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An examination of behavioral intention to use contactless mobile payment: Rapid transit system in Thailand

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ABSTRACT

The purpose of this study is to examine the behavioral intention to use the contactless mobile payment for rapid transit passengers in Bangkok, Thailand. The theoretical background of this study is based on Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI) theory including with five additional constructs i.e. personal innovativeness, social influence, trustworthiness, financial cost, and security risk. A sample of 342 participants who have experiences in purchasing with contactless mobile payment and commuting on rapid transit system was examined by using survey conducted in Thailand. Data was analyzed using the structural equation modeling (SEM). The empirical findings revealed that personal innovativeness, perceived usability, social influence, and perceived financial cost have significant effects over the behavioral intention to use contactless mobile payment whereas perception of trustworthiness and security risk showed insignificant influence. The conclusions of this study provides a basis for further refinement of mobile payment acceptance model which can be generalized to mobile payment study in the other contexts.

Keywords: Contactless Mobile Payment; Rapid Transit Payment; TAM; DOI; Thailand

1. INTRODUCTION

Smartphone technology has been developed to work closely with human everyday life in recent years. It has been shifted from feature phones servicing on voice-based to non-voice-based with internet access. Smartphones have been incorporated into people life activities through the financial services like mobile payment either each service is provided by financial institutions, mobile network operators, or independent service providers.

When considering the number of rapid transit passengers in Bangkok, Thailand, it is over 232.5 million people commuting in one year or 899,427 people per day (BTS, 2016). Comparing to the number of mobile phone subscribers, it has been over 90 million numbers at the end of year 2016 (NBTC, 2017). A huge number of users on these two domains motivate this study to examine the adoption on contactless mobile payment as fare ticket payment for Thai people.

According to prior studies during past few years, lack of relevant research in contactless mobile payment was addressed (Tan et al., 2014; Teo and Tan, 2015a; Morosan, 2016; Oliveira et al., 2016; Phonthanukitithaworn et al., 2016; Yang et al., 2012). There is also none of study of contactless mobile payment for rapid transit system that is conducted in Thailand.

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The purpose of this study aims to examine the individual behavioral intention to adopt the contactless mobile payment services in Thai context. The subsequent of paper is organized by literature review, development of research model along with the hypotheses, the research methodology and data analysis followed by research findings, discussion, and suggestion for future research.

2. LITERATURE REVIEW

2.1 Theoretical foundation

Technology Acceptance Model or TAM (Davis, 1989) is broadly applied by previous studies to derive the theoretical research model in technology acceptance for past decade. TAM is often integrated to other theories like Diffusion of Innovation or DOI (Roger, 2003) in order to explain the effect on mobile payment service adoption (Augsburg and Hedman, 2014; Morosan, 2016; Pham and Ho, 2015; Phonthanukitithaworn et al., 2016; Tan et al., 2014; Yang et al., 2012). Additional factors such as trust, security, and cost are also included into the research model to gain more accurate prediction (Cabanillas et al., 2014; Dahlberg et al. 2015; Pham and Ho, 2015; Ooi and Tan, 2016; Phonthanukitithaworn et al., 2016).

2.2 Proximity and remote mobile payment

Mobile payment technology could be categorized broadly into two main modes i.e. remote payment and proximity payment (Agarwal et al., 2007).

Remote payment (off-store or in-app payment) is a payment method that a customer has no need to stand in the retail shop or point of purchase like face-to-face to make payment. The payment is instead conducted by online drawing funds from customer's electronic money account, credit card account, or bank account to merchant account electronically over secure internet connection.

Proximity payment (in-store payment) requires a customer to present physical evidence like plastic card or mobile phone at the point-of-sale in retail shop. Any customer who wants to pay with proximity method needs to hold the card or mobile device at a short-range in front of the reader terminal for making payment transaction.

2.3 Contactless mobile payment

Contactless mobile payment is one of proximity payment methods. The relevant technology can be the radio frequency technology such as Near Field Communication (NFC) or Radio Frequency Identification (RFID), and by the visualization technology like Barcode or QR Code to conduct payment transaction at the Point-of-sale (POS) terminal (Bank of Thailand, 2013).

Purchasing in retailer store by using contactless mobile payment is just to tap or bring a smartphone screen close to reader. Once the communication is triggered, the transaction is transmitted securely under encryption technology to complete the payment (Cocosila and Trabelsi, 2016). Thus this study shall define contactless mobile payment to "A payment method by using mobile device with radio or visual communication technology to utilize in a variety of payments for goods and services in the near distance at point-of-sale terminal without physical touching". (Li et al, 2014; Tan et al., 2014).

2.4 Prior research in contactless mobile payment context

The aspects of mobile payment technology were examined in several contexts, for instance, the adoption of mobile ticket payment in public transport (Cheng and Huang, 2013; Di Pietro et al., 2015), the acceptance of mobile credit card on smartphone with NFC-enabled (Ooi and Tan, 2016; Tan et al., 2014), NFC-based mobile payment (Pham and Ho, 2015), and mobile payment technology adoption (Phonthanukitithaworn et al., 2016, Oliveira et al., 2016).

