Predicting Consumer Intention to Adopt Near Field Communication Enabled Mobile Payment in Thailand

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Abstract— **Near Field Communication (NFC) enabled mobile payment is the process that allows two devices placed within a few centimeters of each other to exchange data in order to make a payment. The consumers can make purchases directly just by waving or tapping their mobile phones on the NFC reader. Recently, NFC-enabled contactless payment has been emerging in many counties including Thailand. The objective of this study is to identify the factors influencing consumers to adopt the NFC-enabled mobile payment system in Thailand. The hypotheses are constructed to test the influence of 6 independent variables. Online surveys were conducted in early 2017 and the total of 400 completed questionnaires were returned. The empirical results indicated that three factors of Thai respondents; *Relative Advantage*, *Compatibility* and *Social Influence*, were significant predictors of the intention to adopt NFC-enabled mobile payment.**

Index Terms— **NFC; Near Field Communication; Intention; Adopt; Mobile; Payment; Thailand.**

I. INTRODUCTION

The new technologies are always introduced to the world, and they bring more convenience to people. Many of new technology inventions are on mobile phones or smartphones. Nowadays, a mobile phone is not just a phone, but the device can do almost everything.

The smartphone is continuously developed to provide many interesting functions. Until now, the latest technology is the Near Field Communication or NFC - enabled contactless mobile payment with the built-in new channel of payment which had been introduced to the world under the project name "Mobile Wallet" [1]. The consumers can go out and travel without their wallet by subscribing and browsing through many services such as payment cards, offers, vouchers, tickets, and other items in their daily life.

Apple has lunched many new technologies to the world and can be accepted by many people and businesses. Apple Pay was introduced to the world during the release of iPhone 6 in 2014. Meanwhile the Samsung Pay was introduced in 2015.

Thai consumers are more confident in the security of digital transactions. According to the Bank of Thailand [2], the number of electronic payment (e-payment) transactions was increased 85 percent from the year 2012 to 2016.

In 2017 NFC enabled mobile payments have been used in many ASEAN countries such as Singapore, Malaysia, Thailand, and Indonesia. However, there are many consumers in Thailand who are reluctant to use this technology. In 2016 Thai government set the policy to support e-payment system and encourage people to use it and NFC enabled mobile payment is one of the applicable approaches. The objective of this study is to examine factors influencing Thai customers' intention to adopt NFC enabled mobile payment.

II. LITERATURE REVIEW

A. Introduction of mobile payment

Mobile payment or M-payment is an exchange of financial value via mobile devices such as smart phones, tablets, personal digital assistants (PDA) and other mobile devices in return for goods and services. Instead of paying with cash, debit cards or credit cards, customers can easily and conveniently use their mobile phones to pay for a wide range of goods and services.

Nowadays, the mobile phone is more than a telephone but it is equipped with many functionalities. The development of value added mobile services had inspired mobile commerce and mobile payment in order to accelerate the potentials of mobile business. The original mobile payment and other mobile services began with mobile banking and texts messaging to complete transactions. Later on, the customers can make a mobile payment through the application and then through NFC or contactless payment systems.

B. Overview of Near Field Communication Technology

Near field communication (NFC) is a transmission standard for the contactless exchange of data across short distances of 4 to 10 centimeters by a magnetic field [3]. NFC technology was first developed by Sony and NXP semiconductors. It was an evolution of radio-frequency identification (RFID) with the first patent in 1983 by Charles Walton. In order to promote the standardization and development of NFC specifications, NFC Forum was founded by NOKIA, Philips and Sony in 2004. The outstanding characteristic of NFC is the communication modes. NFC can be both active communication by creating its own radio frequency field and passive communication by receiving the radio frequency field generated from other devices.

