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ประเทศไทย

The Diffusion of E-Payment Systems in Thailand

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บทคัดย่อ

ระบบการชำระเงินแบบอิเล็กทรอนิกส์เป็นระบบการชำระเงินที่ได้รับการใช้งานอย่างแพร่หลายทั่วโลก ได้ถูกนำมาใช้งานทั้งในระดับการทำธุรกรรมระหว่างธุรกิจ รวมถึงการใช้จ่ายในระดับของผู้บริโภค โดยมีอัตราการใช้งานที่เพิ่มมากขึ้นอย่างต่อเนื่อง ซึ่งงานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาพฤติกรรมการใช้งานระบบการชำระเงินแบบอิเล็กทรอนิกส์และเพื่อศึกษาการกระจายตัวของการใช้งานระบบการชำระเงินแบบอิเล็กทรอนิกส์ของผู้ใช้ในประเทศไทย โดยศึกษาข้อมูลจากกลุ่มตัวอย่างจำนวน 720 คน ซึ่งเป็นผู้ใช้งานระบบการชำระเงินแบบอิเล็กทรอนิกส์ที่อยู่อาศัยในกรุงเทพมหานคร วิเคราะห์ข้อมูลโดยใช้การศึกษาความแปรปรวนและสหสัมพันธ์แบบเพียร์สันบนพื้นฐานของแบบจำลองสมการเชิงโครงสร้าง ซึ่งผลการศึกษาพบว่าการใช้งานระบบการชำระเงินแบบอิเล็กทรอนิกส์มีความสัมพันธ์เชิงบวกกับ 2 ตัวแปรเศรษฐกิจ คือ อายุ และรายได้ โดยกลุ่มตัวอย่างที่มีอายุมากกว่าและมีรายได้มากกว่า มีแนวโน้มการใช้งานระบบการชำระเงินแบบอิเล็กทรอนิกส์สูงกว่ากลุ่มตัวอย่างที่มีอายุน้อยกว่าและมีรายได้น้อยกว่า และจากการศึกษาวิจัยไม่พบความสัมพันธ์ระหว่างการอยู่อาศัยในพื้นที่เขตศูนย์กลางทางธุรกิจ (Central Business District: CBD) และภาพรวมการใช้งานระบบการชำระเงินแบบอิเล็กทรอนิกส์ ยิ่งไปกว่านั้นเมื่อทำการควบคุมตัวแปรบางตัว ได้แก่ ความพร้อมในการยอมรับการใช้งาน (Adoption readiness) และรูปแบบการชำระเงินแบบอิเล็กทรอนิกส์ พบความสัมพันธ์เชิงบวก

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ระหว่างรายได้ส่วนบุคคลและการใช้งานระบบการชำระเงินแบบอิเล็กทรอนิกส์อีกด้วย ส่วนการอภิปราย
และข้อเสนอแนะถูกนำเสนอในงานวิจัยนี้ต่อไป

คำสำคัญ : การยอมรับการใช้งาน, ความพร้อมในการยอมรับการใช้งาน, ระบบชำระเงินอิเล็กทรอนิกส์, UTAUT2,
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ABSTRACT

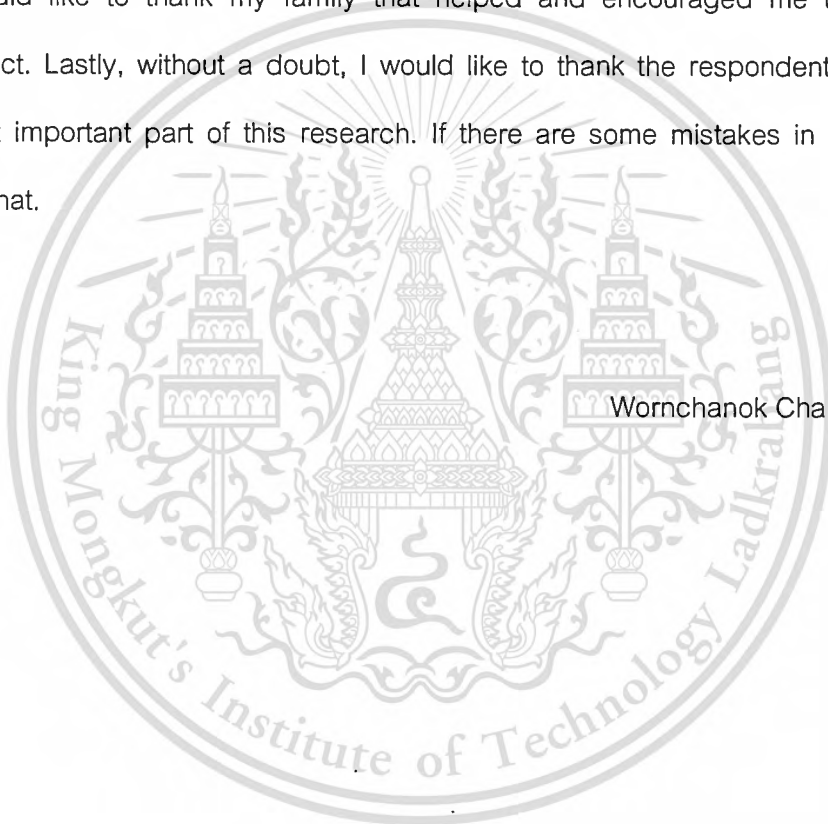
Electronic payment systems are being use worldwide. Together with business-to-business transactions (B2B), consumer electronic payments are increasing used dramatically. This research aims to study the use behavior of electronic payment systems in Bangkok Thailand and to study the diffusion of the electronic payment systems in Bangkok Thailand. 720 respondents who lived in Bangkok were asked in a survey. The research employs Pearson correlations and covariance based structural equation modeling (SEM) to answer two research questions. The findings show that the usage of electronic payment systems has positive relationships with two socio-economics variables: age and income. People who have higher age and income tend to use the electronic payment system more than those who have less age and income. In this research, there is no relationship between Central Business District (CBD) and the overall usage. Moreover, when controlled pertinent variables, personal income that positively affects the use of electronic payment systems. The controlled variables include adoption readiness and technology channels. Discussions have been discussed.