The theoretical model of TAM and DOI were most adopted as based theories. According to critical review of Dahlberg (2015), 23 studies since 2007 reported that perceived ease of use is an important adoption factor for mobile payment services, but some studies did not find the significant relationship even though those are in the same mobile payment context (Ooi and Tan 2016; Pham and Ho 2015). It is probably because traditional mobile payment services are not easy to use due to limited screen size and physical keyboards of smartphone (Tan et al., 2014). However, the smartphone has been developed rapidly as easier, cheaper, faster processing, and wider screen (Ooi and Tan, 2016). Hence several inconsistent suggestions in previous studies require to have further observes for better understanding in determinant factors on behavioral intention towards individual's adoption of contactless mobile payment.

3. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

Based on the thorough literature review, the development of research model is influenced by previous studies in order to explain the behavioral intention to use contactless mobile payment among rapid transit passengers in Thailand. In Figure 1, the model includes 9 variables in 3 constructs i.e. service-oriented, psychological science, and risk construct (Ooi and Tan, 2016; Tan et al., 2014).

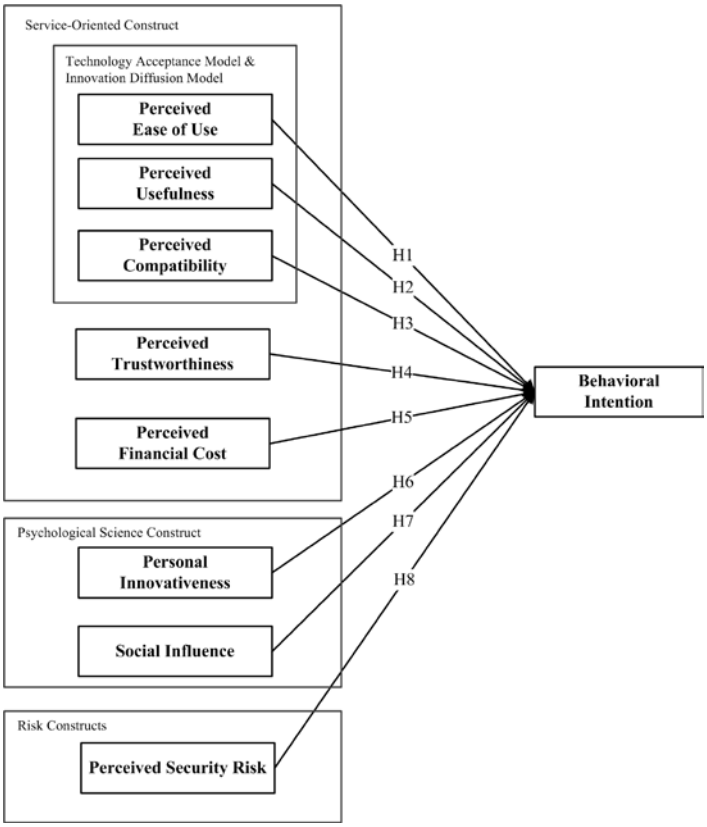

Figure 1 Proposed research model

3.1 Service-oriented construct

Service-Oriented construct consists of 5 variables which are mainly based on TAM and DOI. The additional variables of trust and financial cost having plausible relationship to degree of adoption are included.

Perceived ease of use: Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). For instance, when a consumer feel that mobile payment is easier to use than another is more likely to be accepted (Pham and Ho, 2015). Hence, the hypothesis of perceived ease of use for this study is proposed as:

H1: Perceived ease of use (PEU) has a direct positive effect on behavioral intention (BI).

Perceived usefulness: Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). For instance, a consumer may feel that making payment with their mobile phone has more advantage in term of effectiveness, convenience, and speed of transaction, than existing payment method like cash payment or card payment (Cheng and Huang, 2013; Teo and Tan, 2015a). When consumer realizes that mobile payment can deliver values that other payment services cannot offer, they may feel positively on intention to adopt the mobile payment services (Pham and Ho, 2015). Therefore, the hypothesis regarding to perceived usefulness is proposed as:

H2: Perceived usefulness (PU) has a direct positive effect on behavioral intention (BI).

Relative advantage: Relative advantage refers to "the degree to which an innovation is perceived as being better than the idea it supersedes" (Roger, 2003). This factor is similar to usefulness and often viewed as an equivalent of the perceived usefulness in TAM since both constructs discuss the degree to which users perceive benefits in terms of usefulness when acquiring new technology (Davis, 1989; Moore and Benbasat, 1991; Phonthanukitithaworn et al., 2016; Thakur and Srivastava, 2014). Thus the hypothesis for relative advantage is proposed to be the same as usefulness.

Complexity: This attribute refers to "the degree to which an innovation is perceived as relatively difficult to understand and use" (Roger 2003). Complexity is similar to perceived ease of use to measure the degree that consumers perceives a technology as being uncomplicated reflecting its ease of use (Moore and Benbasat, 1991; Thakur and Srivastava, 2014; Pham and Ho, 2015; Phonthanukitithaworn et al., 2016). Hence, this study proposes the hypothesis for complexity to be the same as perceived ease of use.

