

Determinants for Consumer Adoption of Mobile Payment Technology

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Abstract: The purpose of this study was to investigate factors that influence user adoption of mobile payment and the possibilities to continuously use such technologies and to recommend to others. The research framework integrates the UTAUT 2 and DOI theory, and includes other variables that may affect consumers' use of mobile payments. A questionnaire is used to collect data, and the sample is primarily composed of users who have previously used mobile payments. In total, 350 valid samples were collected. First Findings, payment efficiency can be improved when users think that mobile payments are useful in everyday life, they are simple to operate, and the interface is easy to understand. Second, when users are more appreciative of innovation, they are more accepting of mobile payment technologies. Finally, behavioral intention to adopt is an important factor affecting behavioral intention to recommend. Mobile payment has become a global trend. When the demand for mobile payment increases and can be effectively fulfilled, consumers' desire to adopt the payment system will increase. The results can serve as a strategy reference for service providers who wish to stimulate usage demand of consumers and expand their mobile payment business.

Key words: Mobile payment, UTAUT 2, DOI, behavioral intention to adopt, behavioral intention to recommend.

1. Introduction

In the twenty-first century, information technology has dramatically advanced and prospered. Technology has brought convenience to the public as it has matured, changing daily life. Convenience has become one of the most essential factors in the decision-making processes of the public. Numerous industries, including the financial services industry, have begun integrating with technology to attract consumers. Additionally, payment methods have evolved, with society transitioning from a cash economy to an "electronic transaction economy," indicating the use of credit cards, a "stay-at-home economy," indicating the prevalence of online shopping, and lastly a "finger-swipe economy," indicating the popularity of smartphones for making purchases. Amid the innovation and development of network technology, smartphones have ushered in a mobile payment era- referred to as the "beep economy" - employing the combination of finance and technology. Taiwan did not pass regulations regarding third-party payment until January 2015, and after this date, numerous mobile payment services emerged on the domestic market,

such as the Pi mobile wallet of PChome Online, the t wallet+, O'Pay, Pay2go, and Jkos. Despite the large number of these services, Taiwan has plenty of room for improvement compared with other countries. The consumer usage rate of mobile payment services increased from 19.0% in 2015 to 24.4% in 2016, indicating the potential for mobile payment service development in Taiwan.

Prior research has provided a rather limited understanding of the key drivers in consumer use of mobile payment. Researchers exploring mobile payment services in Taiwan often adopt the technology acceptance model (TAM) as their research framework (e.g., [1]-[3]); few studies evaluate the factors affecting consumer usage. Ref. [4] believe that conventional models, namely the TAM, fail to correctly interpret the usage behavior of mobile payment services. Ref. [5] indicate that most research has employed the same factors to evaluate the behavioral intentions of users and recommend that new factors are employed for further investigation. A comprehensive study about such factors offers the potential to derive important managerial implications regarding how mobile payment could be stressed more effectively, thus leading to greater consumer behavioral intention to recommend. Therefore, on the basis of research by [6], this study integrates the unified theory of acceptance and use of technology 2 (UTAUT 2) proposed by [7] and diffusion of innovation (DOI) theory proposed by [8]; to these theories, the factor of perceived technology security is added.

Mobile payment has increased and the understanding is needed on how managers can effectively boost the number of customers who choose this form of payment as an alternative to more traditional payment. The current research aims to develop and test an integrative model of factors determining consumers' behavioral intention to adopt and recommend of mobile payment services. The purpose of this study is to investigate the usage behavior conditions of mobile payment services and the possibility of users recommending this payment method. For this purpose, we collected data and used the structural equation modeling software PLS to test a research model. This study reveals major factors of consumers' intention to adopt and recommend of mobile payment services. The results supplement the previous research by revealing potential factors and serve as a reference for mobile payment service providers regarding customer decision-making or follow-up studies on related topics.

2. Literature Review and Hypothesis Development

2.1. Mobile Payment

Mobile payments were defined by the Bank for International Settlements in 2012 as follows: "Consumers replace conventional payment methods by making fund transfers on mobile devices, including smartphones and tablets, through audio, text messages, or near-field communications (NFC)." Hence, payment behaviors activated through a network on mobile devices by the means mentioned are considered electronic payments [9].

2.2. UTAUT 2 and Behavioral Intention

Numerous researchers have been developing and proposing various theories as prediction schemes for precisely analyzing the behavioral intention of consumers who utilize new technology products or services (e.g., TAM, DOI, UTAUT); each theory examines a different aspect and adopts a different perspective. UTAUT 2, proposed by [7], is a theoretical framework derived from UTAUT. Ref. [10] explore consumer intention to employ near-field communication mobile payments at hotels by using the UTAUT 2 model. The results demonstrate that the UTAUT 2 model has strong explanatory power. In general, research variables are significantly correlated with behavioral intention and usage behaviors. Thus, this study predicts consumer behavioral intention toward mobile payment on the basis of the UTAUT 2. The hypotheses of this study are explained as follows.