keywords: Adoption, Adoption Readiness, Electronic Payment, UTAUT2, Thailand

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Wornchanok Chaiyasoonthorn

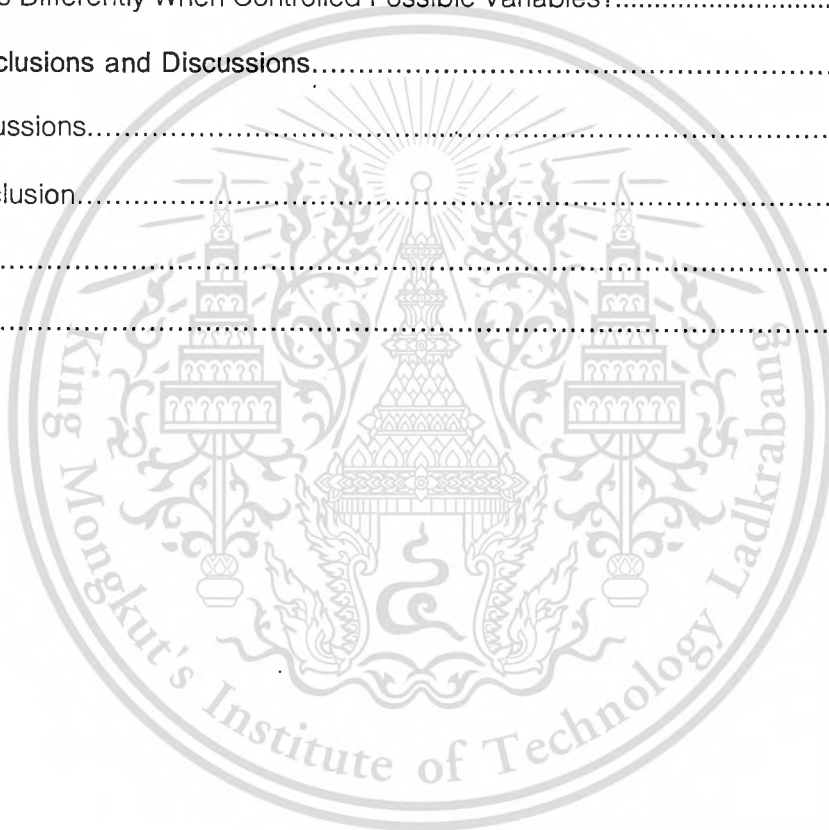


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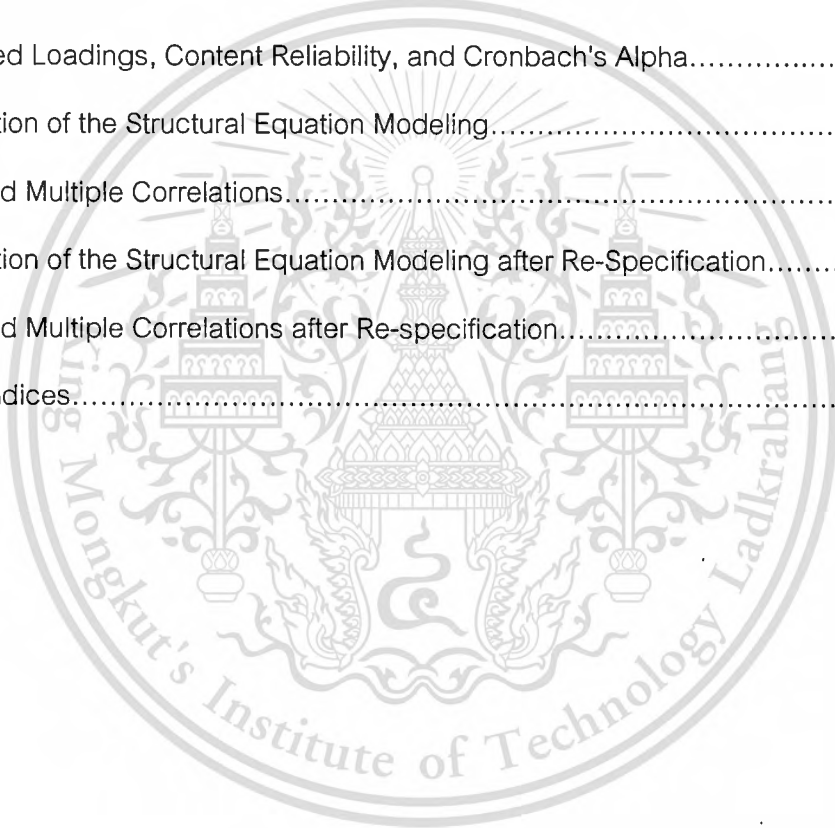
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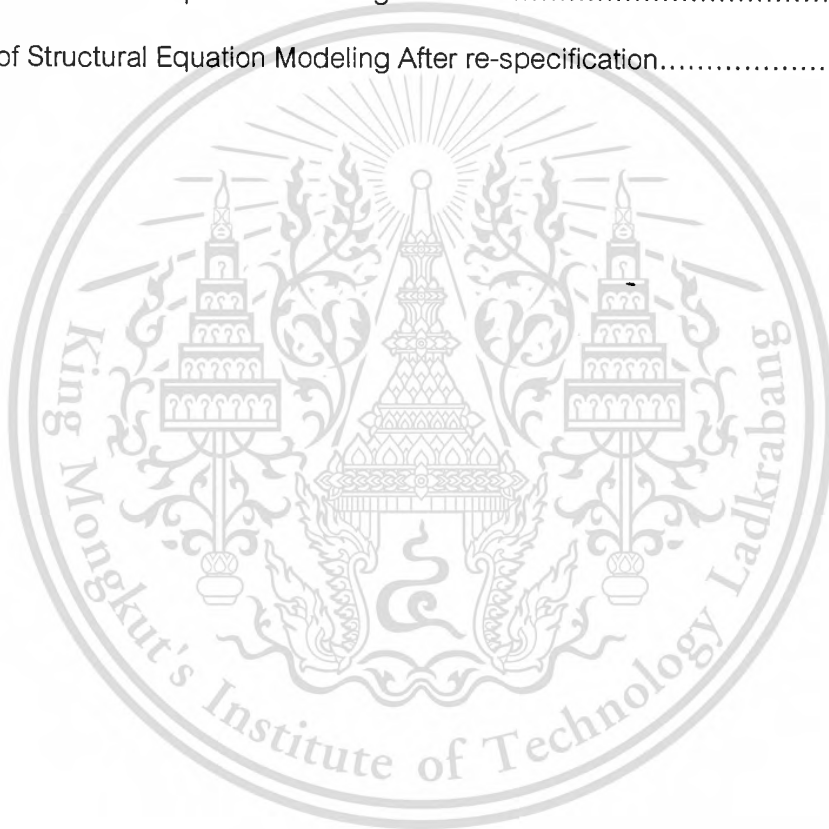
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CHAPTER 1

INTRODUCTION

1.1 Research Background

People worldwide are increasingly using electronic payment (E-payment). Electronic payment systems are the mean to promote electronic commerce (Özkan, Bindusara, & Hackney, 2010). The widespread of diffusion of electronic payment system in various forms lead to the development of the digital economy. In 2012, the adoption of electronic payment systems worldwide generated 360 billion US dollars transactions (Laudon & Traver, 2012). Authorities and academics are questioning how we can promote electronic payment systems for Thai people. The reason behind this is that the governments can save cost not to product paper money to the money market. In addition, it provides the ability to bring businesses to be tracked. People in general can benefit in terms of convenience when they want to purchase products or services on the Internet or other electronic systems. Moreover, electronic payments provide businesses the opportunity to connect to the digital economy, which is increasingly important worldwide.

Thai consumers are becoming an electronic payment adopter. The major business transactions of electronic payments belong to business-to-business transactions (B2B). However, the growth of customer using electronic payments is rising rapidly. The amount of transactions grew from 99,706 million Baht to 121,392 million Baht in 2012 (National Statistical Office, 2014). Considering this fact, we can see that there is a need to find support the electronic payment for the Thai consumers. The critical factors behind this is the growth of electronic commerce.

Electronic commerce is a form of business that allows people to trade at home or remote area. The transactions of electronic commerce can be done domestically or internationally; Thai merchants can trade with partners globally, which in turns the adoption of electronic commerce forces Thai people to adopt electronic payment systems. For instance, if one needs to trade on eBay, PayPal is a great tool to use on eBay. PayPal is a trusted electronic payment system, which allows merchants and customers to trade with each other confidentially. PayPal can also connect merchants and customers with local and international banks.

There are various types of electronic payment systems. The first most familiar system is the Internet banking. Almost major banks have their own Internet banking systems that helps customers do their financial activities online. The Internet banking can also reduce costs and time of both banks and customers. The second type is electronic payment systems of middleman companies such as PayPal and Google wallet that help to connect sellers, customers, and banks together. Credit card companies such as MasterCard, VISA, and American Express which is a middleman who processes transactions of customers when the credit card is used. Other types can also be found. For example, we might see a BTS card which has money inside the card. Once customers use their cards, the money is deducted. However, in this research, we focus on the channels of electronic payment systems. These technology channels include: Using credit cards in store , using credit cards in Internet, using debit cards in store, using debit cards in Internet, using electronic money, using Internet banking, and using other technologies.

Although there were studies conducted to understand the use of electronic payment systems and published in trusted journals (Chellappa & Pavlou, 2002; K. K. Kim & Prabhakar, 2004; Özkan et al., 2010; Pikkarainen, Pikkarainen, Karjaluoto, & Pahnla, 2004; Plouffe, Hulland, & Vandenbosch, 2001; Rakhi & Mala, 2014; Roca, García, & de la Vega, 2009a; K. C. C. Yang, 2005; Y. Yang, Liu, Li, & Yu, 2015), there is no paper conducted in Thailand. In addition, the

theoretical frames that these papers employed are based on TAM (Pikkarainen et al., 2004; Plouffe et al., 2001; K. C. C. Yang, 2005) and UTAUT (Rakhi & Mala, 2014). However, none of these papers applied UTAUT2, which is a recent theory published in Information Systems. Hence, the benefits of this research is to bridge the gap of literature and provide the application of a new theory.

The study rises following questions.

1.2 Research Question

- 1) How groups of people in Bangkok using electronic payments differently?
- 2) What group factors can drive people to use electronic payments differently when controlled possible variables?