NFC-enabled devices have three modes of operating as follows;

a) *Card Emulation Mode or Passive-Active mode*

The NFC-enabled device has functions like a traditional contactless smart card. The device communicates with an external reader, but, the reader can communicate back the NFC devices with the new NFC infrastructure. For example, in airline industry customer can use the device as a ticket, updating seat information, luggage tracking and adding frequent flyer points after a touch device to the reader.

b) *Peer-to Peer Mode or Active-Active Mode*

This mode allows each NFC-enabled device to communicate for exchanging information and share file such as sharing Bluetooth or Wifi link setup parameters or exchange data. The consumers can exchange virtual business cards and digital photos through peer to peer model.

c) Reader / Writer Mode or Active-Passive Mode

A passive legacy tag can be embedded in, such as a smart poster, display, merchandise, business card and inventory for being read and writing information by tapping the NFC-enabled devices in close proximity [4].

In reader mode, the consumer can read the data, such as timetables or special offers from an NFC tag that already consists of the requested data. In writer mode, the device can write data to the tag and can overwrite data if the tag already consists of any data prior to the writing process.

C. Applications

The traditional of NFC technology can only transmit the data or exchange of formation types such as data, telephone number, image or digital authentication between NFC-enabled devices that held in proximity within 10 centimeters. The devices such as mobile phones, stereo speakers, printers or cameras with an NFC chip can enable peer to peer connection and transfer data.

With developed NFC technology, the mobile phone can also use instead of a wallet. NFC-enabled can be used more than a payment for goods and services, but it can store vouchers and membership cards, command photo printing, and secure access to buildings and computers as shown in Figure 1.

Figure 1: Use of NFC in Applications
Source: https\\nfcforall.files.worldpress.com

The NFC mobile phone is also integrated into daily life in the near future wherever the users go. A day will be more convenient, easier and faster by using near field communication as its enhancing the contactless system.

D. NFC Enabled Mobile Payment

NFC mobile devices can be used as a contactless payment system. Most of the existing type of contactless payment such as credit/debit cards, electronic tickets and smartcards will be replaced by this new type of payment system called "NFC mobile payment". The first NFC enabled mobile was introduced by Nokia with the Nokia 6131.

NFC brings the convenience to people's daily life by cutting out the unnecessary hassle of texting or swiping through menus to make payments, but yet still offers the security of a credit card [5].

In recent year, most mobile operating systems have their own application for NFC enabled mobile payments. In 2014 Apple IPhone 6 was launched with NFC application called "Apple Pay' for payment services. Google also fully supports NFC mobile payment by introducing the application named "Google Wallet" for the Android devices running Android 4.4 Kit Kat or a later version. Microsoft window phones are known as Nokia also provided its own wallet application that called "Wallet Hub" for NFC payment, which can integrate multiple NFC payment services within a single application.

With the participating of big financial institutes such as VISA, Master Card, and Pay Pal., Samsung has introduced the "Paywave" application on the Galaxy S4 smartphone in a partnership with VISA. Master Card also cooperates with Android and Blackberry OS to introduce "Paypass" application, which is similar to the previous one. For the "Apple pay", it cooperates with many financial institutes in the U.S. to increase the number of usages for NFC enabled mobile payment.

Recently, there are many countries in the world where have already integrated NFC mobile payment system for the facilities with the association of both government and public sector, for example in China, United Kingdom and United State. Most countries try to apply NFC mobile payment to the public transportation facilities. In 2013, China began to use the NFC mobile payments introduced by China Mobile and China UnionPay [6].

E. NFC Enabled Mobile Payment in Thailand

NFC enabled mobile payment had already been introduced in 2011. VISA credit cooperated with Kasikorn Bank and AIS, a mobile service provider, to introduce "Pay wave" integrated with Nokia 6212 and other 1,500 stores to enable the using of NFC mobile payment in Thailand. However, the popularity of device model was not popular enough, so this plan was faded away [7].

After the first try failed, then True Corporation cooperated with a Chinese firm to introduce "Touch SIM". It was to put the SIM card with RFID in the mobile SIM slot, but it also failed because the size was too big and not compatible with any mobile devices [7].