When users believe that adopting new technological skills can increase their work performance, their intention and attitude toward employing new technology are more positive [11], [12]; thus, individuals' main concern when adopting new technology is whether the technology will increase their work efficiency [11]. Ref. [10] investigate the intention of consumers to use mobile payment at hotels and discover that consumers have a considerable preference for mobile payment when hotels provide sales optimization payment. In addition, [13] identifies a positive correlation between performance expectancy and behavioral intention. Hence, this study proposes hypothesis 1:

H1: Performance expectancy positively affects the behavioral intention of consumers to adopt mobile payment.

A study by [1] indicates that consumers tend to believe that mobile payments are highly efficient when they are user-friendly. User intention to employ mobile payment is relatively strong when the user finds it simple to learn how to employ the payment system, which increases work performance [6]. Accordingly, this study proposes hypothesis 2:

H2a: Effort expectancy positively affects the performance expectancy of mobile payment users.

H2b: Effort expectancy positively affects the behavioral intention of consumers to adopt of mobile payment users.

Ref. [14] state that when the people who are significant to an individual identify with or employ certain technology, their behavior strongly influences the individual's desire to also employ that technology. Ref. [6] indicate that the opinions and advice of people with influence and significance can promote the adoption of mobile platform technologies. Ref. [10] identify a positive correlation between social influence and behavioral intention to adopt mobile payment. Hence, this study proposes hypothesis 3:

H3: Social influence positively affects the behavioral intention of consumers to adopt mobile payment.

When individuals encounter obstacles during their use of a new application, the facilitating conditions—namely, the operating instructions and technological description—become relatively essential [12]. The behavioral intention of individuals toward adopting mobile payment increases with the degree of information and support provided to users of the technology [6], [10]. Hence, this study proposes hypothesis 4:

H4: Facilitating conditions positively affects the behavioral intention of consumers to adopt mobile payment.

Hedonic motivation describes the level of fun and pleasure perceived by an individual while they use a technological product or service [7]. Hedonic motivation is regarded as the crucial factor to consumer acceptance of information technology [15]; research has also verified that it has a positive effect on behavioral intention [7]. Hence, this study proposes hypothesis 5:

H5: Hedonic motivation positively affects the behavioral intention of consumers to adopt mobile payment.

Additionally, studies have confirmed that price value has a positive effect on behavioral intention [7], [16], [17]. When the price value of a service is high, the monetary cost of the service is perceived to be low, which results in users feeling that they benefit more from employing the technology [6]. Hence, this study proposes hypothesis 6:

H6: Price value positively affects the behavioral intention of consumers to adopt mobile payment.

2.3. DOI and Behavioral Intention

Diffusion of Innovations (DOI) is a model of innovation proposed by Rogers in 1962. This model is most commonly employed in academia for predicting and interpreting behavior related to innovation adoption and diffusion. DOI is generally used to interpret the adoption of various financial and mobile technologies. Researchers frequently employ this model as a research structure and investigate the factors that affect mobile payment adoption [18]-[20]. DOI theory has strong explanatory power. According to a study conducted by [21] that explored the influence of innovativeness on the adoption of innovations, relative

advantage, complexity, and compatibility are significantly and consistently correlated with innovation adoption. Due to the similarity between the operational definition of relative advantage and complexity and that of performance and effort expectancy regarding UTAUT 2, we add only the factors of innovativeness and compatibility to the UTAUT 2 model. The hypothesis is as follows:

Ref. [22] indicate that individuals with ability to innovate tend to be the first people to adopt new technology products; in fact, such individuals are essential to the success of new technology products or services [23],[24]. Mobile payment is a destructive innovative technology [25]; individuals who are willing to accept innovations and take risks are relatively more open to adopting new technology [23], [26]. Ref. [27] investigate individual perception of mobile payment adoption and discover that individuals who are highly accepting of innovations have strong intentions to adopt new technology. In addition, individuals with high innovation level and compatibility level tend to recognize the advantages of adopting new technology [6]. Hence, when users are highly accepting of innovations, their level of compatibility, performance expectancy, and effort expectancy increase accordingly. Hence, this study proposes hypothesis 7:

H7a: Innovativeness positively affects mobile payment users' compatibility.

H7b: Innovativeness positively affects mobile payment users' performance expectancy.

H7c: Innovativeness positively affects mobile payment users' effort expectancy.

H7d: Innovativeness positively affects the behavioral intention of consumers to adopt mobile payment.

All consumers have a certain degree of uncertainty toward whether mobile payment is suitable for them. Whether consumers would adopt the system depends on their current values and purchasing habits [1]. A higher level of compatibility between values and needs implies a lower level of uncertainty, resulting in an increase of willingness to adopt mobile payment [28]. A study conducted by [6] reveals that when consumers believe that mobile payment is compatible with their current payment needs, values, and lifestyle, then performance expectancy, effort expectancy, and intention to adopt mobile payment are higher. Hence, this study proposes hypothesis 8:

H8a: Degree of compatibility positively affects performance expectancy.

H8b: Degree of compatibility positively affects effort expectancy.

H8c: Compatibility positively affects the behavioral intention of consumers to adopt mobile payment.