1.3 Research Objective

- 1) To study the use behavior of electronic payment systems in Bangkok Thailand
- 2) To study the diffusion of the electronic payment systems in Bangkok Thailand

1.4 Research Scope

This study aims at researching people who lived in Bangkok Thailand. The respondents had used at least one electronic payment system before answering the questionnaire. The reason to choose people who lived in Bangkok because Bangkok is the largest and the most crowded city of Thailand. The survey of City population showed that there were 12,390,000 people living in Bangkok (www.citypopulation.de). The scope of this research is to study consumer payment systems while business-to-business payment systems are not included in this study.

1.5 Research Contributions

- 1) The study applies UTAUT2 as a whole set of latent variable together other variables explaining the use of electronic payment systems in Bangkok Thailand.
- 2) The study investigates the use of electronic payment systems among groups of people living in Bangkok Thailand so that the diffusion of electronic payments can be seen.



CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical Background

Diffusion of innovation is defined as the widespread of innovation through groups of people. In this study, diffusion of electronic payment systems refers to the use of this technology among groups of people. Adoption and diffusion studies come together because they study the use of technology. However, diffusion research tends to focus on different groups of people use the technology. In this literature review, theories belong to both domains are discussed.

Rogers (1983) first coined the term diffusion of innovation (DOI). His studies in sociology focus on how technology is used by people in different groups. He also divided people using technology into innovators, early adopters, early majority, late majority, and laggards. These characteristics of people affect the decision of adopting of technology. Rogers further proposed five attributes of technology resulting in the adoption of technology by people, saying that relative advantage, compatibility, complexity, trainability, and observability influence the adoption (Rogers, 1983).

While the Theory of Reason Action (TRA) (Ajzen & Fishbein, 1970; Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (TPB) (Fishbein & Ajzen, 2010) have been often used to explain people behavior such as smoking and exercises, these theories can also be used to study the use of technology since use behavior is regarded as one forms of human behavior. However, the limitations of these theories are that they do not offer constructs that help guide the design of technology.

The Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) originated after DOI, TRA, and TPB. It took the ideas of these prior theories and change to help researchers to investigate the use of technology affectively. In addition, it allows designers and developers of technology to understand the artifacts resulting in the improvement of future designs. TAM then was developed to other two versions: TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh & Bala, 2008) but the key constructs are behavioral intention (BI), perceived ease of use (PEOU) and perceived usefulness (PU) used to explain usage behavior of technology.

While TAM is a parsimony model explain the adoption behavior, it has a limitation to include other possible constructs. Then, Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) was created to add more constructs. This theory includes a new construct: facilitating conditions. It also broadens the scope of existing constructs. For example, perceived usefulness is developed to performance expectancy. Perceived ease of use is developed to effort expectancy. Subjective norm is developed to social influence. The theory also adds four moderators: age, gender, experience, and voluntariness of use into the model (Venkatesh et al., 2003). However, the drawback of this theory is that it does not account for habit and intrinsic motivation (hedonic motivation). According to Limayem, Hirt, and Cheung (2007), habit can share the power of explanation of use behavior from behavioral intention. In the case of post adoption of technology, habit plays a more significant role than behavioral intention. For hedonic motivation, it can be considered a form of intrinsic motivation (Deci & Ryan, 2000), in which researchers in behavioral science believe such motivation significantly determines human behavior. In addition, UTAUT is designed for organizational technologies. It is not much tested in consumer behavior.

Consequently, UTAUT2 (Venkatesh, Thong, & Xu, 2012) was developed. In addition to habit and hedonic motivation, it adds price value into the model since it aims for explaining

consumer technologies. However, it reduces the number of the moderations from 4 to 3. The voluntariness of use is removed.

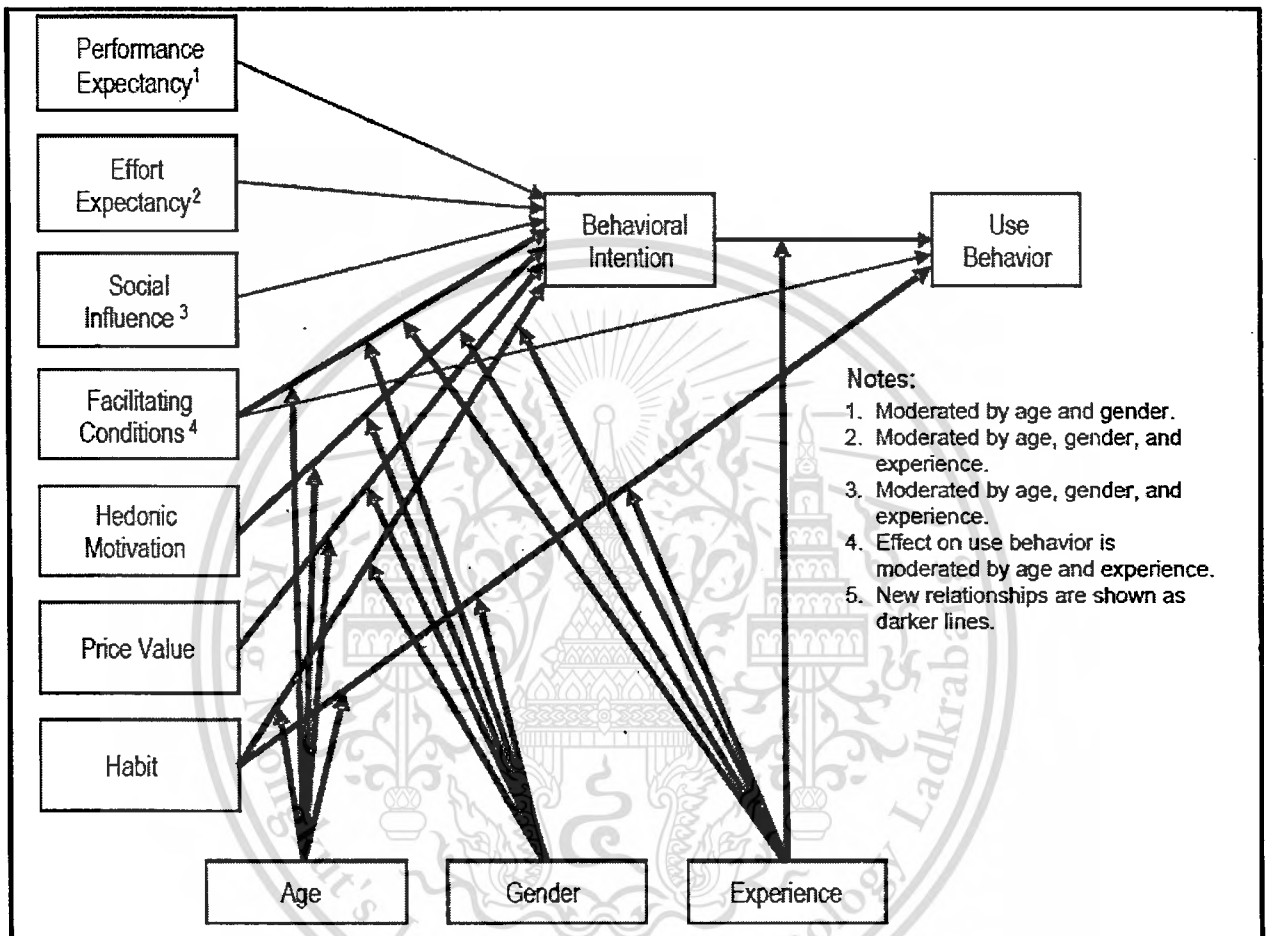


Figure 2.1: Unified Theory of Acceptance and Use of Technology 2

Source: Venkatesh, Thong, and Xu (2012, p.160)

2.2. Relating Literature

In the US, Plouffe, Hulland, et al. (2001) studied the use of a smart card-based electronic payment system. The researchers employed the constructs from TAM and the Perceived Characteristics of Innovating (PCI) inventory. They found that PCI was able to explain the dependent variable better than constructs from TAM.

Another study in the US, Salisbury, Pearson, Pearson, and Miller(2001) investigated the adoption of Web purchase intention. They used TAM as theory underpinning their research but changed to ease of navigation, usefulness, and web security as causes of purchase intention. However, they found that only Web security influenced purchase intention.