Later, Bangkok Smartcard System Limited Company, a member in BTS Group Holding Limited, introduced new E-payment system named "Rabbit". The Rabbit Card is a Top-up contactless stored value smartcard. At first, Rabbit Card is used to paying for transportation by BTS or the Sky Train, an elevated rapid transit system in Bangkok. Then, this card was accepted by many stores and restaurants such as McDonald, Starbucks, Burger King, and more leading chained-restaurants. It also can be used at grocery stores in Thailand [8].

Due to the trend of using Rabbit card is increasing, the company keeps moving to the next step by cooperating with AIS, the leader in telecommunication service provider in Thailand to introduce "AIS mPAY Rabbit". It is a service that brings consumers more convenience in paying BTS fee, buying goods or services with the NFC enabled-mobile payment by tapping their smartphone to the receiver to make a payment [9].

In Thailand, the use of contactless payment is spreading around. Seven Eleven uses "smart Purse" for their contactless payment method, "PayWave" by VISA, and Starbucks also uses their own Top-up card to provide more convenience for customers.

In 2016, Samsung launched "Samsung Pay" in Thailand [10]. Supporting partners include MasterCard, Visa, KCC, Bangkok Bank, Citibank, Kasikorn Bank, KTC and Siam Commercial Bank. There is an obvious trend that people will use more NFC enabled mobile payment method.

F. Theoretical Background
a) Diffusion of Innovations Theory
Diffusion of Innovations Theory was introduced by Everett M. Rogers in 1962. It is the theory explaining what factors would influence individuals to adopt new innovations. Rogers has done many studies in various fields such as marketing, public health and communication technologies and has concluded that it should not be assumed that all innovations are equivalent units of analysis [11]. Rogers also identified five characteristics of innovations that influence the rate of innovation adoptions. The five characteristics are; Relative advantages, Compatibility, Complexity, Trialability and Observability.

b) Technology Acceptance Model (TAM)
Technology Acceptance Model (TAM) is an information technology model which was developed to study individual's acceptance of the technology. Individual may take into his or her account that such technology has ease of use and usefulness to himself or herself before accept the technology [12].

TAM assumed that acceptance of information system is determined based on two major variables which are; perceived usefulness and perceived ease of use [13]. However, the previous study of Pavlou also suggested that trust was the direct variable while perceiving usefulness and perceived ease of use were the indirect variables of intention to transact e-commerce [14].

III. HYPOTHESES DEVELOPMENT AND CONCEPTUAL MODEL

A. Complexity
From the definition of Roger, "complexity is the degree to which an innovation is perceived as relatively difficult to understand and use" [11]. The characteristic involved the ease of use and free of effort which refers to intuitive, flexible, easy installation, and few steps taken for prospective adopters.

H1: Complexity characteristic has a significant impact on consumer intention to adopt NFC enabled mobile payment.

B. Trust and Security
Trust and security are the most important factor that people concern on mobile payment. The NFC payment system needs to integrate the financial cards such as credit cards or debit cards into a mobile phone, and it requires authorized access. Therefore, the consumers mainly concern on trust and security for authentication [15].

H2: Trust and Security have a significant impact on consumer intention to adopt NFC enabled mobile payment.

C. Relative Advantage
Relative advantage is the degree to which an innovation is perceived in term of economic profitability, low initial cost, a decrease in discomfort in status giving [11]. Having relative advantages such as incentives or subsidies will influence consumers to adopt the system instead of making payment by cash or credit card.

H3: Relative advantage has a significant impact on

consumer intention to adopt NFC enabled mobile payment.

D. Cost
Dahlberg et al. [16] acknowledge that the cost characteristic should be separately studied as a factor because it is a significant factor for an adopting decision of mobile payment. The cost of adopting an NFC payment system might be high such as a premium for a transaction. Moreover, NFC technology has a limitation in integration with some mobile phone models, and most of them are recent smart phones. The consumers may require to buy a new smart phone to use this payment system.

H4: Cost has a significant impact on consumer intention to adopt NFC enabled mobile payment.

E. Compatibility
Roger [11] defines compatibility as "the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters. In this study, the author has focused on the past experience of mobile phone services, the ease of use, the convenience, and the efficiency of the NFC payment system.