2.4. Perceived Technology Security and Behavioral Intention

According to a survey conducted by Nielsen Holdings in 2016, the main reason for the relatively low rate of mobile payment adoption among consumers in Taiwan is security issues (stated by 73% of respondents). Moreover, multiple studies (e.g., [6], [29], [30]) have revealed that consumers have doubts about the potential for personal data leakage, fraud, and other security-related issues. These issues affect the adoption of mobile payment in particular because this technology involves personal data and privacy [31]. Hence, perceived security of the technology is an essential influential factor in this study for investigating consumer willingness to adopt mobile payment. Ref. [32] indicates that because mobile payment concerns their money, consumers consider their uncertainty in this newly emerging payment system. Consumers only become ready to adopt the new system when the level of its uncertainty decreases to a personally endurable level. Therefore, increasing consumers' intention to adopt a certain system rests in convincing the consumers that the transaction process of the system is safe or increasing their sense of security toward mobile financial transactions [33]. Hence, this study proposes hypothesis 9:

H9: Perceived technology security positively affects the behavioral intention of consumers to adopt mobile payment.

2.5. Behavioral Intention to Recommend

Mobile payment is currently being promoted slowly in Taiwan [3]. If the technology is to become

mainstream, the technology must mature and numerous users must be willing to adopt it [2014]. Consumers' intention to recommend the technology is thus a significant influential factor [6]. Ref. [34], [35] state that consumers willing to adopt innovative technology are more likely to employ mobile payment and recommend it to other people, which is beneficial to the promotion of mobile payment [6].

H10: Consumers' behavioral intention to adopt mobile payment positively affects their behavioral intention to recommend the technology.

3. Method

3.1. Research Framework

Complying with the research theory of [6], this study explores consumers' behavioral intention to adopt and recommend new technology.

Studies have demonstrated that the UTAUT 2 model has strong explanatory power in research on consumer acceptance of innovative technology products or services. Because mobile payment is not yet universally used in Taiwan [2], habit of mobile payment usage is not included as a factor in this study. Mobile payment being a destructive innovative technology [25], the DOI model developed by [8] is employed as a reference. Research has revealed that consumers place much importance on security-related issues such as personal data privacy and fraud [1], [31]. Considering the influence of security on consumer adoption behaviors, this study integrates the aforementioned factors to investigate their influence on behavioral intention to adopt and recommend new technology. The research framework is illustrated in Fig. 1.

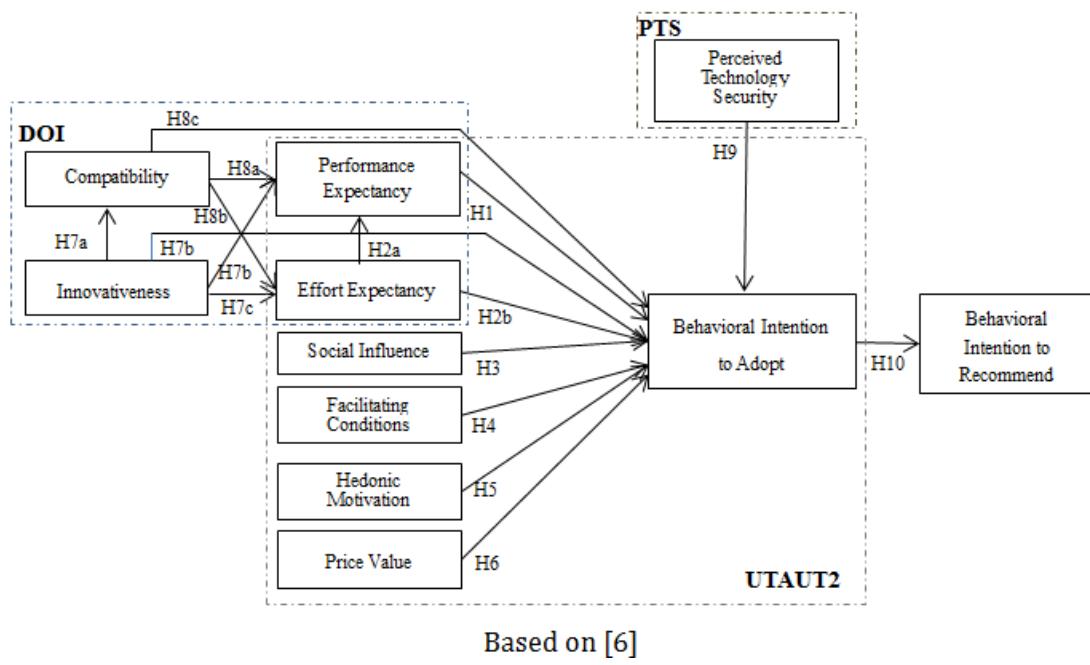


Fig. 1. Research framework.