Also in the US, Chellappa & Pavlou (2002) introduced information security, financial liability, and trust as concerns in the electronic commerce transaction making. The authors claimed that consumer trust was determined by perceived information security. Perceived information security was influenced by encryption, protection, authentication, and verification.

In Finland, Pikkarainen et al. (2004) studied the use of online banking technology. The researchers investigated the acceptance of online banking by using TAM as a theoretical framework. They also conducted a focus group to explain the results. They found that perceived usefulness and information of the online banking Web site were the most critical factors determining the use of the technology.

Back in the US, K. K. Kim and Prabhakar (2004) studied the adoption of Internet banking. The authors took the samples from the Web site of a bank offering Internet banking and 7 Web sites of a local media company. They claimed that technology channels influenced the use of Internet banking. This provided the knowledge that besides psychological constructs, technology channels are also possible to determine the adoption of technology.

In Singapore, K. C. C. Yang (2005) investigated M-commerce technology. Yang attempted to understand how users in Singapore accepted M-commerce. The researcher used TAM as a theoretical foundation. In addition to TAM's constructs, Yang added personal innovativeness, post adoption usage, technology cluster usage, age, and gender to the model. The results showed that perceived usefulness determined attitude toward the technology together with personal innovativeness, post adoption usage, technology cluster usage, age, and gender. Yang also stated that men had a tendency to view M-commerce positively.

In Spain, a study by Roca et al. (2009a) tested a model based on TAM and found that perceived usefulness and perceived trust influenced behavioral intention while trust was determined by perceived usefulness, perceived ease of use, perceived security, and perceived privacy. In addition, perceived ease of use directed perceived usefulness.

Özkan et al.(2010) investigated electronic payment systems. They found that the intention to adopt electronic payment systems is a function of perceived risk, perceived security, perceived trust, using web seals, perceived advantage, and usability.

In Korea, M.-J. Kim, Chung, and Lee (2011) investigated the adoption of online shopping. Instead of using a conventional theory like TAM, the researchers employed customer loyalty, trust, and customer satisfaction. They found that trust and customer satisfaction affected customer loyalty. Trust was influenced by perceived security and navigational functionalities. Meanwhile, customer satisfaction was determined by transaction costs, perceived security, and navigational functionalities.

In India, Rakhi and Mala (2014) investigated the adoption of mobile payments. They introduced adoption readiness that is the adaptation of UTAUT. They also added perceived risk and personal innovativeness to the model. They found that adoption readiness, perceived risk, and personal innovativeness affected intention to use mobile payments. In addition, personal innovativeness determined adoption readiness.

In Spain, Bonsón Ponte, Carvajal-Trujillo, and Escobar-Rodríguez (2015) proposed a model explaining purchase intention of online tourism tickets. The model insisted that trust influenced purchase intention and perceived value while perceived value also determined purchase intention. In addition, the authors claimed that trust was a function of perceived privacy, information quality, and perceived security. Perceived privacy was underpinned by privacy/security and website investment. Perceived security was determined by internet privacy

concerns, familiarity with the website, disposition to third party certification, understanding of Seals, privacy/security policy, website investment, vendor reputation and assurance seal.

As the literature reviews show, most studies employed TAM as the theoretical foundation explaining the adoption of electronic payment systems and relating technologies. In addition, UTAUT was also less employed when compared with TAM. Hence, this research uses the recent version of UTAUT2.

2.3 Constructs Employed in This Research

This section describes constructs that are used in this research.

Use Behavior (UB)

Use behavior is often used in information systems because the field requires the users of information systems use IT in their organization (DeLone & McLean, 2003). However, there are two ideas of use behavior relating to information systems research. First, technology adoption is a concept aims at explaining the full use of IT (Rogers, 1983). Second, technology acceptance which traditionally measures the frequency or amount of time that users use a specific technology as in TAM (Davis et al., 1989). This research follows the notion of use behavior as in TAM (L. Chen, Gillenson, & Sherrell, 2002; L.-D. Chen & Tan, 2004; Smarkola, 2008; Wu & Wang, 2005). The author uses the frequency of use (H.-F. Lin, 2007) to represent the use behavior and the average amount of money that users spent on the electronic transaction per time. The frequency and the average amount of money spent were multiplied and then logarithm was used to make a normal distribution and linearity.

Adoption Readiness (AR)

AR is proposed to be a latent variable. It is defined as to what extent that people are ready to use a specific technology. This construct was introduced by Rakhi and Mala (2014). However, unlike AR in Rakhi and Mala (2014)'s research that used UTAUT, this research uses UTAUT2 as theoretical foundation of AR. AR in this research consists of behavioral intention, facilitating conditions, habits, hedonic motivation, social influence, effort expectancy, performance expectancy, and price value.

Behavioral Intention (BI)

Behavioral intention has been used long before in behavioral science. Technically, it is used to linked human behavior and attitudes (Fishbein & Ajzen, 2010). In this research, Behavioral intention is defined as the extent to which respondents intend to use a specific information system (Malhotra & Galletta, 1999). Unlike TAM and UTAUT1, UTAUT2 claims that habit limits the power of behavioral intention (Limayem et al., 2007).

Performance Expectancy (PE)

This construct is similar to attitudes in TRA and TPB (Fishbein & Ajzen, 2010) and also similar to TAM (Davis et al., 1989; Venkatesh et al., 2003, 2012). Performance expectancy is a cognitive information process of attitudes (Fishbein & Ajzen, 2010; Maio & Haddock, 2010). The basic claim of the construct is that people desire to do something they have to have benefits (Venkatesh et al., 2012). On another side of the same coin, performance expectancy can be viewed as extrinsic motivation (Deci & Ryan, 2000; K.-Y. Lin & Lu, 2011; Malhotra, Galletta, & Kirsch, 2008; Ryan & Deci, 2000a).

Effort Expectancy (EE)

EE is close to the ease to use of an information system in TAM. Technology should not be difficult for users to use, learn, and understand/ Effort expectancy is defined as the degree to which users view that a specific technology is easy to use (Venkatesh et al., 2003).

Facilitating Conditions (FC)

It is a construct used to represent perceived behavioral control (Fishbein & Ajzen, 2010) or self-efficacy (Bandura, 1982). This construct also took on technology compatibility as in Diffusion of Innovation (DoI). The basic premise of this construct is that users use technology somewhat they can control the technology (Ajzen, 1991; Rogers, 1983; Taylor & Todd, 1995; Venkatesh et al., 2003). So, facilitating conditions represent the conditions that when users use technology, they are supported by conditions. By definition, facilitating conditions means the extent to which an individual believes that they obtain conditions supporting them to use technology (Venkatesh et al., 2003). In UTAUT2, facilitating conditions are believed to positively determine both behavioral intention and use behavior (Escobar-Rodríguez & Carvajal-Trujillo, 2014; Venkatesh et al., 2012).

Social Influence (SI)

Social influence refers to the extent to which respondents believe that important people to them think that they should or should not use the technology (Venkatesh et al., 2003). Social forces can determine people to use technology; in fact social influence is in fact similar to subjective norm in TRA and TAM (Vannoy & Palvia, 2010; Venkatesh et al., 2003). The effects of social forces of human behavior were found in many studies (Ajzen, 1991; Escobar-Rodríguez & Carvajal-Trujillo, 2014; Fishbein & Ajzen, 1975; Suksa-ngiam & Chaiyasoonthorn, 2015; Venkatesh & Davis, 2000).

Price value (PV)

Price value is a new construct in the UTAUT/TAM family. It accounts to the fact that many consumer technologies requires users to pay for using them. Price was long before studied in economics. UTAUT2 claims that users consider the benefits versus price when they use technology (Venkatesh et al., 2012). In economics, price is a representation the equilibrium between demand and supply but UTAUT2 uses it to explain behavioral intention.

Hedonic Motivation (HM)

Hedonic motivation means fun. It takes on the idea of intrinsic motivation. It recognizes that some people use technology because it is fun (Deci & Ryan, 2000; Ryan & Deci, 2000a, 2000b; Venkatesh et al., 2012). In this study, hedonic motivation is measured in the extent of feeling of fun and joyfulness when consumers use technology (Venkatesh et al., 2012). Literature support that hedonic motivation significantly causes the increase behavioral intention in various technologies such as learning management software (Raman & Don, 2013), social network(Oechslein, Fleischmann, & Hess, 2014), and electronic commerce(Pascual-Miguel, Agudo-Peregrina, & Chaparro-Peláez, 2015).

