study is to identify factors that affect the adoption intention of NMP among consumers in Malaysia, by using Faculty of Computer and Mathematical Sciences (FSKM), UiTM Shah Alam as the case study for this research. The quantitative data analysis approach is used in this study. There were 150 questionnaires analyzed using the SPSS. This research identified three factors that affect the adoption intention of NMP which are perceived usefulness, perceived cost and compatibility. By understanding the factors affecting the intention to adopt NMP, financial technology companies can focus to provide the solutions according to market interest, needs and readiness.

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1. INTRODUCTION

Near Field Communication (NFC) is a set of communication protocols which allows two electronic devices to communicate by bringing them close with one another within about 4 cm in distance. Mobile phones that support NFC can act like a smart card when presented to a contactless terminal [1]. NFC is based on the Radio-frequency identification (RFID) technology which is standardised in ISO/IEC 18092. The intention of NFC is to connect electronic devices with a touch to make transactions simpler and more convenient and allows quick exchange of digital content. NFC operates at 13.56 MHz and was jointly developed between NXP Semiconductors and Sony Corporation [2].

Communications using NFC is similar to Infrared and Bluetooth technologies, with some differences. When using Infrared technology, data transfers from one device to the other will require a direct line, whereby when using NFC technology, communication does not require a straight line, it can still communicate as long as the two devices are close to each other. Bluetooth technology on the other hand was introduced so that the device can communicate with each other in a much further distance. Characteristics such as ease of use, secured communication channel, usage in different situation and the need to transfer data at high speed with very low energy together with some other advantages made the NFC technology to grow really fast and make big companies such as Sony, Samsung and Apple to embed this technology in their devices [3]. In a study conducted by Renardi et al. on the characterizations and advantages of using NFC in public transportation, it has found that NFC could be used to support contactless transaction and data exchange with international standardization [4].

Payment using an NFC-enabled mobile phone is often called NFC Mobile Payment (NMP). According to StatCounter [5], mobile usage in Malaysia has increased to almost double within a year, which

is from a small percentage of 10% in May 2012 to 20% in May 2013. Despite the huge grow in the use of mobile technologies, making payment for purchases using mobile devices, especially using the NFC-enabled mobile devices is still a fresh idea and not many consumers in Malaysia has use it [6]. Based on the statistics provided by World Pay [7], only 0.3% of the mobile phone users in Malaysia who uses their mobile phones to make payment for their purchases which is considered low compared to the high increase rate of mobile users.

There are a lot of factors that could impact the adoption intention of NMP among consumers in Malaysia. Those factors can be caused by the technology itself, and it can either be product-related such as the compatibility of smartphones and readers having NFC capabilities, or personal-related factors such as the consumer's perceived motivations and concerns towards using NMP. It can also be due to demographic factors such as age group, gender and monthly income which the researcher intends to find out by conducting this research project.

The study was done to identify the factors that affect the tendency of consumers in replacing their traditional payment methods of using physical debit cards, credit cards and also Touch 'n Go cards as an example which they usually need to take out from their wallets to use it, with a new payment method which is using an NFC-enabled smartphone which they can quickly retrieve for making payment at contactless readers or terminals provided by the merchants or payment solution providers.

Having a good understanding on what the consumer needs will guide the related parties to enhance their product and services accordingly, especially on how to address their concerns regarding NFC Mobile Payment. By providing a solution that can meet or exceed the consumer's expectations, it will increase their market presence and enhance their profits in the long run. It will also help to eliminate the risk of producing products or services that are not needed which can prevent losses if it is not well accepted by the consumers.

Mobile payment will make checkout counter faster where the counter personnel can focus more on customer service rather than the hassle of handling cash. When retail outlets can focus more on scanning the items purchased and tapping the customer's credit card or mobile phone for payment, it can greatly minimize human errors since we don't need to handle change anymore. According to a 2001 MIT study, consumers using mobile technology or credit cards will tend to spend twice more than using cash [8]. From a consumer stand point, Mobile NFC services can provide better functionality and convenience for making payment when compared to using the debit/credit cards [9].

Prior researchers [10]-[12] have all adopted the Technology Acceptance Model (TAM) for the research on NFC Mobile Payment. TAM is used as it is a distinguished model to explain adoption behavior in information technology and it provides the framework to study the external factors effects that may influence the system. Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are the two belief variables in TAM.

Sajid and Haddara [10] has conducted a qualitative survey in Norway to obtain users' insights towards the perceived motivations and concerns in NMP. Pham and Ho [13] has adopted the Diffusion of Innovation Theory (DOI) which was developed by Rogers [14] and it is often used in research to study about the adoption intention of new innovation or technology, in the research on intention to adopt NMP among Malaysian consumers.