3.2. Operational Definition of Variables

The variables in this study are performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, innovativeness, compatibility, perceived technology security, behavioral intention to adopt, and behavioral intention to recommend (Table 1). A 5-point Likert scale is employed to evaluate levels of agreement from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Operational Definition

Construct	Operational Definition	Item	References
Performance Expectancy	Expected degree to which mobile payment can improve daily life or work performance.	4	
Effort Expectancy	Expected degree to which mobile payment is easy to adopt, use, and understand.	4	
Social Influence	Degree to which a user's significant others believe that he or she should adopt mobile payment.	3	Venkatesh <i>et al.</i> (2012)[7]
Facilitating Conditions	Degree to which a user perceives the availability of resources and support during mobile payment adoption.	3	
Hedonic Motivation	Degree to which a user perceives that they will experience fun and pleasure from adopting mobile payment.	3	Venkatesh <i>et al.</i> (2012) [7]; Brown & Venkatesh (2005) [36]
Price Value	Degree to which the costs of adopting mobile payment are in proportion to the benefits received.	3	Venkatesh <i>et al.</i> (2012) [7]; Dodds <i>et al.</i> (1991) [37]
Innovativeness	Degree to which a user tends to adopt new innovations.	4	Agarwal & Karahanna (2000) [38]
Compatibility	Level of compatibility between mobile payment and a user's current values, needs, and experiences.	4	Moore & Benbasat (1991) [39]
Perceived Technology Security	Level of security perceived by a user concerning confidential data processing through mobile payment.	4	Cheng <i>et al.</i> (2006) [40]
Behavioral Intention to Adopt	Degree to which a user intends to adopt mobile payment in the future.	6	Venkatesh <i>et al.</i> (2012) [7]; Davis (1989) [11]
Behavioral Intention to Recommend	Degree to which a user intends to recommend mobile payment to others after adopting the technology.	2	Venkatesh <i>et al.</i> (2012) [7]; Bélanger & Carter (2008) [41]

3.3. Sample Design and Data Collection

To examine the validity of the research tools employed, a pretest was conducted before the actual experiment. The official questionnaire was administered to individuals identified through purposive sampling and snowball sampling. The research participants, mainly those who had experience of using mobile payment, were required to complete an online survey located on a public Google spreadsheet; each participant had to log in to their Google account to prevent the same person from completing the survey twice. The period in which the online questionnaire could be completed was April 10 to May 13, 2017, and 365 responses were collected. Subsequently, the data collected were examined; 15 questionnaires were eliminated because they were completed by participants with no experience of using mobile payment. A total of 350 valid questionnaires were collected. From the response data, there were more female

respondents than male respondents; 75.2% of the mobile payment users had an age of 21-30 years, revealing that acceptance and adoption of new technologies is relatively more prevalent among young adults. The distribution of education levels attained by the participants shows that 80% of the participants had a bachelor's degree or higher. Regarding occupation, 48.6% of the respondents were students and 48.4% were employees. The most commonly used mobile payment among the participants was LINE pay (35.7%), subsequently followed by Apple pay (27.4%) and Alipay (14%). Most participants had been using the technology for 1 month or less and at an average of five times each month. Promotion of mobile payment began at the end of 2013. Since 2016, the payment method has gradually gained popularity, with more people applying to be able to use it. However, only a few stores allow consumers to pay using this system, which might account for the low frequency of usage among the participants in this study.

4. Empirical Analysis

4.1. Analysis of Reliability and Validity

Before performing analyses using structural equation modeling (SEM), the reliability and validity of the official questionnaire should be assessed. Each factor in this study has an α coefficient higher than 0.85 and a factor loading of 0.95 or higher; thus, they are higher than the thresholds recommended by scholars and the questionnaire has adequate reliability. The calculated composite reliability (CR) and average variance extracted (AVE) of each factor are also higher than those recommended by researchers, indicating that the CR and convergent validity of the latent variables are within acceptable ranges (Table 2). In addition, the divergent validity test documented in Table 3 indicates that the values on the diagonals of each variable (square root of the AVE) are higher than those not on the diagonals (correlation between latent variables), which complies with the suggestion by [42]. Given this analysis, the measure used in this study has adequate reliability and validity. Thus, hypothesis testing can be conducted and the explanatory power of the model can be determined.

Table 2. Reliability and Validity Analysis for Potential Variables

Construct	Item	Mean	Factor Loading	Cronbach's α	CR	AVE
Performance Expectancy	PE1	3.87	0.88	0.9	0.93	0.78
	PE2	3.96	0.91			
	PE3	3.69	0.90			
	PE4	3.75	0.84			
Effort Expectancy	EE1	3.75	0.83	0.92	0.94	0.8
	EE2	3.79	0.92			
	EE3	3.87	0.92			
	EE4	3.91	0.91			
Social Influence	SI1	3.2	0.93	0.93	0.96	0.88
	SI2	3.14	0.96			
	SI3	3.13	0.94			
Facilitating Conditions	FC1	3.77	0.89	0.85	0.91	0.77
	FC2	3.67	0.90			
	FC3	3.79	0.85			
Hedonic Motivation	HM1	3.5	0.92	0.92	0.95	0.87
	HM2	3.65	0.94			
	HM3	3.65	0.93			
Price Value	PV1	3.68	0.82	0.85	0.91	0.77
	PV2	3.83	0.93			
	PV3	3.74	0.88			
Innovativeness	I1	3.85	0.87	0.86	0.92	0.79
	I2	3.58	0.88			
	I3	3.86	0.91			
Compatibility	C1	3.67	0.86	0.92	0.95	0.81
	C2	3.46	0.90			
	C3	3.63	0.92			