Habit (Ha)

Habit is a powerful construct introduced in UTAUT2. Not only it influences use behavior, it takes the explaining power of behavioral intention (Limayem et al., 2007) in particular post adoption. Habit means the extent to which consumers believe that their use of technology is habit. In addition, it positively affect the use behavior (Venkatesh et al., 2012). A study about mobile banking confirms that habit affected both use behavior and behavioral intention (Baptista & Oliveira, 2015).

Besides UTAUT2 constructs which are used to depict adoption readiness, perceived trust, Central Business District (CBD), technology channels, consumer personal income are added to explain use behavior.

Perceived Trust (PT)

Perceived trust consists of confidentiality, integrity, authentication, of technology usage (Flavián & Guinalú, 2006). It influences the attitudes of consumers becoming confident with technology (Roca, García, & de la Vega, 2009b). Perceived trust may involve in parts of systems, processes, and people. However, this research judges PT as a reflection of adoption readiness (AR).

Central Business Districts (CBD)

This research desires to understand how this technology diffuse in location. Hence, the geography of Central Business District of Bangkok is used to depict the notion that people in the inner city might have better chance to use technology than people outside. For example, Porter (1998) claims that inner city contains better infrastructure than areas surround resulting in concentration of companies and jobs. Several businesses decided to be located in inner cities because they believe they better share ideas with customers. In this diffusion study, this notion is used to construct a hypothesis that CBD positively influences the use of electronic payment systems. CBD is defined as districts of Chatuchak, PhayaThai, Din Dang, Huai Kwang, Ratchathewi, Wattana, Khong Toey, Pathum Wan, Samphantawong, Bang Rak, and Sathorn. These districts are centers of businesses and trades.



Figure 2.2 Central Business District of Bangkok

Technology Channels

Following the concept of K. K. Kim and Prabhakar (2004), the author proposes the channels of electronic payment systems. 6 channels are proposed in this research; they refer to channel (CH)1 - 6. This literature review is summarized into a theoretical framework in figure 2.3.

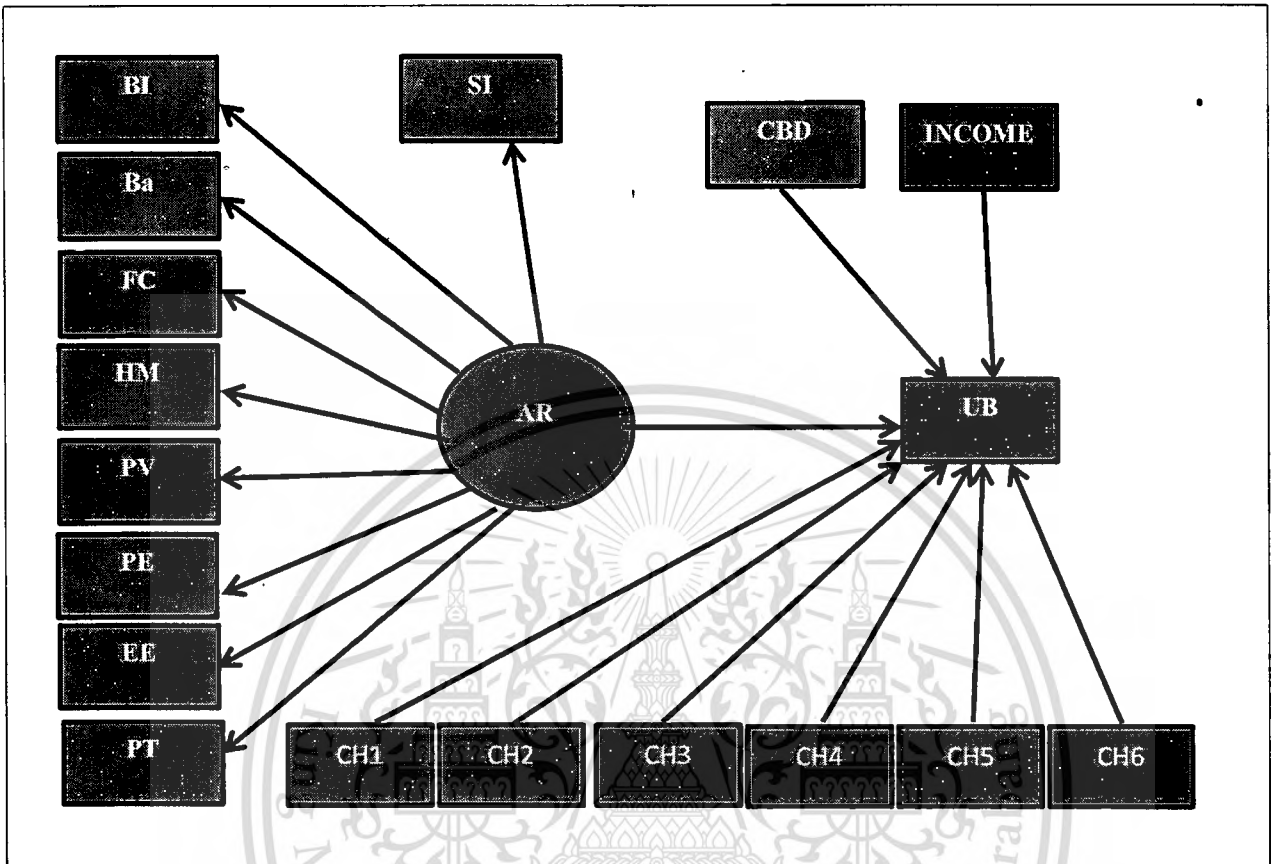


Figure 2.3 The Theoretical Model

Based on the literature, we propose hypotheses. All hypotheses are shown in figure 2.3

Hypothesis 1: Adoption readiness (AR) positively affects use behavior.

Hypothesis 2: technology channels positively affect use behavior.

Hypothesis 3: central business district positively affects use behavior.

Hypothesis 4: personal income positively affects use behavior.

CHAPTER 3

METHODOLOGY

This research is a quantitative research. It aims to explain use behavior across group of people. This section shows two types of analysis. The first section shows descriptive statistics used to address research question1: how groups of people in Bangkok using electronic payments differently? The second section shows casual explanation answering research question 2: what drive people to use electronic payments differently?

3.1 Descriptive Statistics

Based on the literature review, the descriptive statistics used to find out detailed description of diffusion of electronic payment systems. The descriptive statistics inform about mean, frequency, percentage, standard deviation (S.D). The significance of relationship is measured by Pearson's correlation.

3.2 Structural Equation Modeling

The use of structural equation modeling was used to inform the structure behind the use of electronic payment system. There are two types of structural equation modeling: co-variance based and variance based (PLS). However, in this research, co-variance based structural equation modeling, was used. The advantage of co-variance based structural equation modeling is that it allows researchers to evaluate how the model fits with the empirical data. In addition, it also allows researchers to modify the model.

3.3 Measurement Items

All items were items on self-reported questionnaire. Adoption readiness is the construct that must be assess validity and reliability. For the constructs based on UTAUT2, items were measured based on the items listed on Fishbein & Ajzen (2010), Venkatesh et al. (2003), and Venkatesh et al.(2012). The items were designed to be seven point-Likert scales ranging from disagree (1) to strongly agree (7). The items from UTAUT2 are attitudinal constructs that should be assessed their reliability and construct validity.

3.4 Reliability and Construct Validity

In this research, the author measured the reliability via Cronbach' Alpha. Both are used to measure reliability of attitudinal constructs including perceived trust. However, the composite reliability was re-evaluated for the latent variable.

In terms of validity, face validity is achieved because the items were taken from the theories. Since, there is only latent variable – discriminant validity is ignored. For Cronbach's Alpha, the value accepted in this research is greater than 0.70 (Hair, Black, Babin, & Anderson, 2010). For construct validity, the standardized factor loading is than 0.50 as the minimum requirement while the average variance extracted (AVE) is more than 0.50 (Hair, Black, Babin, & Anderson, 2010).

3.5 The Estimation

The estimation of variables is the maximum likelihood. The author used the maximum likelihood estimation because it allows the researcher to use variables with different measurement scales when assumptions of normality and adequate sample size are achieved. It is the most widely used estimation (Hair, Black, Babin, & Anderson, 2010).