Compatibility: This attribute refers to "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Roger, 2003). Compatibility is used to measure a new technology that consistent to existing practices and meet daily consumer's lifestyle (Tavilla, 2015). It is also evaluated by assessing the innovation's compatibility among the existing values and beliefs, previously introduced ideas and potential adopters' needs (Rogers, 2003). The hypothesis related to individual perception of compatibility for this study is proposed as:

H3: Perceived compatibility (PC) has a direct positive effect on behavioral intention (BI).

Trialability: This refers to "The degree to which an innovation may be experimented with on a limited basis" (Roger, 2003). It is a degree to which the technology allows consumers to try on and to understand it better before making decision to accept.

Observability: Definition for this attribute refers to "the degree to which the results of an innovation are visible to others" (Roger, 2003). Its degree is to measure on technology or innovation can be seen and learnt by consumer who have not yet adopted.

However, a meta-analysis (Tornatzky and Klein, 1982) indicates that out of the 5 original constructs of

Diffusion of Innovation, only relative advantage, complexity, and compatibility were consistently related to the technology adoption. Hence this study proposes removing factor of trialability and observability out from the hypothesis development.

Perceived trustworthiness: Trust is defined as the "willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trust or irrespective of the ability to monitor or control that other party" (Mayer et al., 1995). Consumers would be unwilling to use mobile payment if they feel that mobile payment services is delivered by providers who are lack of trust (Cabanillas et al., 2014; Chong et al., 2012; Ooi and Tan, 2016; Phonthanukitithaworn et al., 2016). However, trust has less effect if mobile payment service is in early stage and not widely used in market since consumers have no experience and unknown yet about services (Pham and Ho, 2016). Thus, the hypothesis for perception of trustworthiness is proposed as:

H4: Perceived trustworthiness (PT) has a direct positive effect on behavioral intention (BI).

Perceived financial cost: Perceived financial cost is defined as the extent to which an individual believes that using mobile payment will cost extra money (Luarn and Lin, 2005). Cost may include transaction fees, new mobile phone costs, and subscription fees (Tan et al., 2014; Pham and Ho, 2015; Ooi and Tan, 2016; Phonthanukitithaworn et al., 2016;). Nevertheless, some studies argued the inconsistency evidence that cost has no significant relationship to behavioral intention of consumers (Tan et al., 2014; Pham and Ho, 2015; Phonthanukitithaworn et al., 2016; Ooi and Tan, 2016). Therefore, the hypothesis for financial cost perceived by individual is proposed as:

H5: Perceived financial cost (PFC) has a direct negative effect on behavioral intention (BI).

3.2 Psychological science construct

Personal innovativeness: Personal innovativeness is a trait reflecting user acceptance on a new innovation (Agarwal and Prasad, 1998). As mentioned by Kuo and Yen (2009), personal innovativeness represents an individual's willingness to accept new products or services as a risk taker with positive belief of adoption on new technology context (Agarwal and Prasad, 1998; Tan et al., 2014). Several studies had demonstrated that personal innovativeness is a strong predictor of adoption in mobile payment context (Oliveira et al., 2016; Tan et al., 2014; Pham and Ho, 2015; Cheng and Huang, 2013; Thakur and Srivastava, 2014). Thus, this study proposes the hypothesis for personal innovativeness as:

H6: Personal innovativeness (PI) has a direct positive effect on behavioral intention (BI).

Social influence: Social influence is defined as the degree to which an individual perceives the degree of approval of a certain behavior by important referents (Venkatesh et al., 2003, 2012). As definition by Oliveira et al. (2016), consumes would be influenced by other opinion from family, friends, or colleagues, that they should use a particular technology (Venkatesh et al., 2012). As adopting new technology may enhance consumers' image and social status, it is reasonably hypothesized the factor associations that the greater the perception of social image, the greater the intention to adopt mobile payment service voluntarily (Tan et al., 2014). Therefore, the hypothesis regarding to social influence is proposed as:

H7: Social influence (SI) has a direct positive effect on behavioral intention (BI).

3.3 Risk construct

Perceived security risk: In domain of mobile payment, Ooi and Tan (2016) defined the variable of perceived security risk to the degree of the perception of protection against risk associated with mobile transactions in term of information loss and financial loss. Perceived security risk is a critical determinant especially in the pre-adoption stage of a technology adoption for consumers who have no experience of using (Phonthanukitithaworn et al., 2016). However, Cheng and Huang (2013) and Tan et al., (2014) argued with their finding that risk of personal information loss and risk of using mobile payment was not too concerned by young people and the one who have ever used. Therefore, the hypothesis relevant to perception of security risk for this study is proposed as:

H8: Perceived security risk (PSR) has a direct negative effect on behavioral intention (BI).

4. RESEARCH METHODOLOGY

4.1 Questionnaire development

In Table 1, totally 27 indicators were measured by a 5-point Likert-Scale varying from strongly agree (5) to strongly disagree (1). The questionnaire was prepared in English and Thai languages and revised by research experts who have proficiency in both languages for plausible comments. Ten people representing focus group were invited to participate for pilot testing.