	C4	3.56	0.93				
Perceived Technology Security	PTS1	3.21	0.95				
	PTS2	3.23	0.96				
	PTS3	3.15	0.95	0.97			
	PTS4	3.24	0.95				
Behavioral Intention to Adopt	BIA1	3.47	0.93				
	BIA2	3.5	0.93				
	BIA3	3.48	0.93	0.92			
	BIA4	3.67	0.88		0.94		
	BIA5	3.43	0.82				
	BIA6	2.81	0.59				
Behavioral Intention to Recommend	BIR1	3.8	0.96	0.9			
	BIR2	3.9	0.95		0.95		

Table 3. Square Root of the AVE of Each LATENT variable and the Coefficients of Correlation between the Latent Variables

	PE	EE	SI	FC	HM	PV	I	C	PTS	BIA	BIR
PE	0.88										
EE	0.65	0.89									
SI	0.54	0.43	0.94								
FC	0.62	0.69	0.43	0.88							
HM	0.60	0.54	0.57	0.58	0.93						
PV	0.60	0.62	0.51	0.58	0.63	0.88					
I	0.56	0.60	0.45	0.59	0.56	0.56	0.89				
C	0.63	0.61	0.57	0.59	0.65	0.68	0.70	0.90			
PTS	0.43	0.40	0.46	0.45	0.53	0.53	0.41	0.51	0.95		
BIA	0.65	0.56	0.56	0.57	0.67	0.63	0.57	0.73	0.60	0.86	
BIR	0.58	0.55	0.49	0.54	0.63	0.57	0.55	0.56	0.46	0.61	0.95

Note: 1.PE (Performance Expectancy)、EE (Effort Expectancy)、SI (Social Influence)、FC (Facilitating Conditions)、HM (Hedonic Motivation)、PV (Price Value)、I (Innovativeness)、C (Compatibility)、PTS (Perceived Technology Security)

BIA (Behavioral Intention to Adopt)、BIR (Behavioral Intention to Recommend)

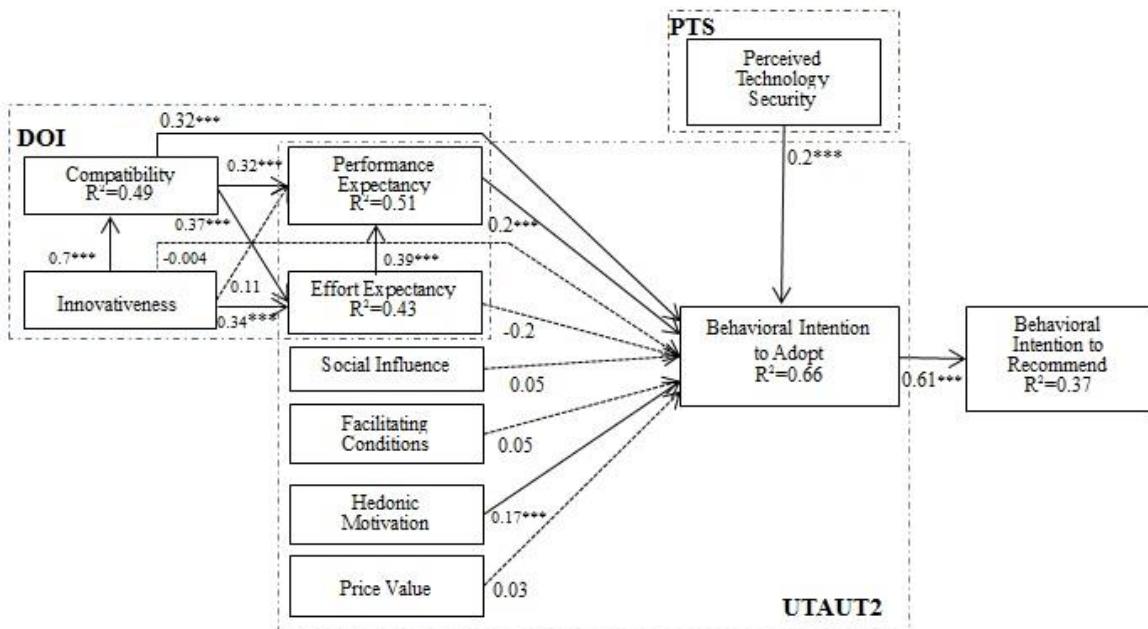
2. Bold values on diagonals represent the square root of the AVE of each latent variable.