H5: Compatibility has a significant impact on consumer intention to adopt NFC enabled mobile payment.

F. Social influence
Bohle and Krueger [17] acknowledged that social and cultural factors are important determinants for the use of different payment instruments. TAM indicated that social influence consists of two components, namely subjective norm and image [18]. Subject norms defined as "the degree to which an individual perceives that people who are important to them think they should or should not use a certain system or perform a certain action." [19].

Due to collectivism culture, Thai people have grouped orientation. The widely use of the payment system in society, family and friends will affect the decision to adopt the system.

H6: Social influence has a significant impact on intention to use for Thai.

The conceptual model of this study consists of six independent variables and one dependent variable as shown in Figure 2.
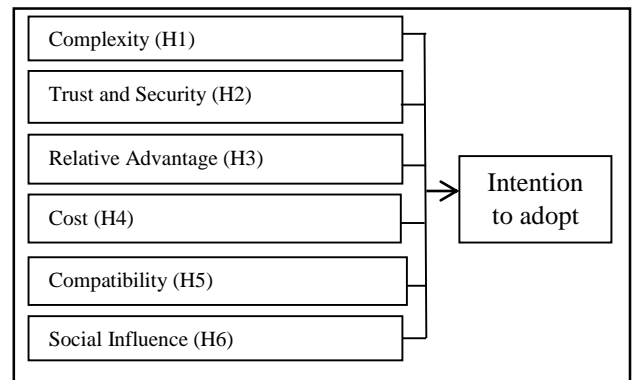

Figure 2: Conceptual Model

IV. METHODOLOGY

A. Samples and Data Collection

The target population is Thai people who use smartphones. The global mobile market report [20] shows that in 2017 Thailand has approximately 27 million smartphone users. Using 95 percent confidence level with a sampling error of 5 percent based on Yamane [21], a sample size of respondents is 400. The researchers used quota sampling technique for data collection; half of the samples are female and the rest of samples are male. An online based survey questionnaire was developed to test hypotheses in this study. Questionnaires were distributed during January to March 2017. Total of 400 completed questionnaires, 200 from female and 200 from a male, were returned

B. Research Instrument and Variable Measurement

Twenty one questions were used to measure the 6 independent variables and 4 questions were used to measure a dependent variable. Besides demographic profiles, all items are measured on a five-point Likert Scale ranging from 1 (strongly disagree) to 5 (strongly agree). The sample of the questionnaire is in the Appendix.

C. Reliability

The reliability of the questionnaire was tested using Cronbach's alpha [22]. Table 1 shows that the reliability coefficients (α) of all independent variables are above 0.7. Therefore, the questions used in the questionnaire are reliable [23].

Table 1
Reliability Analysis

Variable	Cronbach's alpha
Complexity	0.749
Trust and Security	0.825
Relative Advantage	0.764
Cost	0.933
Compatibility	0.889
Social Influence	0.727

D. Validity

Table 2
Factor Analysis

Variable	No. of Item	Factor Loading	Eigen Value	Percentage of Variance
Complexity	3	0.681-0.727	3.391	15.957
Trust and Security	5	0.735-0.811	3.833	18.211
Relative Advantage	3	0.668-0.843	2.225	11.624
Cost	3	0.623-0.874	1.973	9.717
Compatibility	4	0.648-0.803	2.456	11.282
Social Influence	3	0.623-0.845	2.821	9.542

To test the validity of the constructs, factor analysis with varimax rotation is applied. The cut-off point for factor loading of 0.50 is used as suggested by Hair el al. [23]. The results in Table 2 confirm the existence of 6 factors with factor loading values above 0.50 and eigenvalues greater than 1.0 for all variables. These results confirm that each of these constructs is unidimensional and factorially distinct, and that all items used to operationalize the particular construct are loaded onto a single factor [24].

V. DATA ANALYSIS

Statistical Package for Social Sciences (SPSS) is used to analyze primary data collected from questionnaires in this study.