3.6 Computer Software

The author used IBM's SPSS and AMOS 21.0 to estimate the structural model.



CHAPTER 4

RESEARCH RESULTS

The objectives of this research are to study the use behavior of electronic payment systems in Bangkok Thailand and to study the diffusion of the electronic payment systems in Bangkok Thailand. In this section, the chapter is divided into sub-sections responding to each research question. The characteristics of respondents are shown in table 4.1. In this research, there were more women than men. 330 respondents were men (45.8 %) while 390 respondents were women (54.2 %). The majority of respondents were people age between 20.5 and 30 years old (440 people or 61.1 %), followed by people age between 30.5 and 40 years old (149 people or 20.7 %). Most respondents obtained a bachelor degree (402 people or 55.8%).

The majority of samples had income lower than or equal to 25,000 Bath a month (437 people or 60.7). 635 respondents or 88.2 % lived outside the CBD. 280 respondents or 38.9 worked for a private company. Table 4.1 shows the characteristics of respondents.

Table 4.1 The Characteristics of Respondents

		Frequency	Percent
Gender	Men	330	45.8
	Women	390	54.2
Age group (years)	<= 20	33	4.6
	20.5 - 30	440	61.1
	30.5 - 40	149	20.7
	40.5 -50	71	9.9
	> 50	27	3.8

Table 4.1 (Continued)

		Frequency	Percent
Education level	Mid primary school	9	1.3
	Primary school	16	2.2
	Mid school	14	1.9
	High school	57	7.9
	Diploma	37	5.1
	Bachelor	402	55.8
	Master	174	24.2
	PhD or above	11	1.5
Personal income	Income <= 25000	437	60.7
	Income > 25000	283	39.3
CBD	Outside CBD	635	88.2
	Inside CBD	85	11.8
Occupation	Student	113	15.7
	Private employer	14	1.9
	Private employee	280	38.9
	Government officer	86	11.9
	State-owned public employee	53	7.4
	Freelancer	91	12.6
	Family business	63	8.8
	Others	20	2.8

4.1 RQ1: How Social-Economics Classes of People in Bangkok Use Electronic Payments Differently?

The descriptive statistics show mean, frequency, percentage, standard deviation (S.D) of social-economics variables and electronic payment usages. Socio- economics variables include: age, gender, CBD, and personal income. Table 4.2 shows Descriptive Statistics of Diffusion of Electronics Payments among Socio-economics factors

Table 4.2 Descriptive Statistics of Diffusion of Electronics Payments among Socio-economics factors

	Groups		Frequency	Amount
Gender	Men	Mean	4.5265	915.6051
		N	330	330
		Std. Deviation	3.23261	551.81938
	Women	Mean	3.9187	932.5698
		N	390	390
		Std. Deviation	2.97864	587.03005
Age group	<=20	Mean	4.3293	690.6722
		N	33	33
		Std. Deviation	3.23935	648.64172
	20.5-30	Mean	4.0114	893.9209
		N	440	440
		Std. Deviation	2.92041	569.14842
	30.5-40	Mean	4.4966	1007.2247
		N	149	149
		Std. Deviation	3.35537	572.95271

Table 4.2 (Continued)

	Groups		Frequency	Amount
Income	40.5	Mean	4.5155	1095.9851
		N	71	71
		Std. Deviation	3.47936	536.71948
	50.5	Mean	4.5766	809.0038
		N	27	27
		Std. Deviation	3.51635	401.10069
	<=25000	Mean	3.7520	856.5318
		N	437	437
		Std. Deviation	2.78767	583.89677
>25000	Mean	4.8849	1030.2032	
	N	283	283	
	Std. Deviation	3.44493	534.13925	
CBD	outside	Mean	4.1284	919.0274
		N	635	635
		Std. Deviation	3.00160	569.55874
Inside	Mean	4.7120	967.8762	
	N	85	85	
	Std. Deviation	3.80742	581.84693	
All samples	Total	Mean	4.1973	924.7943
		N	720	720
		Std. Deviation	3.11024	570.83076

In this research, the variables of interest are gender, age, the CBD area, and personal income. Both frequency of usage and the amount money spent per transaction were multiplied by each other before the result was transformed by logarithm. So, Total usage (UB) is equal to $\log_{10}(UB1 \times UB2)$. In this section, there are mixture of ratio variables and categorical variables. In order to solve the consistency of analysis, dummy variables are used to transform categorical variables to ratio variables. Gender consists of men (0) and women (1). Respondents' income consists of less than or equal to 25, 000 Baht (0) a month and more than 25,000 Bath a month (1). Central Business District (CBD) consists of outside CBD (0) and inside CBD (1). Hence, a Pearson's correlation matrix was compute in table 4.3.

Table 4.3 Pearson's Correlation Matrix

	UB	Log(UB1)	log(UB2)	Age	CBD	Gender	Income
Total	1						
Lg(UB1)	.661**	1					
LgUB2	.752**	.002	1				
Age	.124**	.052	.120**	1			
CBD	.026	.031	.007	-.014	1		
Gender	-.052	-.094*	.013	-.049	-.026	1	
Income	.244**	.178**	.169**	.326**	.067	-.150**	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

According to table 4.3, the overall usage (UB) has positive relationships with age and income. People who have higher age, and income tend to use the electronic payment system more than those who have less age and income. When considered in details, we found that the frequency of usage (Log (UB1)) negatively significantly correlates with gender. The interpretation is that men used electronic payment systems more than women. The frequency of usage positively significantly correlates with personal income. The interpretation is that people who had higher income used more frequently than those who had less income. The amount of money spent per transaction (Log (UB2)) had a positive relationship with age. People who had higher age had a higher transaction per time than people who had less age. In addition, the amount of money spent per transaction (Log (UB2)) had a positive relationship with income. People who have higher income have higher transaction per time. In addition, both age and income also have a relationship with each other. It suggests that people who have higher age tend to have higher income. In terms of CBD, this research did not find any significant relationship with the usage variables.

4.2 RQ2: What Socio-Economics Factors Can Drive People to Use Electronic Payments Differently When Controlled Possible Variables?

In order to determine what drive people to use electronic payments differently, the concept of adoption readiness was employed as a single variable since this research focused on group variables. Table 4.4 depicts the channels of technology usage.

Table 4.3 Technology Channels

Channels	Frequency	Percent
Credit cards in store	234	32.5
Credit cards in Internet	77	10.7
Debit cards in store	92	12.8
Debit cards in Internet	39	5.4
Electronic money	130	18.1
Internet banking	93	12.9
Other technologies	55	7.6
Total	720	100.0

4.2.1 Measurement Reliability and Validity of Utaut2's Constructs

The benefit of using adoption readiness is to control UTAUT2's constructs while the structure of causal relationships is not a concern in this research. Table 4.4 is the result of the reliability test. As we can see, social influence, hedonic motivation, and perceived trust are not quite a good depiction of adoption readiness since they provide standardized factor loadings below .7. However, we call calculate the average variance extraction (AVE) of adoption readiness and then we found that the AVE is .54. The construct validity is ensured (Hair et al., 2010). When considering reliability tests, construct reliability (C.R. = .66) is acceptable because it is more than .6 even though a good C.R. should be more than .7. Besides C.R., Cronbach's Alpha is at .914 which is above the threshold (.7) (Hair et al., 2010).

Table 4.4 Standardized Loadings, Content Reliability, and Cronbach's Alpha

Latent variable	Observed variable	Standardized Factor Loading	C.R.	Alpha
AR	BI	.826	.66	.914
	FC	.827		
	Ha	.751		
	HM	.611		
	SI	.530		
	PE	.791		
	EE	.728		
	PV	.864		
	PT	.607		

4.2.2: The Results of Structural Equation Modeling

This research does not consider validity and reliability of variables other than adoption readiness since they are objective measurement while adoption readiness is a subjective measurement (a set of attitudinal constructs of UTAUT2). The result of the structural equation modeling was shown in figure 4.1 and table 4.5. Even though we have tested age, and gender in the prior section by using Pearson's correlation. In this section, we do not want to add them into the model because we have already known from UTAUT2 that age, gender act as moderators rather than causal factors. Therefore, only two variables from previous sections are added into the model. In addition, the model needs to control technology channels. Hence, channels of transaction are added to the model. The results support hypothesis 1, 2, and 4. However, hypothesis 3 is rejected. According to table 4.4, technology channels 2,3,4 and 6 are not significant. In addition, CBD provides no significant result to the model.