Table 1 Questionnaire sources and number of indicators

Constructs	Number of Indicators	Sources
Perceived ease of use (PEU) **PEU1:** I think using CMP is easy for me **PEU2:** I think learning to use CMP is easy for me	2	Davis et al., 1989; Cheng and Huang, 2013; Pham and Ho, 2015
Perceived usefulness (PU) **PU1:** I think using CMP would enhance my effectiveness in my daily life **PU2:** I think using CMP is more convenient than other payment method **PU3:** I think using CMP is faster than other payment method	3	Cheng and Huang, 2013; Tan et al., 2014
Perceived compatibility (PC) **PC1:** I think that using CMP fit well with my lifestyle **PC2:** I think that using CMP fit well with the way I like to conduct my payment transactions **PC3:** I believe that using CMP fit well with the way I like to manage my finances	3	Pham and Ho, 2015; Phonthanukitithaworn et al., 2016
Perceived trustworthiness (PT) **PT1:** I think the participants involved in process of making payment via CMP are trustworthy **PT2:** I think the process of making payment via CMP is trustworthy **PT3:** I think the information received during the process of CMP is trustworthy	3	Pham and Ho, 2015
Perceived security risk (PSR) **PSR1:** I feel insecure to provide personal information when using CMP **PSR2:** I am worried that my transaction would be known to others when using CMP **PSR3:** I am concerned that my transaction is unsafe	3	Pham and Ho, 2015; Morosan et al., 2016; Yang et al., 2015
Perceived financial cost (PFC) **PFC1:** I think the entrance fees for using CMP is high **PFC2:** I think the transaction fees for using CMP is high **PFC3:** I think using CMP increase my cost of payment	3	Tan et al., 2014; Phonthanukitithaworn et al., 2016
Social influence (SI) **SI1:** Friend's suggestions will affect my decision to use CMP **SI2:** Family or relatives' suggestions have influence on my decision to use CMP **SI3:** I will use CMP if the service is widely used by people in my community **SI4:** Using CMP will enable me to improve my social status	4	Tan et al., 2012; Tan et al., 2014
Personal innovativeness (PI) **PI1:** I am curious about how things work **PI2:** I am always interested in most up-to-date products **PI3:** I like to experiment with new information technologies	3	Cheng and Huang, 2013; Tan et al., 2014; Oliveira et al., 2016

Table 1 Questionnaire sources and number of indicators (Continued)

Constructs	Number of Indicators	Sources
Behavioral intention (BI) **BI1:** I intend to use CMP for my daily life **BI2:** I intend to use CMP further in the future **BI3:** I intend to use CMP when the opportunity arises	3	Pham and Ho, 2015; Tan, 2014
Total	27	

4.2 Sampling procedure and data collection

The target population in this study was individuals who had prior experiences in contactless mobile payment and commuting on rapid transit system as mandatory. The location for data collection was at central business district area in Bangkok, Thailand. The reason to select this area is because there are diverse groups of user comprising various ages, educations, occupations, and backgrounds including with the availability of rapid transit system.

A purposive method was used in this study which is appropriate when the judgment of individuals with particular experience is required (Neuman, 2014). Since contactless mobile payment in Thailand is in early stage then obtaining a list of individuals with the experiences mentioned above was still difficult. Thus, snowball sampling method was also applied by requesting each participant to redistribute questionnaire to their personal contacts. As recommended by Kline (2011), sample size to parameter ratio for the statistical precision of structural equation modeling (SEM) techniques is considered at 20:1. Then, a minimum sample size for this study could be at least 200 responses.

Sampling was done during 15 December 2016 to 31 January 2017 through email, social media, and site visit at companies around the rapid transit station. Whole 442 responses were collected. The questionnaires were scrutinized and there were only 355 valid and usable samples. However, there were 13 outliers in samples to be removed. Then the final sample remainders were 342 which satisfied the sample size determined for the study.

5. DATA ANALYSIS AND RESULTS

5.1 Profile of respondents

The summary of respondent's demographic information is presented in Table 2. The gender of respondents consists of 142 males and 200 females. Most respondents were between 20 to 39 years of age. More than half of respondents were employees. Their educational level were bachelor degree or higher. They also had experiences in contactless mobile payment between 1-12 months and more. Current types of fare ticket payment for rapid transit system were stored-value card and cash as one time fare ticket, respectively. Table 3 presents the relationship between education level and age of respondents.

Table 2 Demographic information of respondents

Item		Frequency	Percentage (%)
Gender	Male	142	41.5
	Female	200	58.5
Age (Years)	Below 20	21	6.1
	20 – 29	104	30.4
	30 – 39	148	43.3
	40 – 50	65	19.0
	Over 50	4	1.2

Table 2 Demographic information of respondents (Continued)

Item		Frequency	Percentage (%)
Education level	Under Bachelor degree	30	8.8
	Bachelor degree	185	54.1
	Master degree or higher	127	37.1
Occupation	Student	45	13.2
	Employee	272	79.5
	Self-employed / Business owner	25	7.3
Duration of experience	Less than 1 month	85	24.9
	1 – 12 months	143	41.8
	Over 12 months	114	33.3
Current fare ticket payment	One time fare ticket	109	31.9
	Stored-value card ticket	204	59.6
	Mobile phone payment with NFC	29	8.5