A. Descriptive Statistics

Descriptive statistics of samples on demographic data are shown in Table 3. The majority of respondents is in the age range of 15 to 50. Most of the respondents have a bachelor degree or higher.

Table 3
Demographic Profile

Demographic profile	Number	Percentage
Gender		
Female	200	50
Male	200	50
Age		
Less than 15	32	8
15-34	178	44.5
35-50	172	43
More than 50	18	4.5
Highest education level		
Diploma or less Degree	54	13.5
Bachelor Degree	228	57
Graduate Degree	118	29.5

B. Correlation Analysis

The correlation of means of the variables is conducted to determine the variability of the factors as shown in Table 4. For intention to adopt NFC mobile payment, the factors that have the strongest relationship are Relative advantages (r = 0.706) followed by Compatibility (r = 0.666) and Social Influence (r = 0.554). On the other hand, the factor that has the weakest relationship with the dependent variable is Cost (r = 0.339).

Table 4
Correlation among Variables

Variables	CP	TS	RA	CS	CM	SI	IA
CP	1	0.544	0.528	0.214	0.503	0.214	0.405
TS		1	0.571	0.297	0.546	0.285	0.518
RA			1	0.423	0.451	0.332	0.706
CS				1	0.301	0.145	0.339
CM					1	0.389	0.666
SI						1	0.554

Note: CP= Complexity, TS = Trust and Security, RA = Relative Advantage, CS= Cost, CM= Compatibility, SI= Social Influence, IA = Intention to Adopt

C. Collinearity Diagnostics Tests

To measure the degree of multi-collinearity, Collinearity Diagnostics tests are performed. According to O'Brien [25], a tolerance value of less than 0.20 or a VIF higher than 5 causes concern of multi-collinearity problem.

According to Table 5, all variables; Complexity, Trust and Security, Relative Advantage, Cost, Compatibility, and Social Influence are not in the critical level of muti-collinearitiy problem as the tolerance values of all variables are more than 0.20 and all VIF values are less than 5. Therefore, the results validate all variables.

Table 5
Collinearity Diagnostics Tests

Variables	Collinearity Statistics	
	Tolerance	VIF
Complexity	0.568	1.672
Trust and Security	0.413	2.410
Relative Advantage	0.389	2.537
Cost	0.813	1.223
Compatibility	0.448	2.220
Social Influence	0.822	1.212

D. Stepwise Multiple Regression and Hypothesis Test

As shown in Table 6, three variables have a significant impact on the intention to adopt NFC enabled mobile payment. The three predictors; Relative Advantage,

Compatibility and Social Influence can be explained by 58% of the variance of the dependent variable (adjusted R^2 = 0.580). Relative advantage (β =0.393, p=0.000) has the strongest impact on intention to use NFC-enabled mobile payment, followed by compatibility (β =0.336, p=0.001), and social influence (β =0.166, p=0.001). The results from the multiple regression in Table 6 shows that hypotheses H3, H5, and H6 are supported, but hypotheses H1, H2, and H4 are not supported. In summary, the multiple regression model was illustrated in Figure 3.
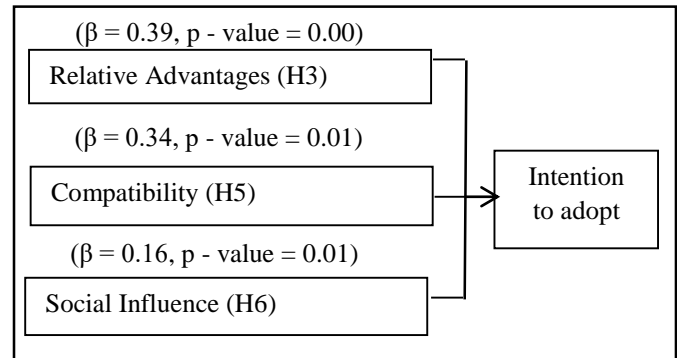