Pal et al. [11] stated that for late adopters, personal innovativeness has an effect on Perceived Ease of Use (PEOU) which indicates that they prefer less changes. They will only adopt it when the technology is mature enough or when the technology has a mass adoption rate. This group of people will only adopt new technology when it has become popular in the market. To get familiar with new technology, extra training is required for people with a lower degree of innovativeness.

Sam et al. [12] said that personal innovativeness has no positive impact on perceived usefulness. A person's motivation to explore new things such as the NFC technology does not mean that it is going to be useful to them.

Even though NFC technology has been around since 2010, a study by Sajid and Haddara [10] on user awareness on NFC technology shows that 69% of the respondents are aware about it, 26% were unaware, while 5% of the respondents mentioned that they never heard of it. When a user is already aware on NFC technology, it may be perceived that they will adapt to NFC technology better. Sam et al. [12] stated that with the emergence of smartphones in the recent years, a lot of people have started making online purchases using their smartphones. The study found that users will not have difficulty in adopting NMP if they have sufficient knowledge on mobile payment.

In a study by Sajid and Haddara [10], a question was asked to gain participants preference between NMP and credit card or cash, where the results shown that 73.74% of respondents preferred NMP while 26% preferred credit card or cash. Given that the opportunity exists, approximately 3 out of 4 respondents would prefer NMP which is perceived to be useful compared to credit card or cash.

According to Pal et al. [11], for early adopters, previous knowledge about NFC technology is important for Perceived ease-of-use (PEOU) which could be due to the belief of that when they know about a technology beforehand, regardless of how complex it is, it will be easier to adopt it. PEOU has also be effected by user mobility and reachability. However, there are no factors that affect Perceived Usefulness (PU) which could mean that the early adopters are rather doubtful about the system usefulness and do not expect much about NMP.

Sajid and Haddara [10] studied on a question on whether we are ready to replace cash and credit cards completely using NMP in the future. This finding could be an important factor to gauge on the user readiness in changing their payment methods. The majority of respondents agreed at 51.02%, while 31.63% disagreed while 17.35% are not ready for it. For those who are disagreed and not ready, they simply could not bear with the thoughts of having smartphones to replace the traditional payment method of cash and credit cards.

A study by Sam et al. [12] in Macau found that Trust and Security has a positive impact on Perceived Usefulness (PU). Sajid and Haddara [10] studied on the trust towards NMP and found that 68.37% of the respondents trusted the technology while the remaining 31.63% did not. This concern of user trust is an interesting topic to be researched on as it will try to understand whether consumers will trust to make payment using NFC-enabled smartphones as compared to the traditional payment method of using cash or physical debit cards, credit cards or Touch ‘n Go cards. Will they trust that their phones will be secured when making the payment electronically and whether an sms or push notifications for every transactions to the consumer can alleviate their concerns regarding trust and security when using NMP.

Sajid and Haddara [10] found that the main concern regarding NFC Mobile Payment was “Fear of the mobile getting lost or stolen, and further misused” at 59.79%, followed by "The security and safety of my transaction from mobile to bank" at 24.74%, "Difficult to use" at 9.28%, and lastly, "Difficult to understand the technology" at 6.19%. The study found that 43% of the respondents believe that NMP is the way to go in the future, while the rest of them have doubts for NMP to replace the traditional payment methods which are the plastic cards, such as debit cards and credit cards, and cash.

2. RESEARCH MODEL AND RESEARCH METHOD

The research model of this study was developed from Technology Acceptance Model (TAM) and Diffusion of Innovation theory (DOI). The TAM was developed by Davis [15] which covers the causal relationships between features in the system design, perceived usefulness, perceived ease of use, attitude toward using, and actual behavior. The DOI was developed by Rogers [14] and it is often used in research to study about the adoption intention of new innovation or technology. In this study however, not all the constructs in DOI are used. This modification is made to the model in order to accommodate the study in the context of the intention to adopt NMP among Malaysian consumers.

There are nine hypothesis being tested in this study.

H1: There is a significant relationship between perceived usefulness (PU) and the intention to adopt NMP.
H2: There is a significant relationship between perceived ease of use (PE) and the intention to adopt NMP.
H3: There is a significant relationship between an individual’s compatibility (CO) and the intention to adopt NMP.
H4: There is a significant relationship between perceived cost (PC) and the intention to adopt NMP.
H5: There is a significant relationship between additional value (AV) and the intention to adopt NMP.
H6: There is a significant relationship between personal innovativeness (PI) and the intention to adopt NMP.
H7: There is a significant relationship between NFC-Related Knowledge (NK) and the intention to adopt NMP.
H8: There is a significant relationship between concerns on theft/fraud/loss (CF) and the intention to adopt NMP.
H9: There is a significant relationship between consumer trust (CT) and the intention to adopt NMP.