3. Values not on diagonals represent the correlation coefficients between two latent variables.

4.2. Verification of the Research Hypotheses

This study utilizes Smart PLS 3.0 software to analyze and verify causality among the latent variables by employing SEM; the coefficient of determination (R^2) is used to determine the explanatory power of the research model [43]. Analysis of the data presented in Fig. 2 indicates that performance expectancy, effort expectancy, compatibility, behavioral intention to adopt, and behavioral intention to recommend have an R^2 of 0.51, 0.43, 0.49, 0.66, and 0.37, respectively. The results demonstrate that the variance in the endogenous variables that is explained by the exogenous variables reaches a certain level. Performance expectancy ($t = 3.62, p < 0.001$), hedonic motivation ($t = 2.48, p < 0.001$), compatibility ($t = 4.58, p < 0.001$), and perceived technology security ($t = 3.9, p < .001$) all have positive effects on behavioral intention to adopt mobile payment. Both effort expectancy ($t = 5.79, p < 0.001$) and compatibility ($t = 5.04, p < 0.001$) have positive effects on performance expectancy. Both innovativeness ($t = 5.08, p < 0.001$) and compatibility ($t = 5.67, p < 0.001$) have positive effects on effort expectancy. Innovativeness ($t = 22.7, p < 0.001$) has a positive effect on compatibility. Behavioral intention to adopt ($t = 16.74, p < 0.001$) has a positive and significant effect on behavioral intention to recommend mobile payment. With a t value lower than 1.96 and a p value higher than 0.05, no support is obtained for the remaining six hypotheses; thus, effort expectancy, social influence, facilitating conditions, price value, and innovativeness have no significant effects on behavioral intention to

adopt mobile payment. Additionally, innovativeness has no significant effect on performance expectancy.



Note: 1. Solid lines indicate significance whereas dashed lines indicate no significance.

2. 2. * : p<0.05; ** : p<0.01; *** : p<0.001

Fig. 2. Results of SEM analysis.

5. Conclusion and Suggestions

5.1. Theoretical Implications

Mobile payment has become a global trend. However, the market for mobile payment in Taiwan still remains at the developmental stage, unlike in other countries. Hence, effectively increasing consumers' willingness to adopt and then recommend mobile payment is a priority for the financial industry. The purpose of this study is to explore the factors influencing the adoption of mobile payment by consumers and their intention to recommend this system to other people. Research data was collected through questionnaire to verify the hypotheses proposed in this study. The results can serve as a strategy reference for service providers who wish to expand their mobile payment business. The results are as follows: (1) Regarding behavioral intention to employ mobile payment, four aspects—namely performance expectancy, hedonic motivation, compatibility, and perceived technology security—are the most prominent influential factors, and combined, they have a moderate explanatory power of 66%. Among these variables, both compatibility and perceived technology security positively affect behavioral intention to adopt mobile payment, which accords with the findings of research conducted by [6], [30]. These effects verify that both compatibility and perceived technology security are substantially correlated with behavioral intention to adopt. (2) Both effort expectancy and compatibility have positive and significant effects on performance expectancy, with an explanatory power of 51%. Performance expectancy and effort expectancy reflect perceived usefulness and perceived ease of use, respectively, in the TAM. Numerous studies have indicated that perceived ease of use has a significant effect on behavioral intention, influencing perceived usefulness directly or indirectly [11], [30]. Thus, when the level of effort expectancy is high, consumers' performance expectancy toward a technology may also be high. Compatibility has a significant effect on performance expectancy, which complies with the results of numerous studies. Ref. [28] find that compatibility has an

indirect effect on perceived usefulness. Likewise, a study conducted by [30] reveals that compatibility has a significant effect on perceived usefulness. Hence, when users believe that mobile payment is useful in their daily life and that the interfaces of mobile payment systems are easy to use and comprehend, payment efficiency is higher. (3) Innovativeness has positive effects on both effort and compatibility expectancy, with separate explanatory powers of 43% and 49%. Hence, users who prefer innovative products and services are highly accepting of new technology. (4) Behavioral intention to adopt mobile payment has a positive and significant effect on behavioral intention to recommend, with an explanatory power of 37%; this result accords with those of other studies. Oliveira *et al.* (2016) indicate that behavioral intention to recommend is an essential influential factor. Sharing personal opinions with relatives and friends on social networks increases recognition of products and services and promotes them, leading others to successfully adopt mobile payment technology. Hence, behavioral intention to adopt is an essential factor influencing behavioral intention to recommend.

Finally, according to the hypothesis verification illustrated in Fig. 2, the factors effort expectancy, social influence, facilitating conditions, price value, and innovativeness do not affect behavioral intention to adopt; likewise, innovativeness does not affect performance expectancy. The reasons for this are expected to be as follows: (1) Regarding effort expectancy: People are strongly affected by online information, and most people have a certain degree of information literacy. Table 2 reveals that the average score for items EE1 to EE4 is higher than 3. The high information literacy of the participants may thus have led to these participants feeling that adoption of mobile payment was effortless. (2) Regarding social influence: The actions of people are affected by those of their significant others, who can be friends, classmates, colleagues, and family members. Nonetheless, not many users adopt mobile payment due to the influence of people around them. According to the study conducted by [14], when technology is voluntarily adopted, social influence has no significant effects on behavioral intention. The same results were observed regarding mobile payment because most of the participants had begun using mobile payment voluntarily. (3) Regarding facilitating conditions: Mobile payment systems began to gain popularity in 2016. Installation of related equipment in major chain stores became prevalent in 2017. Currently, however, only a few stores in Taiwan allow consumers to pay with such systems, which may account for facilitating conditions having no significant effect on behavioral intention to adopt. (4) Regarding price value: The factor of price value is added to the UTAUT 2 by Venkatesh and other researchers because consumers must pay for their purchases. However, in this case, the adoption of mobile payment requires only a free application, which may account for price value having no significant effect on behavioral intention to adopt. (5) Regarding innovativeness: Technology has changed drastically in the past few years. Convenient, digitized, and mobile innovations are being pursued. Hence, people are relatively willing to adopt new technology, which may account for innovativeness having no significant effects on behavioral intention to adopt and performance expectancy.