Figure 3: Summary of Multiple Regression

Table 6
Stepwise Multiple Regression

	Variables	B	β	t	Sig	R	R^2	Adj. R^2	Overall F
Criterion:	Intention to adopt					0.765	0.585	0.580	88.125
Predictor:	1. Relative advantages	0.387	0.393	5.608	0.000				
	2. Compatibility	0.365	0.336	4.81	0.001				
	3. Social Influence	0.162	0.166	3.225	0.001				

VI. CONCLUSION

The results indicate that only three factors; *Relative Advantage, Compatibility* and *Social Influence* have an impact and can predict the intention to use NFC enabled mobile payment variable. The *Relative Advantage* is the greatest predictor of intention to use the NFC-enabled mobile payment and it obtains the highest correlation with the intention to adopt. The majority of respondents are in the age range of 15-50 which is considered generation X and generation Y. They intend to adopt the payment service because it suits their life styles and needs. They are confident in their ability and technological knowledge to be able to use the NFC enabled mobile payment. Their decision making is more influenced by the social environments such as social media, advertising, trends and people around them. Family and friend also have a high influence on their decisions or their tendency to try new things.

Another three factors; *Complexity, Trust and Security*, and *Cost* do not significantly affect the intention to use NFC-enabled mobile payment. The cost variable has the lowest correlation with the intention to use. For *Complexity* variable and *Trust and Security* variable, most respondents have education at least Bachelor degree. Moreover, the system of NFC-enabled mobile payment and credit card are quite similar. Thus, the complexity and security are not obstacles for them to use this payment system.

APPENDIX

Questionnaire: Answer the following questions from 1=strongly disagree to 5= strongly agree.

Complexity
1. The simplicity of a NFC enabled mobile payment solution would affect my decision to adopt it.
2. I use most of the advanced features on my mobile phone/device.
3. I am willing to follow in order to complete a NFC enabled mobile payment within 3 steps.

Trust and Security
1. I am comfortable with having my credit/debit card integrated into my mobile phone.
2. My trust and security concerns will affect my decision to adopt NFC enable mobile payment.
3. Receiving a SMS confirmation after every NFC enabled mobile transaction will increase my trust and security concerns.
4. Fingerprint authentication after every NFC enabled mobile transaction will increase my trust and security concerns.
5. I would adopt NFC mobile payments if zero liability cover was provided to protect me against the fraudulent transaction.

Relative Advantage
1. I would rather use an NFC enabled mobile phone to pay for my groceries at the counter instead of cash.
2. I would rather use an NFC enabled mobile phone to pay for my groceries at the counter instead of credit/debit card.
3. I would adopt NFC enabled mobile payments because it is a "cool" technology.

Cost
1. I would adopt NFC enable mobile payments if I had to pay a premium for every transaction.
2. I would adopt NFC enabled mobile payments even if I had to purchase a new smart phone.
3. I would consider adopting NFC enabled mobile payments if the NFC mobile phone purchase was subsidized.

Compatibility

1. I have had a positive experience using mobile services such as 3G/4G.
2. The ease of using an NFC enabled mobile payment solution would influence my decision to adopt.
3. The convenience of using an NFC enabled mobile payment solution would influence my decision to adopt.
4. The efficiency associated with a mobile payment solution would influence my decision to adopt.

Social Influence

1. Friend's suggestions and recommendations will affect my decision to use NFC enabled mobile payment.
2. Family/relatives have an influence on my decision to use NFC enabled mobile payment.
3. I will use NFC enabled mobile payment if the service is widely used by people in my community.

Intention to Adopt

1. I am likely to use an NFC enabled mobile payment in the near future.
2. I am willing to use an NFC enabled mobile payment in the near future.
3. I will think about using an NFC enabled mobile payment.
4. I intend to use an NFC enabled mobile payment when the opportunity arises.

REFERENCES

[1] Matt Egan (2015). What is NFC? Uses of NFC | How to use NFC on your smartphone. [Online]. Available: http://www.pcadvisor.co.uk/how-to/mobile-phone/3472879/what-is-nfc-how-nfc-works-what-it-does/

[2] Bank of Thailand (2017). Volume of Payment Transactions processed through Payment Systems and Channels. [Online]. Available: http://www2.bot.or.th/statistics/ReportPage.aspx?reportID=681&language=eng

[3] Thomas Lerner, *Mobile Payment*, Springer Fachmedien Wiesbaden, 2013.