Table 4.5 The Estimation of the Structural Equation Modeling

Relationships		Estimate	S.E.	C.R.	P
BI	<--- AR	1			
FC	<--- AR	0.838	0.037	22.778	***
Ha	<--- AR	0.917	0.035	25.858	***
HM	<--- AR	0.722	0.043	16.934	***
SI	<--- AR	0.602	0.042	14.258	***
PE	<--- AR	0.904	0.04	22.72	***
EE	<--- AR	0.784	0.039	20.241	***
PV	<--- AR	0.91	0.041	22.043	***
PT	<--- AR	0.642	0.04	16.194	***
UB	<--- AR	0.057	0.014	4.117	***
UB	<--- INCOME	0.161	0.035	4.611	***
UB	<--- CH1	0.156	0.071	2.208	0.027
UB	<--- CH2	-0.009	0.081	-0.112	0.911
UB	<--- CH3	0.02	0.077	0.259	0.795
UB	<--- CH4	-0.12	0.094	-1.266	0.206
UB	<--- CH5	-0.345	0.075	-4.601	***
UB	<--- CH6	0.044	0.079	0.558	0.577
UB	<--- CBD	-0.001	0.051	-0.016	0.987

The result shown in figure 4.2 was standardized regression weight.

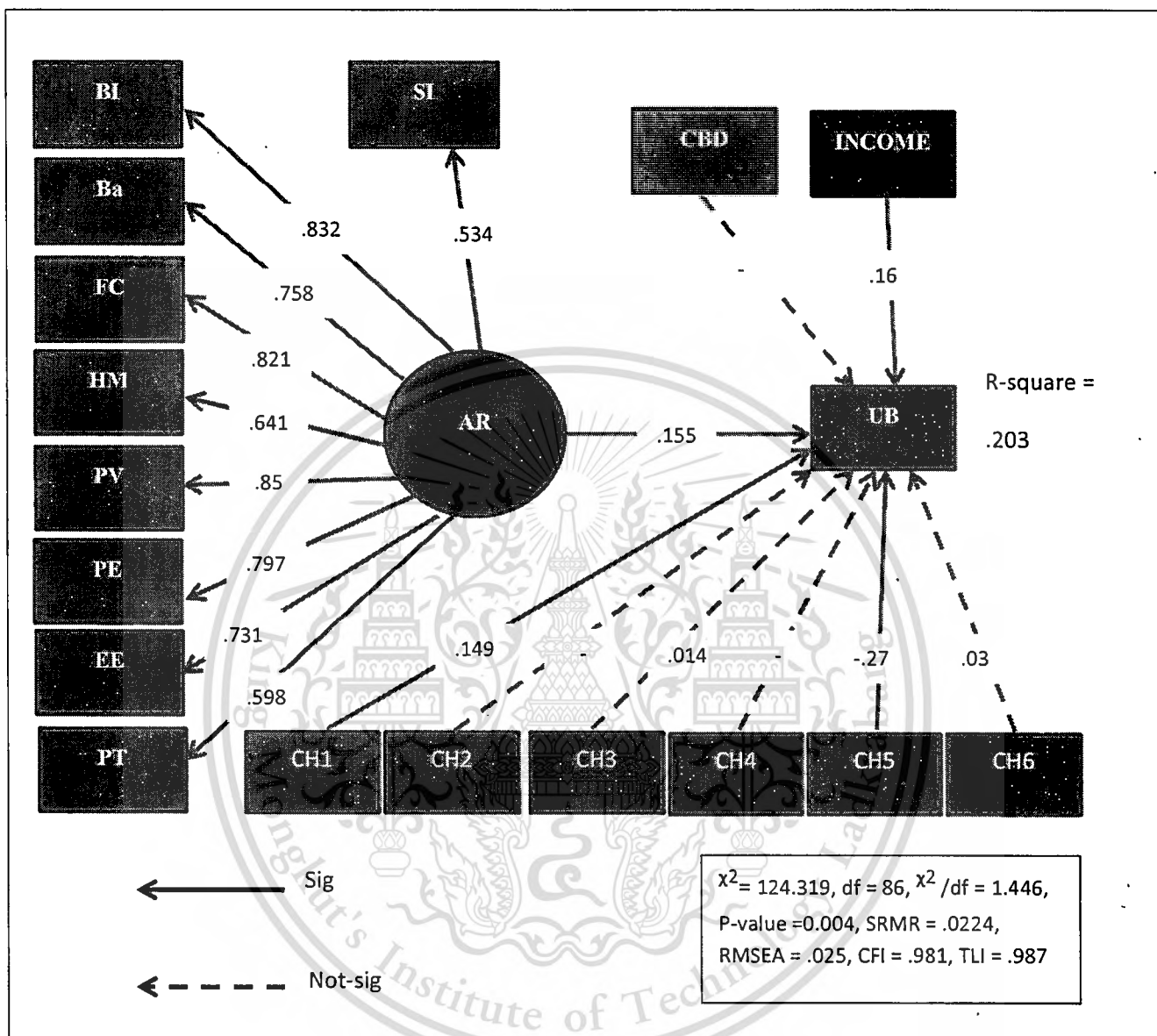


Figure 4.1 The Result of Structural Equation Modeling

Table 4.6 shows the R-square of each variable except the latent variable.

Table 4.6 The Squared Multiple Correlations

	Estimate
UB	0.203
PT	0.357
PV	0.722
EE	0.535
PE	0.635
SI	0.285
HM	0.376
Ha	0.575
FC	0.675
BI	0.692

The model was then specified. All non-significant paths were removed. Table 4.7 shows the results after the model was re-specified.

Table 4.7 The Estimation of the Structural Equation Modeling after Re-Specification

	Relationships	Estimate	S.E.	C.R.	P
BI	<--- AR	1			
FC	<--- AR	0.841	0.037	22.61	***
Ha	<--- AR	0.916	0.036	25.537	***
HM	<--- AR	0.72	0.043	16.73	***
SI	<--- AR	0.6	0.043	14.06	***

Table 4.7 (Continued)

	Relationships		Estimate	S.E.	C.R.	P
PE	<---	AR	0.9	0.04	22.227	***
EE	<---	AR	0.784	0.039	19.956	***
PV	<---	AR	0.924	0.042	21.986	***
PT	<---	AR	0.649	0.04	16.228	***
UB	<---	AR	0.058	0.013	4.484	***
UB	<---	Income	0.155	0.035	4.465	***
UB	<---	CH1	0.155	0.038	4.097	***
UB	<---	CH5	-0.347	0.046	-7.61	***