5.2. Implications for Practice and Research Contributions

First, when the demand for mobile payment increases and can be effectively fulfilled, consumers' desire to adopt the payment system will increase. That is, if mobile payment service providers wish to stimulate usage demand, they must increase the number of service items they offer and combining utility fees, in addition to promoting the service in places such as brick-and-mortar shops, virtual stores, hospitals, and on transportation. Second, conventional payment methods (cash or credit cards) are easier to understand than mobile payment for the general public. Thus, service providers should reduce the complexity of mobile payment design. Consumers' intention to adopt mobile payment will increase once they are convinced that mobile payment is easy to learn and can increase payment efficiency.

Third, personal data privacy and security issues are always points of concern for consumers. Thus, mobile payment providers should strengthen the risk management and security protection of their systems and

increase recognition of user identity during payments to assure transaction security and antileakage of personal data. Consumers' intention to adopt mobile payment increases once they have faith in the security of the system. In addition, consumers' intention to adopt mobile payment systems increases if they perceive that making payments in this way can be fun and pleasurable. While designing their interface, service providers should increase user enjoyment by adding innovations or appropriate interactive programs. Service providers can also offer preferential programs to users or provide cashback rewards for those who recommend the system to their friends.

Finally, increasing the compatibility of mobile payment is beneficial to increasing consumers' willingness to adopt such systems. While designing the mobile payment transaction process, the system provider should consider consumers' needs, values, and lifestyles as much as possible to increase payment efficiency and stimulate consumers' intention to adopt the system.

Mobile payment services have to offer added value or better mechanisms to succeed. This article has some contributions. First, we define the key terms used in our research and elaborate on TAM, which provides the general concept for our research model. Subsequently, we review previous work on mobile payment service and it helps to explain the existing body of knowledge on each factor of the framework from various perspectives. Building on theory and the prior studies about mobile payment, we develop our hypotheses, specifying a set of factors that are proposed to directly or indirectly determine consumers' intention to adopt and recommend mobile payment services. The model provides an overview of the mobile payment services to draw a broader picture of the drivers of consumer's adoption and recommendation of mobile payment services compared to previous research. Finally, we test this model with a large sample, which enables us to conduct several stability tests in order to increase confidence in the findings.

6. Limitations and Suggestions for Future Research

Even though the Taiwanese government has strongly promoted mobile payment since 2017, numerous topics are still worthy of discussion. Because mobile payment usage had not reached universality in Taiwan during the survey period, the habit of mobile payment usage was not discussed in this study. Subsequently, this study is based on cross-sectional data. Further study and analysis are necessary for investigation of whether this factor is affected by the time spent by users in making mobile payments, individual experiences, or other latent variables. Suggestions for future research directions are as follows: (1) Perform studies using larger sample sizes. (2) Once mobile payment becomes universal, usage habit and experiences can be included in the research framework, whether this comprises the UTAUT 2 model or other theories. (3) Longitudinal research is the recommended research method for observing research subjects over long periods of time. This type of research design would be beneficial to the study of subject developmental changes as well as causal relationships, which can be identified using SEM.

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References

- [1] Chang, Y. C. (2006). *Factors Influencing Mobile Payment*. National Central University, Taiwan.
- [2] Guo, Y. H. (2016). *Research on Impact Factor of the Consumers Using Mobile Payment Intention*. Chinese Culture University, Taiwan.
- [3] Hsu, C. Y. (2017). *A Study of the Influential Factors of Mobile Payment Based on Technology Acceptance Model*. Takming University of Science and Technology, Taiwan.