The proposed research model is shown in Figure 1. A 5 point Likert scale is used to measure user’s response on the questionnaires provided. The study questions are crafted base on items taken from existing questionnaires in selected literature reviews and modified to suite our study and is shown in Figure 2.

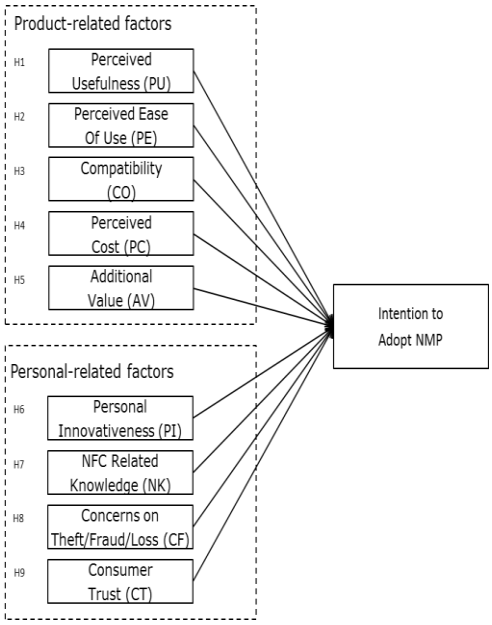

Figure 1. Research Model

Perceived Usefulness (PU)	PU1	Using NFC installed mobile devices in my life would enable me to accomplish tasks more quickly.
	PU2	Using NFC installed mobile devices in my life would increase my productivity.
	PU3	Using NFC installed mobile devices would enhance my effectiveness on the job.
	PU4	Using NFC installed mobile devices would make it easier to do my job.
	PU5	I would find NFC installed mobile devices useful in my job.
Perceived Ease of Use (PE)	PE1	Learning to operate NFC payment function would be easy for me.
	PE2	I would find it easy to get NFC to do what I want it to do.
	PE3	My interaction with NFC would be clear and understandable.
	PE4	I would find NFC to be flexible to interact with.
	PE5	It would be easy for me to become skillful at using NFC installed devices.
Compatibility (CO)	CO1	I will adopt NFC-enabled mobile payment if it is compatible with other mobile services
	CO2	I will adopt NFC-enabled mobile payment if it fits well with the way I like to manage my payment transactions
	CO3	I will adopt NFC-enabled mobile payment if it fits well with my lifestyle
	CO4	I will adopt NFC-enabled mobile payment if it fits well with my daily routine tasks
Perceived Cost (PC)	PC1	I will adopt NFC-enabled mobile payment if its registration fees are inexpensive
	PC2	I will adopt NFC-enabled mobile payment if its transaction fees are inexpensive
	PC3	I will adopt NFC-enabled mobile payment if its annual maintenance fees are inexpensive
	PC4	I will adopt NFC-enabled mobile payment if the cost involved in purchasing the mobile phone is reasonable
Added Value (AV)	AV1	I will adopt NFC-enabled mobile payment if it allows me to perform many additional functions along with the payment function
	AV2	I will adopt NFC-enabled mobile payment if the additional functions it offers are attractive
	AV3	I will adopt NFC-enabled mobile payment if the additional functions it offers meet my needs
	AV4	I will adopt NFC-enabled mobile payment if the current additional functions it provides are up to my expectation
Personal Innovativeness (PI)	PI1	If I heard about a new information technology, I would look for ways to experiment with it.
	PI2	Among my peers, I am usually the first to explore new information technologies.
	PI3	I am interested in exploring new information technology.
NFC-Related Knowledge (NK)	NK1	Knowing more NFC related knowledge would increase the chances that I use it.
	NK2	Lack of NFC related knowledge would reduce my chances to use the new technology.
Concerns on Theft/Fraud/ Loss (CF)	CF1	Concerns on theft/fraud/loss of my mobile phone would reduce my chances to use the new technology
	CF2	I will adopt NFC-enabled mobile payment if I can be protected against theft or loss of my mobile phone
	CF3	I will adopt NFC-enabled mobile payment if I can be protected against fraudulent transactions
Consumer Trust (CT)	CT1	My trust and security concerns will affect my decision to adopt NFC enabled mobile payment.
	CT2	Receiving a SMS confirmation after every NFC enabled mobile transaction will alleviate my privacy and security concerns.
	CT3	Receiving a Push Notification confirmation after every NFC enabled mobile transaction will alleviate my privacy and security concerns.
Intention to Adopt (IA)	IA1	I intend to use NFC-enabled mobile payment to make payments in the near future if I have access to it
	IA2	I intend to use NFC-enabled mobile payment frequently in the near future if I have access to it
	IA3	I intend to recommend NFC-enabled mobile payment to my family and friends in the future

