

A study on the willingness of smartphone users to use mobile payment in a technology acceptance model

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ABSTRACT: *With the popularity of smartphones and the increasing diversity of people's transaction patterns, this study explores the relevant concerns of smartphone users for the use of mobile payments, such as security, convenience and social connection, so as to explore the willingness of smartphone users to use mobile payments. In this study, 215 questionnaires were collected through questionnaire surveys, and the content of the questionnaires was analyzed in the mode of technological acceptance, trying to explore convenience, safety, and the impact of sensory ease of use, perceptual usefulness, and use intention on usage behavior, and finally integrated with the sub-results, and found that: (1) convenience and perceptual usefulness had a positive effect (2) safety had a positive effect on perceptual usefulness (3) social association had a positive effect on perceptual usefulness (4) Perceptual ease of use has a positive effect on perceptual usefulness (5) perceptual ease has a positive effect on use intention, and (6) use intention has a positive effect on use behavior.*

KEY WORD: *Mobile payments, Technology Acceptance models, Fintech*

I. INTRODUCTION AND LITERATURE REVIEW

1.1 Research background

The development and maturity of today's smart phones has not only changed people's lifestyles, but also promoted the development of mobile commerce. With the continuous transformation of mobile payments on smartphones and the support of the banking system, the global mobile payment population is increasing.

Traditional currency transactions or credit card payments, although fast and straightforward, still have disadvantages, such as the inconvenience of cash and the need to go to the bank or ATM to withdraw when it runs out, the risk of credit card theft and the very troublesome thing to lose. Mobile payment is more efficient and simple than traditional payment methods.

Today's governments are also promoting cashless societies. According to the New York Times, electronic payment mechanisms such as credit cards and mobile phone applications are gradually becoming popular, and Sweden is rapidly moving towards a cashless society. According to eMarketer's research, 34.9% of smartphone owners will make physical payments through mobile phones in retail channels in 2021.

At present, in the international field, Apple Pay, Google's Android Pay and Samsung Pay are all expanding their payment scope in different ways. As for the world's largest mobile payment market, China, led by Alipay and WeChat Pay, is also constantly changing the payment consciousness and life mode of Chinese people. In terms of regional markets, mainland China is a global leader in near-end mobile payment applications, and is expected to account for 61.2% of global mobile payment users in 2018. Even though the mayoral share of mainland China will decline as the number of users in the rest of the world increases, by 2021, China will still account for 56.0% of the world's near-end mobile payment users [1].

As for the Asia-Pacific region, due to China's contribution to mobile payment, the penetration rate of near-end mobile payment users in the Asia-Pacific region will reach about 50%. However, in terms of usage by the total population, the Asia-Pacific region is comparable to North America. Because smartphones are used in North America compared to before, this makes them more willing to experiment with mobile payments. If measured by the global population, eMarketer expects that 13.2% of the world's population will become users of near-end mobile payments in 2018. By 2021, this percentage is expected to grow to 17.2%. The predicted growth rate does disappoint manufacturers, but it also illustrates its strong growth potential.

1.2 Purpose of the study

Based on the motivation of the appellate study, this study hopes to combine the willingness of mobile payment for Taiwanese users with the support of questionnaire survey and technology acceptance model, and explore the future development of mobile payment in Taiwan. In addition, the degree of influence of others

around the user and whether it really affects the user's willingness to use will also be discussed in this study. This study takes Taiwanese smartphone users as the target and adds their external variables "convenience", "security", "product awareness" and "social association" to explore their impact on the user's ultimate "willingness to use", including the impact of users' "perceived usefulness" and "perceived ease of use" on mobile payment, and ultimately "willingness to use" by influencing whether "intention to use" is generated.

Objectives of this study:

1. Explore the willingness of users to use mobile payment.
2. Discuss whether users' willingness to use mobile payment increases or decreases due to the influence of people around them or society.
3. Discuss the perceived ease of use, perceived usefulness and willingness to use the user's intention to use mobile payment when using mobile payment.

1.3 Literature Review

1.3.1. Mobile payment

In recent years, the development of mobile technology has become more mature and the use of mobile phones has become more widespread, so there are endless business opportunities for mobile payment services. Arvidsson [5] mentioned that mobile payments can be roughly divided into three types: The first is the "credit card on the phone" model of Apple Pay, Google Pay (also including Samsung Pay). The second is transportation stored value such as one-pass and leisurely cards, which are actually the most common mobile payment methods in Taiwan because of the popularity of co-branded credit cards. The third type is Alipay, WeChat Pay, such as Line Pay, street entrance, PC home Pi, etc. belong to this category.

The third is currently highly competitive and will take some time to see who wins, but the first two can quickly spread out. But there are some bottlenecks in Taiwan: not all banks support credit cards, and there are restrictions on what cards can be used in consumer stores. Taiwan's business competition "exclusivity" is a common method, but for the infrastructure of mobile payment, exclusivity is not only limited in time, but also can affect user willingness and affect popularity during a period of rapid rise [6].