- [4] Gao S., & Yang Y. (2014). The role of trust towards the adoption of mobile services in China: An empirical study. *Digital Services and Information Intelligence. I3E 2014. IFIP Advances in Information and Communication Technology*. Springer, Berlin, Heidelberg.
- [5] Gao, S., Krogstie, J., & Siau, K. (2011). Developing an instrument to measure the adoption of mobile services. *Mobile Information Systems*, 7(1), 45-67.
- [6] Oliveira, T., Thomas, M., Baptista, G., & Campos, F. (2016). Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology. *Computers in Human Behavior*, 61, 404-414.
- [7] Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36(1), 157-178.
- [8] Rogers, E. M. (1995). *Diffusion of Innovations* (4th Ed). New York, NY: Free Press.
- [9] Weng, S. J., & Tian, Y. R. (2014). Application and development of mobile business payment. *Financial Information Quarterly*, 78, 19-26.
- [10] Morosan, C., & DeFranco, A. (2016). It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. *International Journal of Hospitality Management*, 53, 17-29.
- [11] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.
- [12] Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: Toward a conceptual model of utilization. *MIS Quarterly*, 15(1), 125-143.
- [13] Huang, C. P. (2016). *Investigating Consumer's Acceptance Behavior on Mobile Payment by UTAUT2 Model*. National Taipei University of Technology, Taiwan.
- [14] Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27 (3), 425-478.
- [15] Ji, J. Y. (2013). *Applying UTAUT Model to Explore the Factors of Teacher in Using Interactive Whiteboard Elementary Schools in Taoyuan*. Vanung University, Taiwan.
- [16] Raman, A., & Don, Y. (2013). Preservice teachers' acceptance of learning management software: An application of the UTAUT 2 model. *International Education Studies*, 6(7), 157-164.
- [17] Yang, S. (2013). Understanding undergraduate students' adoption of mobile learning model: A perspective of the extended UTAUT 2. *Journal of Convergence Information Technology*, 8(10), 969-979.
- [18] Chen, J. J., & Adams, C. (2005). User acceptance of mobile payments: a theoretical model for mobile payments. *Proceedings of the Fifth International Conference on Electronic Business (ICEB)*. Hong Kong.
- [19] Mallat, N. (2007). Exploring consumer adoption of mobile payments-A qualitative study. *The Journal of Strategic Information Systems*, 16(4), 413-432.
- [20] Arvidsson, N. (2014). Consumer attitudes on mobile payment services-results from a proof of concept test. *International Journal of Bank Marketing*, 32(2), 150-170.
- [21] Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, 29(1), 28-45.
- [22] Jashapara, A., & Tai, W. C. (2006). Understanding the complexity of human characteristics on e-learning systems: an integrated study of dynamic individual differences on user perceptions of ease of use. *Knowledge Management Research & Practice*, 4(3), 227-239.
- [23] Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research*, 9(2), 204-215.
- [24] Yang, K. C. C. (2005). Exploring factors affecting the adoption of mobile commerce in Singapore.

Telematics and Informatics, 22(3), 257-277.

- [25] Bussman, O., Flint, J., Rotenberg, J., Cairns, A., Harris, J., & Sahai, N., *et al.* (2015). The future of financial services how disruptive innovations are reshaping the way financial services are structured, provisioned and consumed. Retrieved October 1, 2016, from the World economic forum website: http://www3.weforum.org/docs/WEF_The_future_of_financial_services.pdf
- [26] Yi, M. Y., Fiedler, K. D., & Park, J. S. (2006). Understanding the role of individual innovativeness in the acceptance of IT-based innovations: Comparative analyses of models and measures. *Decision Sciences*, 37(3), 393-426.
- [27] Zeng, Q., & Ma, J. (2016). Understanding the role of individual perception on mobile payment: Moderating or mediating. *Journal of Advanced Management Science*, 4(3), 195-200.
- [28] Wu, J. H., & Wang, S. C. (2005). What drives mobile commerce?: An empirical evaluation of the revised technology acceptance model. *Information & management*, 42(5), 719-729.
- [29] Shin, D. H. (2009). Determinants of customer acceptance of multi-service network: An implication for IP-based technologies. *Information & Management*, 46(1), 16-22.
- [30] Schierz, P. G., Schilke, O., & Wirtz, B. W. (2010). Understanding consumer acceptance of mobile payment services: An empirical analysis. *Electronic Commerce Research and Applications*, 9(3), 209-216.
- [31] Duane, A., O'Reilly, P., & Andreev, P. (2014). Realising m-payments: modelling consumers' willingness to M-pay using smart phones. *Behaviour & Information Technology*, 33(4), 318-334.
- [32] Chang, C. J. (2014). *User Intention of Mobile Payment Adoption*. National Taiwan University, Taiwan.
- [33] Shin, D. H. (2010). The effects of trust, security and privacy in social networking: A security-based approach to understand the pattern of adoption. *Interacting with Computers*, 22(5), 428-438.
- [34] Leong, L. Y., Hew, T. S., Tan, G. W. H., & Ooi, K. B. (2013). Predicting the determinants of the NFC-enabled mobile credit card acceptance: A neural networks approach. *Expert Systems with Applications*, 40(14), 5604-5620.
- [35] Miltgen, C. L., Popović, A., & Oliveira, T. (2013). Determinants of end-user acceptance of biometrics: integrating the "Big 3" of technology acceptance with privacy context. *Decision Support Systems*, 56, 103-114.
- [36] Brown, S. A., & Venkatesh, V. (2005). A model of adoption of technology in the household: A baseline model test and extension incorporating household life cycle. *MIS Quarterly*, 29(3), 399-426.
- [37] Dodds, W. B., Monroe, K. B., & Grewal, D. (1991). Effects of price, brand, and store information on buyers' product evaluations. *Journal of Marketing Research*, 28(3), 307-319.
- [38] Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 24(4), 665-694.
- [39] Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, 2(3), 192-222.
- [40] Cheng, T. C. E., Lam, D. Y. C., & Yeung, A. C. L. (2006). Adoption of internet banking: An empirical study in HONG KONG. *Decision Support Systems*, 42(3), 1558-1572.
- [41] Bélanger, F., & Carter, L. (2008). Trust and risk in e-government adoption. *Journal of Strategic Information Systems*, 17(2), 165-176.
- [42] Hair, J. F., Black, B., Babin, B., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis* (6th Ed.). Upper Saddle River, NJ: Prentice Hall.
- [43] Pavlou, P., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS Quarterly*, 30(1), 115-1143.



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