Table 3 Relationship between education level and age of respondents

Education Level		Age (years old)					Total
		Below 20	20-29	30-39	40-50	Over 50	
Under Bachelor degree	*Count*	14	11	2	2	1	30
	Percent of Total	4.1%	3.2%	0.6%	0.6%	0.3%	8.8%
Bachelor degree	*Count*	7	69	79	28	2	185
	Percent of Total	2.0%	20.2%	23.1%	8.2%	0.6%	54.1%
Master degree or higher	*Count*	0	24	67	35	1	127
	Percent of Total	0.0%	7.0%	19.6%	10.2%	0.3%	37.1%
Total	*Count*	21	104	148	65	4	342
	Percent of Total	6.1%	30.4%	43.3%	19.0%	1.2%	100.0%

5.2 Factor analysis

The factor analysis was performed to test for reliability and validity for the collected data. Using Equamax with Kaiser Normalization based on the Eigen value over 1, the final analysis suggested 7 factors with the total rate of variance explained at 74.010%. Factor loading is the relationship of each indicator to the underlying factor while loadings value below 0.4 was dropped in order to meet the satisfactory for convergent and discriminant validity (Hair et al., 1998). Each factor presents with indicators in descending order of loading value as presenting in Table 4 and Table 5.

Table 4 Final result of factor analysis

Indicator	Perceived Usability	Perceived Trustworthiness	Personal Innovativeness	Social Influence	Perceived Financial Cost	Behavioral Intention	Perceived Security Risk
PU2	**.741**	.096	.190	.087	-.137	.170	-.001
PU1	**.738**	.154	.153	.030	-.117	.189	.021
PC1	**.730**	.227	.155	-.001	.021	.246	-.018
PU3	**.702**	.106	.226	.073	-.051	.140	.026
PEU1	**.639**	.302	.185	-.067	-.064	.162	-.081
PEU2	**.628**	.353	.184	-.093	-.089	.230	-.091
PC2	**.587**	.297	.179	.069	.075	.300	-.020
PC3	**.582**	.203	.121	.162	.091	.154	-.041
PT2	.088	**.891**	.082	.157	.025	.072	-.076
PT3	.107	**.877**	.080	.108	.024	.155	-.023
PT1	.213	**.834**	.108	.089	.061	.126	-.050

Table 4 Final result of factor analysis (Continued)

Indicator	Perceived Usability	Perceived Trustworthiness	Personal Innovativeness	Social Influence	Perceived Financial Cost	Behavioral Intention	Perceived Security Risk
PI2	.098	.106	**.886**	.075	.025	.232	.079
PI3	.108	.083	**.878**	.046	.027	.238	.036
PI1	.132	.068	**.841**	.097	-.046	.207	.022
SI2	.092	.074	.056	**.881**	.118	.000	.052
SI1	.050	.084	.070	**.867**	.132	.027	.043
SI3	.029	.035	.091	**.802**	.031	.162	-.022
SI4	-.139	.253	.016	**.565**	.264	.253	.036
PFC1	.008	.005	-.004	.086	**.931**	-.062	.153
PFC2	-.037	.016	-.012	.114	**.919**	-.071	.188
PFC3	-.042	.060	.012	.166	**.837**	-.020	.184
BI2	.136	.146	.230	.113	-.039	**.877**	-.033
BI3	.074	.015	.262	.141	-.114	**.784**	.012
BI1	.213	.220	.274	.078	-.029	**.766**	-.053
PSR2	-.030	-.096	.026	.007	.183	-.015	**.923**
PSR3	.004	-.051	.075	-.005	.108	.011	**.898**
PSR1	.004	.018	.010	.068	.190	-.043	**.860**

Table 5 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Percentage of Variance	Cumulative Percentage	Total	Percentage of Variance	Cumulative Percentage	Total	Percentage of Variance	Cumulative Percentage
PUS	7.357	27.248	27.248	7.357	27.248	27.248	3.813	14.123	14.123
PT	3.974	14.720	41.968	3.974	14.720	41.968	2.887	10.692	24.815
PI	2.471	9.150	51.118	2.471	9.150	51.118	2.755	10.204	35.018
SI	2.199	8.144	59.262	2.199	8.144	59.262	2.701	10.002	45.020
PFC	1.540	5.705	64.967	1.540	5.705	64.967	2.681	9.929	54.950
BI	1.378	5.103	70.070	1.378	5.103	70.070	2.609	9.662	64.611
PSR	1.064	3.940	74.010	1.064	3.940	74.010	2.538	9.399	74.010

Table 6 KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.844
Bartlett's Test of Sphericity	Approx. Chi-Square	6103.813
	Degree of freedom (df)	351
	Significant (p)	0.000

According to Table 4, item with loadings value below 0.4 was dropped in order to meet the satisfactory for convergent and discriminant validity (Hair et al., 1998). It was noticed that the indicators from 3 variables: PEU, PU, and PC, were loaded onto the same factor. This means that it was not possible to obtain distinct valid measures of the three variables. Therefore, a new variable with name of "Perceived Usability" (PUS) was introduced with a new hypothesis (H9: Perceived usability has a direct positive effect on behavioral intention) which replaced the hypotheses H1, H2, and H3. The indicators for PEU, PU, and PC are providing valid measures for the new variable PUS and they are retained as measures of

that latent variable in the subsequent analyses. The new variable PUS is defined as the degree to which a person perceives that interacting with technology is compatible to lifestyle with usefulness and effortless. The result in Table 6 shows that Kaiser–Meyer–Olkin (KMO) is 0.844, Bartlett's test is 6103.813, and the degree of freedom (df) is 351 thus the result of factor analysis is appropriate.