Figure 2. Questionnaire for Intention to Adopt NMP

3. RESULTS AND ANALYSIS

3.1. Demographic Analysis

In total, 200 questionnaires were randomly distributed to consumers in FSKM, UiTM Shah Alam which comprises of Master and Degree students with an estimated total of 1,400 students. Out of those questionnaires that were distributed, only 153 questionnaires were returned. Thus, the response rate of this study is 10.93%. However, only 150 questionnaires were analyzed using the SPSS software where 3 questionnaires were removed from further analysis due to its incomplete nature.

Figure 3 shows the summary of the demographic profile in FSKM. It shows that only 24% from the respondents own a Credit Card. All 150 respondents own a smartphone. 29.33% using Apple iPhone while 69.33% are using Android phones. 63.33% are female, 82% are from 18-28 years of age and 51.33% are from the RM2,000 to RM4,000 income group.

Category	Item	Frequency	Percentage
Owning a credit card	Yes	36	24.00
	No	114	76.00
	Total	150	100.00
Credit card usage monthly	Not using a credit card	114	76.00
	Use only when necessary	11	7.33
	1 - 3 times	12	8.00
	4 - 10 times	10	6.67
	11 - 20 times	1	0.67
	21 times and above	2	1.33
	Total	150	100.00
Owning a smartphone	Yes	150	100.00
	No	0	0.00
	Total	150	100.00
Phone brand	Apple iPhone running iOS	44	29.33
	Google, Samsung, HTC, Motorola, LG, Sony or other running Android	104	69.33
	Nokia or Windows running Windows Phone	2	1.33
	Total	150	100.00
Gender	Female	95	63.33
	Male	55	36.67
	Total	150	100.00
Age Group	18 – 28 years	123	82.00
	29 – 39 years	23	15.33
	40 – 50 years	3	2.00
	51 years and above	1	0.67
	Total	150	100.00
Monthly Income	I am not working currently, or less than RM 2,000	50	33.33
	RM 2,000 – RM 4,000	77	51.33
	RM 4,001 – RM 6,000	11	7.33
	RM 6,001 – RM 8,000	6	4.00
	RM 8,001 – RM 10,000	3	2.00
	RM 10,001 and above	3	2.00
	Total	150	100.00

Figure 3. Demographic Profile of the Respondents

3.2. Reliability and Validity Analysis

Prescott and Soeken [16] stated that the aim of a pilot test is to identify the feasibility, adequacy of instrumentation, and problems of data collection strategies and proposed methods and added answering methodological questions, and planning a larger study. According to Monette et. al [17], the ideal sample size for the purpose of pilot testing is 20. In this study, a sample of 32 consumers was randomly selected to get their feedback and suggestions regarding the questionnaire prepared. The collected questionnaires was analyzed using the SPSS statistical software to find out whether it is reliable. The results of the reliability analysis showed that all the variables used in this study are reliable and will be considered to be used to conduct the intended study. There are seven variables with Cronbach Alpha value more than 0.80 which are considered as Very Good Reliability, one variable with a Cronbach Alpha value more than 0.70 which is considered as Good Reliability and the remaining two variables with Cronbach Alpha value more than 0.60 which are considered as Fair Reliability. Following are the reliability test results generated using SPSS for the pilot test.

No	Variables	Cronbach's Alpha	No. of items	Level of Reliability
1	Perceived Usefulness (PU)	0.93	5	Very Good Reliability
2	Perceived Ease of Use (PE)	0.954	5	Very Good Reliability
3	Compatibility (CO)	0.974	4	Very Good Reliability
4	Perceived Cost (PC)	0.899	4	Very Good Reliability
5	Additional Value (AV)	0.948	4	Very Good Reliability
6	Personal Innovativeness (PI)	0.803	3	Good Reliability
7	NFC-Related Knowledge (NK)	0.666	2	Fair Reliability
8	Concerns on Theft/Fraud/Loss (CF)	0.639	3	Fair Reliability
9	Consumer Trust (CT)	0.872	3	Very Good Reliability
10	Intention to Adopt (IA)	0.933	3	Very Good Reliability

Figure 4. Reliability Test

3.3. Hypothesis Testing

From the nine hypothesis being tested, only three hypothesis were accepted, which are the Perceived Usefulness (PU), Compatibility (CO) and Perceived Cost (PC). Six hypothesis were rejected which are the Perceived Ease-of-use (PE), Additional Value (AV), Personal Innovativeness (PI), NFC-Related Knowledge (NK), Concerns on Theft/Fraud/Loss (CF) and Consumer Trust (CT).