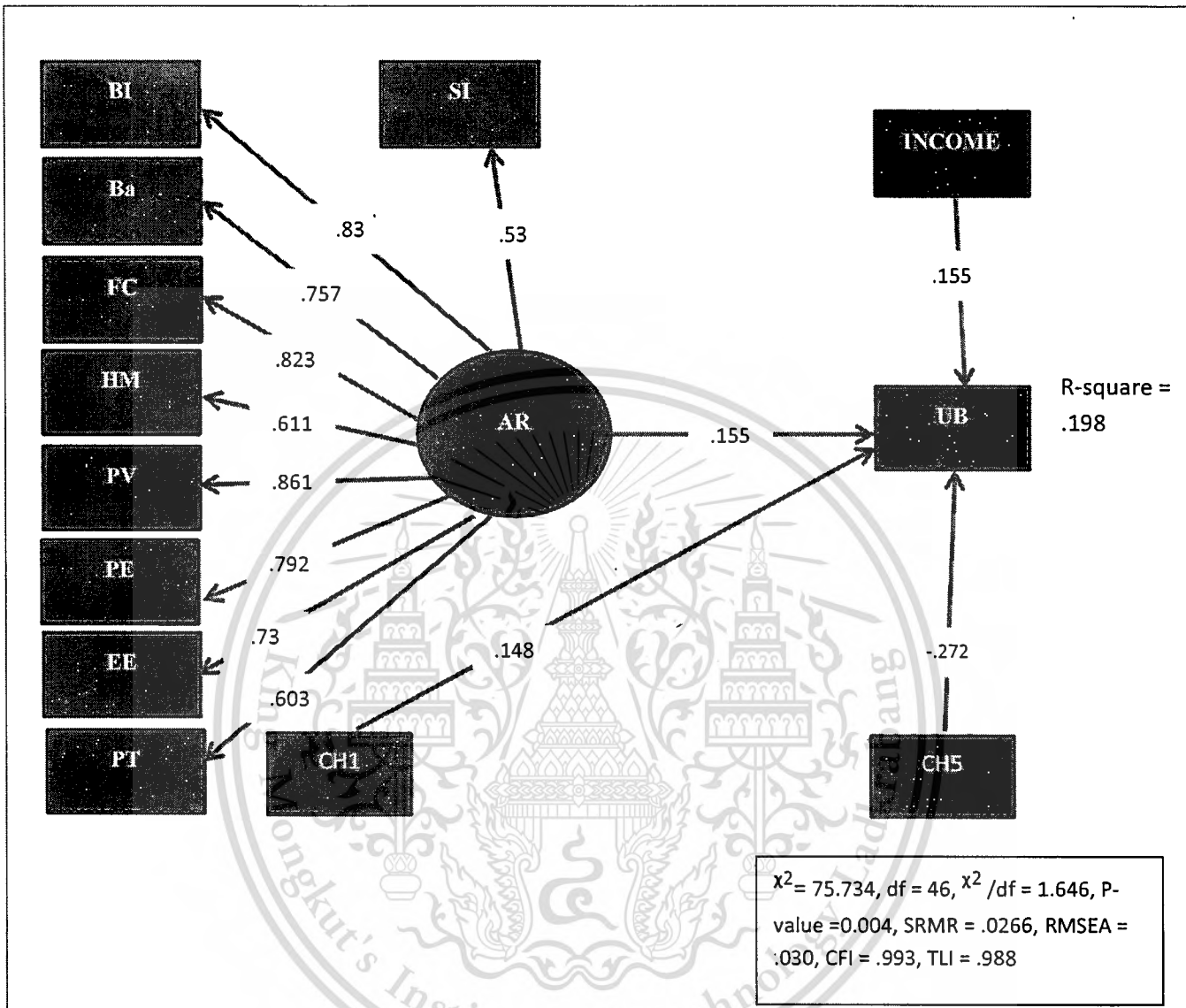


Figure 4.2 The Result of Structural Equation Modeling After re-specification

Table 4.8 summarizes the R-square of each variable except the latent variable.

Table 4.8 The Squared Multiple Correlations after Re-specification

	Estimate
UB	0.198
PT	0.363
PV	0.742
EE	0.533
PE	0.627
SI	0.281
HM	0.373
Ha	0.573
FC	0.677
BI	0.69

After re-specification, all non-significant relationships were removed. The results from all significant paths can be used to summarize the findings that the adoption readiness is able to explain the use of electronic payment system together with income and some technology channels. The overall explanation is 19.8 that all independent variables together can explain the dependent variables, which is use behavior. The final model can be used to assess the model fit indices since structural equation modeling is capable to do so.

Table 4.9 shows that fit indices and their recommendations.

Table 4.9 Model Fit Indices

Index	Value	Recommended value	References
Chi-square	75.734	N/A	
Df	46	N/A	
P-value	.004	>.005	Hair et al.(2010)
Normed Chi square	1.646	<5	Marsh and Hocevar (1985)
CFI	.993	>.90	Hair et al.(2010)
SRMR	.0224	<.08	Hair et al.(2010)
RMSEA	.03	<.08	Bollen and Long(1993)
TLI	.988	Approach 1	Hair et al.(2010)

CHAPTER 5

DISCUSSIONS AND CONCLUSION

This chapter is dedicated for discussions and conclusion. The discussion part is divided into each research question.

5.1 Discussions

RQ1: How social-economics classes of people in Bangkok use electronic payments differently?

Diffusion and adoption of technology come together because they both study users' behavior. This research shows that users in fact diffuse in their use of technology. People who have higher income use electronic payment system more than those who have lower income. This unequal diffusion of technology may lead to the phenomenon of the digital divide. Research show that low-income people were less access to information technology such as mobile phones and the internet. This issue might complicated since income is often connect to employment and education (Rice & Katz, 2003). A similar research conducted in the US by using the qualitative approach found that the use of the Internet is determined by the quality of education. When people have good enough education, they have reason to use the Internet. When they have poor education, they do not develop attitudes toward the use of the Internet and computer in their jobs. We can learn from this research that education affect the altitudes toward the use of new technology. The more education that people have the more likelihood that people use technology (Kvasny & Keil, 2006). The phenomenon would be the same as the use of electronic payment systems. Education and income go together. Hence, the diffusion of innovation should consider education and income more than traditional factors such as age, and gender.

While it is expected to have a significant relationship with the usage, Central Business District (CBD) has no significant relationship with the usage. Contradicting to notion that people who live in CBD should have higher usage rate of electronic payments, the results provide no relationship when income, technologies channels, and adoption readiness are controlled. Gender also has a bi-variate relationship in the case of frequency of usage (logUB1). However, according to the UTAUT, gender moderates the relationships of UTAUT1-2 constructs. Because it can moderate the relationships, the effect is shown that men used more often than women did. However, when considered the total usage, gender has no relationship with the total usage (UB).

Age has a bi-variate relationship with the amount of money spent per transaction (logUB2) and the total usage (UB). However, if one controls the effect income, this relationship disappears because people who have high age have more income when compared with people at the younger age. To sum up gender and age do not directly affect the usage but they moderate the relationships among the constructs of UTAUT 1-2 (Venkatesh et al., 2003, 2012).

RQ2: What socio-economics factors can drive people to use electronic payments differently when controlled possible variables?

As mentioned on the first discussion of research question1. After controlling all possible variables, we found that only income affects the usage of electronic payment systems. In this research we controlled constructs of UTAUT2 via the application of adoption readiness and technology channels. The answer to this question is that we found that rich and poor can drive people to use electronic payment differently. The model resulted from this research is acceptable.

5.2 Conclusion

People in Thailand are becoming an electronic payment adopter. While the major business transactions of electronic payments belong to business-to-business transactions (B2B), the growth of people using electronic payments is increasing precipitously. This research aims to study the use behavior of electronic payment systems in Bangkok Thailand and to study the diffusion of the electronic payment systems in Bangkok Thailand. The study then comes up with two research questions: How groups of people in Bangkok using electronic payments differently? And What group factors can drive people to use electronic payments differently when controlled possible variables? This study aims at researching people who lived in Bangkok Thailand. The study uses both Pearson correlations and structural equation modeling to answer the research questions. The samples in this research are 720 respondents who live in Bangkok Thailand. The results show that the overall usage has positive relationships with age and income. People who have higher age and income tend to use the electronic payment system more than those who have less age and income. In this research, there is no relationship between CBD and the overall usage. In addition, after controlled all possible variables, only income that positively affects the use of electronic payment systems. The controlled variables include adoption readiness and technology channels. Discussions have been discussed.

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ตำแหน่งปัจจุบัน ผู้ช่วยศาสตราจารย์

ประวัติการศึกษา

ชื่อย่อปริญญา	สาขา	สถาบันที่จบ	ปีที่จบ
วท.บ.	วิทยาการคอมพิวเตอร์	สถาบันเทคโนโลยีพระจอมเกล้า เจ้าคุณทหารลาดกระบัง	2544
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ผลงานวิจัย/งานสร้างสรรค์

ผลงานวิจัย/งานสร้างสรรค์ที่ตีพิมพ์เผยแพร่(ระดับชาติและนานาชาติ)

หัวหน้าโครงการ

1. Thai Tourists' Satisfaction: A CASE STUDY OF Talingchan Floating Market Tourism Management, *วารสารเกษตรพระจอมเกล้า*, 2552.
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ผู้ร่วมโครงการ

1. ปัจจัยที่มีผลต่อความสำเร็จในการพัฒนาทรัพยากรมนุษย์ของธุรกิจเกษตรอินทรีย์เพื่อสร้างให้เป็นองค์การแห่งการเรียนรู้โดยรับการจากสาขาวิชาบริหารธุรกิจและพัฒนาการเกษตร ปังบประมาณ 2552

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