5.3 Reliability and validity measures

The reliability and validity of the construct were tested by using Cronbach's alpha coefficient, composite reliability (CR > 0.70) and average variance extracted (AVE > 0.50). However the AVE less than 0.5 is still acceptable if CR is higher than 0.6 then the convergent validity of the construct is still adequate. The maximum magnitudes of skewness (0.746) and kurtosis (1.872) are less than the thresholds of 3 and 10 respectively which it can imply a normal distribution (Kline, 2011). Hence, this study has confirmed the reliability and convergent validity of the dataset as presenting in Table 7 with the descriptive statistics, such as mean and standard deviation, of each questionnaire item and variable.

Table 7 Descriptive statistics and result of validity and reliability measures

Factor	Mean	Standard Deviation	Skewness	Kurtosis	Cronbach's Alpha	Interpretation for Reliability	CR	AVE
Perceived usability (PUS)					0.890	Good	0.867	0.451
PEU1	4.20	0.629	-0.184	-0.592				
PEU2	4.11	0.680	-0.141	-0.838				
PU1	4.31	0.610	-0.438	0.204				
PU2	4.33	0.617	-0.501	0.166				
PU3	4.35	0.620	-0.691	1.455				
PC1	4.14	0.702	-0.462	-0.010				
PC2	4.01	0.687	-0.284	-0.053				
PC3	3.98	0.722	-0.443	0.457				
Perceived trustworthiness (PT)					0.895	Good	0.901	0.750
PT1	3.72	0.761	-0.075	0.024				
PT2	3.82	0.749	-0.248	0.017				
PT3	3.91	0.741	-0.198	-0.149				
Perceived security risk (PSR)					0.899	Good	0.923	0.799
PSR1	3.39	0.879	-0.175	-0.105				
PSR2	3.50	0.940	-0.434	0.038				
PSR3	3.64	0.878	-0.399	0.213				
Perceived financial cost (PFC)					0.919	Excellent	0.925	0.804
PFC1	3.07	0.957	-0.262	-0.071				
PFC2	3.07	0.946	-0.260	0.034				
PFC3	3.08	1.011	-0.154	-0.335				
Social influence (SI)					0.828	Good	0.865	0.623
SI1	3.51	0.965	-0.746	0.054				
SI2	3.40	1.016	-0.505	-0.401				
SI3	3.59	0.948	-0.615	0.009				
SI4	3.30	1.074	-0.460	-0.451				
Personal innovativeness (PI)					0.900	Excellent	0.902	0.754
PI1	4.26	0.663	-0.648	0.640				
PI2	4.18	0.709	-0.563	0.158				
PI3	4.17	0.720	-0.697	0.570				
Behavioral Intention (BI)					0.861	Good	0.851	0.657
BI1	3.87	0.746	-0.177	-0.396				
BI2	3.97	0.716	-0.396	0.395				
BI3	4.14	0.620	-0.546	1.872				

5.4 Research model assessment and hypotheses testing

The results of SEM analysis with AMOS software indicate that PUS, PFC, PI, and SI are statistically significant at level of 0.05 or less while 2 direct effects, PT and PSR, have insignificant relationship. The model fit was evaluated by suggested 7 indices (Hair et al., 2010; Hu and Bentler, 1999; MacCallum et al., 1996; Karin and Helfried, 2003; McQuitty, 2004) i.e. Root Mean Residual (RMR<0.05), Goodness of Fit Index (GFI>0.9), Adjusted Goodness of Fit Index (AGFI>0.8), Normalized Fit Index (NFI>0.9), Incremental Fit Index (IFI), Comparative Fit Index (CFI>0.9), and RMS Error of Approximation (RMSEA<0.060).