Hypothesis	Accepted/ Rejected	Reasons
H1: There is a significant relationship between perceived usefulness (PU) and the intention to adopt NMP.	Accepted	P-Value (0.005) less than 0.05
H2: There is a significant relationship between perceived ease of use (PE) and the intention to adopt NMP.	Rejected	P-Value (0.470) more than 0.05
H3: There is a significant relationship between an individual's compatibility (CO) and the intention to adopt NMP.	Accepted	P-Value (0.028) less than 0.05
H4: There is a significant relationship between perceived cost (PC) and the intention to adopt NMP.	Accepted	P-Value (0.021) less than 0.05
H5: There is a significant relationship between additional value (AV) and the intention to adopt NMP.	Rejected	P-Value (0.430) more than 0.05
H6: There is a significant relationship between personal innovativeness (PI) and the intention to adopt NMP.	Rejected	P-Value (0.169) more than 0.05
H7: There is a significant relationship between NFC-Related Knowledge (NK) and the intention to adopt NMP.	Rejected	P-Value (0.359) more than 0.05
H8: There is a significant relationship between concerns on theft/fraud/loss (CF) and the intention to adopt NMP.	Rejected	P-Value (0.747) more than 0.05
H9: There is a significant relationship between consumer trust (CT) and the intention to adopt NMP.	Rejected	P-Value (0.518) more than 0.05

Figure 5. Hypothesis Testing

The majority of the independent variables (5 out of 9) in this study has a "Low positive correlation" with the dependent variable as their Pearson Correlation Coefficient falls between the range of 0.30 – 0.50. The relationship direction for all of the independent variables with the dependent variable is positive.

The independent variables that are being studied is able to predict 52.3% of the variance in the dependent variable. The regression model that are being used in the study are statistically fit to predict the dependent variable using the independent variables of the study. There are three independent variables in the study that have a significant relationship with the dependent variable. The study done has shown that not all the independent variables being studied has a significant relationship with the intention to adopt NMP. By understanding the factors affecting the intention to adopt NMP, financial technology companies, such as CIMB, Maybank, Samsung, Apple and Touch 'n Go can focus to provide the solutions according to market interest, needs and readiness. Big decisions need to be done which will lead to huge investments to implement the intended solution and capitalize to capture the market share to generate profits for the company.

4. CONCLUSION AND RECOMMNEDATIONS

The result of the study concluded that Perceived Usefulness (PU), Compatibility (CO) and Perceived Cost (PC) are the three factors that affect the adoption intention for NMP. The remaining factors have no significant relationship on the adoption intention towards NMP, which are the Perceived Ease-of-use (PE), Additional Value (AV), Personal Innovativeness (PI), NFC-Related Knowledge (NK), Concerns on Theft/Fraud/Loss (CF) and Consumer Trust (CT). The study findings has provided a good understanding to the developers of mobile phone software, mobile phone manufacturers, banking institutions and other related parties on what features and functionalities to be focused upon when coming up with the intended product or services. The study has provided valuable insights to financial technology companies to explore, plan and strategize in the areas that they can add value and implement the required solution to capture the consumer market.

The study done here is only done in one closed community, which is only covering FSKM in UiTM Shah Alam with only 150 valid respondents. This limitation of the study is due to the time constraint in completing the study within a few months only. A bigger study sample to cover other faculties in UiTM, or other colleges or universities as well as other companies will provide a better insights and meaningful data to

extend the research further. This research study will have to make the assumptions that the analysis of the adoption intention may be influenced by other factors which were not mentioned in this study, and also In some cases, the participants may refuse to speak against their unwillingness to adopt to NMP.

It is also suggested for future researchers to relook at the independent variables to be used in future studies and the questions to be asked in order to represent it better. Apart from studying the intention to adopt NMP, it is also suggested to make a comparison against the intention to adopt QR Code Mobile Payment (QMP). Apple has recently added QR reading to its camera which indicated that the company is following a trend with blind optimism in the hope that it will get a good outcome out of it. QR codes is not really popular in the U.S., where Apple's influence and market share is the highest worldwide, but in Asia, particularly in China, it is a well-established technology which enabled payments, website discovery and many more [18].

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