[4] Ekata Desai, Mary Grace Shajan, "A Review on the Operating Modes of Near Filed Communication," *International Journal of Engineering and Advance Technology*, vol.2, no.2, pp.322-325, 2012.

[5] Nearfieldcommunication (2017). History of Mobile & Contactless Payment Systems. [Online]. Available: http://www.nearfieldcommunication.org/payment-systems.html.

[6] R. Boden (2013). NFCWorld. NFC mobile ticketing to go live in Beijing [Online]. Available: http://www.nfcworld.com/2013/07/24/325076/nfc-mobile-ticketing-to-go-live-in-beijing/.

[7] Thai Telecommunications (2012). NFC for easier life. [Online]. Available: http://th-telecom.blogspot.com/2012/03/nfc.html.

[8] Rabbit (2015). The places you can use. [Online]. Available: https://card.rabbit.co.th/where-use-top-rabbit.

[9] AIS mPAY Rabbit. [Online]. Available:: http://www.ais.co.th/mpay/aismpayrabbit/faq.html

[10] NFCworld (2017). Samsung Pay goes live in Thailand. [Online]. Available: https://www.nfcworld.com/2017/02/08/349984/samsung-pay-goes-live-thailand/.

[11] Everett M. Rogers, Diffusion of Innovations, New York: The Free Press, 2003.

[12] Igi-global.com. (2015). What is Technology Acceptance Model (TAM), IGI Global? (2015). [Online]. Available: http://www.igi-global.com /dictionary/ technology-acceptance-model-tam/29485

[13] F. D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," MIS Quarterly, vol.13, no. 3, pp. 319–340, 1989.

[14] Paul A. Pavlou, "Consumer Acceptance of Electronic Commerce: Integrating Trust and Risk with the Technology Acceptance Model," International Journal of Electronic Commerce, vol. 7, no. 3, pp.101-134, 2003.

[15] N. Mallat, "Exploring Consumer Adoption of Mobile Payments - A Qualitative Study," *Journal of Strategic Information Systems*, vol. 16, no. 4, pp. 413-432, 2007.

[16] T. Dahlberg, N. Mallat, J. Ondrus, and A. Zmijewska, "Past, present and future of mobile payments research: a literature review", *Electronic Commerce Research and Applications*, vol. 7, no. 2, pp. 165-181, 2008.

[17] Knud Böhle and Malte Krueger. Payment Culture Matters-A comparative EU-US perspective on Internet payments. Seville: European Commission, Joint Research Centre. 2001.

[18] V. Venkatesh, "Technology acceptance model 3 and a research agenda on interventions," *Decision Science*, vol. 39, no. 2, pp.273-315, 2008.

[19] A. Dillon & M. Morris, "User acceptance of information technology: Theories and models," *Journal of American Society for Information Science*, vol. 31, pp. 3-32, 1996.

[20] Newzoo.com (2017). The Mobile Global Report. [Online]. Available: https://newzoo.com/insights/rankings/top-50-countries-by-smartphone-penetration-and-users/.

[21] Taro Yamane, Statistics: An Introductory Analysis. New York: Harper and Row, 1967.

[22] Lee J. Cronbach, "Test reliability: Its meaning and determination," Psychometrika, vol. 12, no.1, pp. 1-16, 1947.

[23] J. F. Hair, W. C. Black, B. J. Babin, R. E. Anderson, & R. L. Tatham, Multivariate Data Analysis. Upper Saddle River, NJ: Prentice Hall, 2006.

[24] T.S.H. Teo, "Demographic and motivation variables associated with internet usage activities," Internet Research, vol. 11, pp.125-137, 2001.

[25] R. M. O'Brien, "A Caution Regarding Rules of Thumb for Variance Inflation Factors," Quality and Quantity, vol. 41, pp.673-690, 2007.