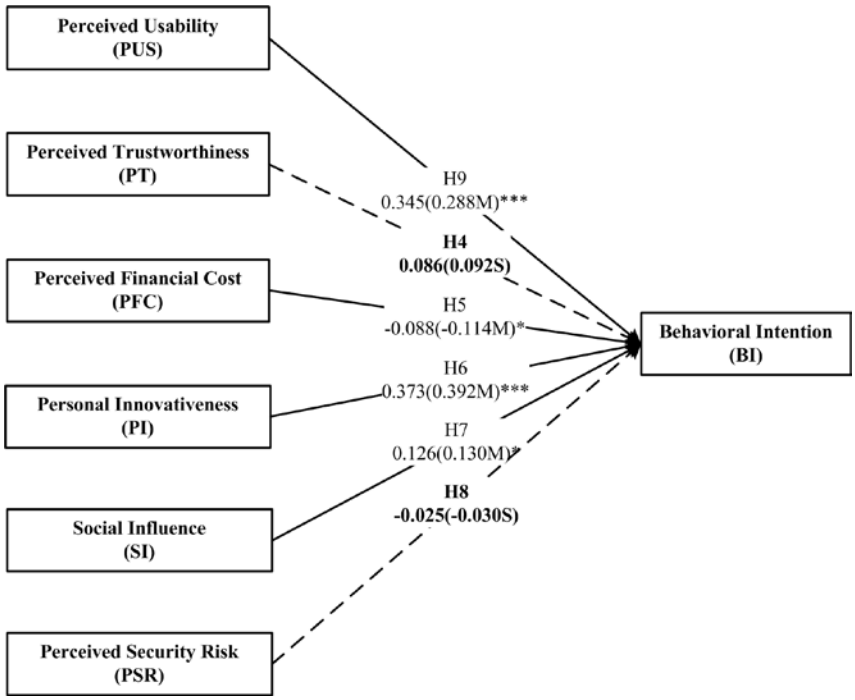

Figure 2 Analysis of direct effects in the research model ($^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$)

Table 8 Fit statistics for the research model

Model	N	Normed Chi-square (χ^2/df)	RMR	GFI	AGFI	NFI	IFI	CFI	RMSEA	R^2 (BI)
Fit criteria		< 3.0	< 0.05	> 0.90	> 0.80	> 0.90	> 0.90	> 0.90	< 0.06	
Research Model	342	703.866/303= 2.323	0.04	0.86	0.83	0.89	0.93	0.93	0.06	0.457

Note: *R^2 is the proportion of the variance of each endogenous variable explained by the variables affecting it.*

Table 9 Summary of the research hypotheses testing

Hypothesis	Unstandardized Effect	Standardized Effect	P-Value	Conclusion
H4	0.086	0.092S	0.121	Not Supported
H5	-0.088	-0.114M	0.030*	Supported
H6	0.373	0.392M	0.000***	Supported
H7	0.126	0.130M	0.013*	Supported
H8	-0.025	-0.030S	0.547	Not Supported
H9	0.345	0.288M	0.000***	Support

Note: *a) $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$; b) S, M, or L to indicate the magnitude of the effect for small, medium, or large, respectively (Cohen, 1988).*

A normed Chi-square statistics ($\chi 2/df$) is at 2.323 which is less than 3.00 (Hair et al, 2010) and its variance (R2) is 46 percent approximately which is observed in the endogenous model variable of behavioral intention to use contactless mobile payment. The holistic result of test statistics demonstrates the adequate values even GFI and NFI do not meet the recommended fit criteria.

The data analysis indicates that PI, PUS, and SI have significant direct positive effect to behavioral intention with standardized coefficients of 0.392^{***}, 0.288^{***}, and 0.130^{*}, respectively. PFC has a significant direct negative effect with standardized coefficients of -0.114^{*}. PT and PSR on the dash line have insignificant direct effect to BI with standardized coefficients of 0.092, and -0.030, respectively. PEU, PU, and PC were not presented since they were combined into a new variable at hypothesis (H9). A new hypothesis H9 is introduced with the same direct effects as were previously presented due to PEU, PU, and PC. It is not possible to test the hypotheses H1, H2, and H3 because the measure for PEU, PU, and PC individually are not valid, and these variables are no longer in the model. This does not mean H1, H2, H3 are not supported. Therefore, the estimation of the structural model indicates that four hypotheses (H5, H6, H7, and H9) are supported while two hypotheses (H4 and H8) are not supported.

6. DISCUSSION

The research model is carried out from theoretical models that include determining factors of intention to use a particular technology. As result, the findings from data analysis suggest several significant implications for predicting degree of adoption as described by subsequent sections.

6.1 Personal innovativeness

Personal innovativeness (PI) is found to be the most significant influence for the behavioral intention to use contactless mobile payment among rapid transit passengers. This factor repeatedly shows the consistency with findings from previous studies that personal innovativeness is an influential predictor of mobile payment adoption (Oliveira et al., 2016; Tan 2014; Pham and Ho 2015; and Cheng and Huang, 2013). Since the majority of respondents (73.7%) are in age between 20-39 years old and having high level of education, they can have more chances to learn many emerged technologies in their generation. Thus, they can be the best representing group for persons who have high degree of personal innovativeness to have plausible positive attitude to adopt the contactless mobile payment accordingly.

6.2 Perceived usability

The significant finding of perceived usability (PUS) is created by the combination of three perceptions of ease of use (PEU), usefulness (PU), and compatibility (PC) in respondent's perspectives. To confirm a new variable, the several studies have been observed (Moore and Benbasat, 1991; Sangle et al., 2011; Algethmi and De Coster, 2013; Carter et. al., 2003; Carter et. al., 2005). Found that, usability was previously indicated to design of computer technology to work with users as Human-Computer Interaction or HCI (Albion, 1999). Then, Acton (2004) discussed on argument of Davis (1989) that perceived usability consisted of perception of ease of use, usefulness, and intention towards the acceptance of the underlying information system. Afterwards, since usability was still broadly addressed, McGee et al. (2004) proposed the new construct of usability including consistency, effortless and usefulness as a framework of study. Thus, the role of perceived usability in this study is valid. The definition of usability can refer to a degree to which a person perceives that interacting with mobile phone to perform contactless mobile payment is compatible to life style with usefulness and effortless.

When considering to each of the variables separately i.e. PEU, PU, and PC, this finding is still

consistent to previous study that people have positive attitude to actually use particular technology if they perceived usefulness and ease of use (Davis, 1989). Compatibility has influence to innovation diffusion from early adoption to mass adoption likewise various studies to concluded the finding in harmony (Cheng and Huang, 2013; Kim et al., 2010; Leong et al., 2013; Oliveira et al., 2016; Tan et al., 2014).

The phenomenon of this finding is probably because technology in the past was built to replace manual works in organization where mandatory policies were applied (Devis, 1989). People then had to adopt technology whether they were willing to accept it or not. However, technology of smartphone nowadays is in contrast. People voluntarily adopt it for personal purpose under a non-organization setting (Ooi and Tan, 2016). It can be said that smartphone today is a necessity for human life to interact with smartphone for almost activities everywhere and every time. Trouble life would happen if they are going out to work or study without smartphone in hand. Therefore, the finding of usability is able to be considered as a new construct with a significant causal relationship (direct effect 0.345 at significant level $p<0.001$) with behavioral intention to use contactless mobile payment for rapid transit passengers in Thailand.

6.3 Social influence

As finding, pressure forced by surrounding society has an effect on individual behavior. An individual normally concern using new technology if knowing in such technology is inadequate. Then, they are willing to wait for a particular technology is accepted by others in the society to ensure that no critical impact to them. Therefore, contactless mobile payment may be adopted by early adopters who are highly interested and have a strong need to use for purchasing goods and services. Subsequently, if this group of early adopters inspire the non-adopters to use, a critical mass as social influence effect to adopt may raise just overnight even to those who are not interested to use it before (Schierz et al., 2010).

6.4 Perceived financial cost

Financial cost refers to the extra money that respondents are charged to complete the payment. The charging cost includes fees from subscription and transaction. Finding in this study shows the negative impact when cost is involved in the payment process which means that the higher cost from purchasing with contactless mobile payment, the lower behavioral intention to use.

However, this finding is not in line with the conclusion of some previous studies (Tan, 2014; Pham and Ho, 2015; Ooi and Tan, 2016; Phonthanukitithaworn et al., 2016). This is probably because the indicators of financial cost in prior studies referred to cost of device and data package which were measured differently to the indicators used by this study. Therefore this reason could explain the dissimilar finding.

6.5 Perceived trustworthiness

This finding indicates that respondents have less concern about trustworthiness provided by service providers or its payment process of contactless mobile payment. Trust is insignificant influence on behavioral intention to accept the particular technology at early stage of adoption (Pham and Ho, 2015). Respondents will normally trust on what they can see and perceive by themselves like historical transaction and available account balance through the mobile or internet application.

However, the finding of trust is inconsistent with prior studies that trust was validated to be important determinant for mobile payment (Kim et al., 2010; Teo et al., 2015b; Ooi and Tan, 2016). This might be related to the service provider who is operating the payment system which is currently non-banking companies. If the system is run by commercial banks where the most trusted party is expected,

trustworthiness is might be expected highly to be perceived by respondents.

6.6 Perceived security risk

Perceived security risk (PSR) is insignificantly effect on behavioral intention in this study as it is less concerned by individual who have ever used (Tan et al. 2014; Cheng and Huang, 2013; Ooi and Tan, 2016). Since respondents are experienced users who have ever made purchasing with contactless mobile payment, thus this finding confirm the explanation. Besides that, contactless mobile payment is recently used as micropayment with low-value money to buy food and beverage. Thus it is viewed as a low risk of losing money in adopter's view (Di Pietro et al., 2015).

It is noticed that both trust and security risk were found similarly as insignificant influence factors towards the behavioral intention. The experienced respondents had less worry about losing their privacy and information from using the system. This might because the significant level of personal innovativeness that may override the level of perceived trust and risk (Mayer et al., 1995; Marett et al., 2015).

7. CONCLUSION AND FUTURE RESEARCH

This study has presented the examination of the behavioral intention of people who are using contactless mobile payment services and having experiences of commuting on rapid transit system in Thailand. A theoretical research model was derived from popular theoretical models of technology acceptance and diffusion of innovation together with several constructs proven by previous study in the field of contactless mobile payment adoption.

The finding reveals that the behavioral intention to use contactless mobile payment in Thai setting is mostly influenced by persons who are curious and willing to try new technology. The recommendation from others in society will impact to decision of individual adoption. If financial cost of using to purchase stuffs is non-appearance, the adoption level will be increased. Adopters confirmed that contactless mobile payment is usability since they perceived usefulness, ease of use, and compatibility to their life. This combination variable is the first in contactless mobile payment study thus further research in order to confirm the level of confidence is required.

Finally, the next study may repeat the research methodology with research model of this study to examine the adoption behavior through respondents having different type of background, such as occupation or academic majors. This might also consider repeating in countries where the contactless mobile payment is widely adopted, for instance, China, Taiwan, Singapore, South Korea, etc. The reason is to provide the comprehension on contactless mobile payment perspective for stakeholders in mobile payment industry in order to achieve a long-term sustainable success in the future.

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