Although unlike other countries that have developed mobile payment rapidly, the proportion of mobile payment used in mobile payment has gradually increased, but from the end of 2011 to 2012, many operators in Taiwan, including the banking industry of the original financial transactions, transportation ticket manufacturers, and even telecommunications operators, have also entered the mobile payment market one after another, trying to transplant the payment function of existing credit cards or stored value cards from sensor cards to mobile phones, making mobile phones a new vehicle for payment. These examples once again herald the coming era of mobile payment. According to the data of the Ministry of Economic Affairs' "2015 B2C Online Store Analysis and Trend in China", credit cards, ATMs, and supermarket pickup and payment are still the most important financial flow channels for online stores and consumers. The proportion of online stores offering third-party payment methods increased from 17.6% in 2013 to 27.8% in 2014. The proportion of consumers using it also increased from 2.7% in 2013 to 13.9%. Most of the third-party payment tools offered by online stores come from the platform of choice, such as PChome's PayLink or Yahoo's Easy Pay. According to the Financial Regulatory Commission's "Fintech Development Strategy White Paper", Taiwan's electronic payment rate is 26%, lower than the neighboring countries South Korea 77%, Hong Kong 65%, China 56% and Singapore 53%, the development started relatively late. As of January 2016, there are 91.78 million financial cards in circulation, 38.55 million credit cards and 70.24 million electronic tickets, but the popularity of electronic payment is not as expected [8].

1.3.2. Fintech

In 2015, the term financial technology (fintech) began circulating in Taiwan's financial industry. But what is fintech? According to Chris Kinner, author of *Digital Bank*, which is almost everyone's book in Taiwan's banking industry, "Fintech is a new industry that uses information technology to recreate financial services." Just as technology reinvented music (such as iPod, Spotify), entertainment (such as Netflix), retail (such as Amazon), accommodation (such as Airbnb), and taxi (such as Uber), technology began to disrupt highly regulated, inefficient, and costly financial services [8].

The National Centre for Digital Research (NDRC) in Ireland defines fintech as a "financial services innovation" and recognizes that the term can also be used to refer to areas where technology is widely used, such as front-end consumer products, competition between new entrants and existing players, and even new things like Bitcoin.

FinTech is a new type of solution that is highly disruptive and innovative in the development of business models, products, processes, and application systems in the financial services industry.

Fintech's advantage is that they can provide a better experience than banks. Traditional banks can provide full-functional, one-stop financial services. But fintechs are using technology to make processing cheaper, process easier, and more flexible in hours and locations for a wide range of banking services.



Figure 1. Fintech companies are replacing banking services one by one. Image source:CBInsights

1.3.3. The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was proposed by Davis (1986) based on the Theory of Reasoned Action (TRA) and Planned Behavior (TPB) proposed by Fishbein & Ajzen (1969) [2] The theories developed on this basis are used to explain and predict the use of information technology, and also analyze the user's acceptance and attitude behavior when using new technology. In addition, the model also explores the influence of external factors on users' internal beliefs, attitudes and intentions, which in turn affect the actual use of information technology.

(1) Theory of rational behavior

The theory of rational behavior was proposed by Fishbein & Ajzen in 1970 [3]. The theory is called a behavior diagram. It is influenced by attitudes and subjective norms, and behavioral intent further influences actual behavior.

As shown in the following figure:

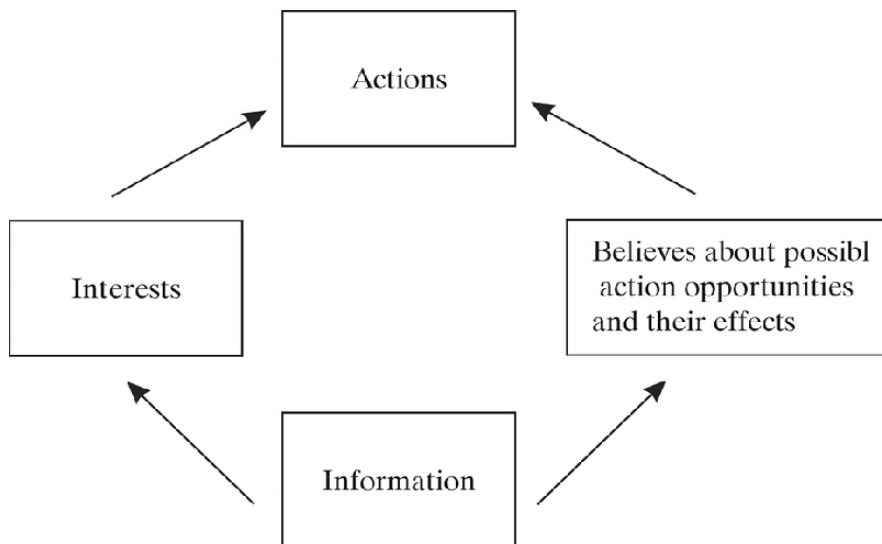


Figure 2. Model of the rational choice theory

Source: https://www.researchgate.net/figure/Model-of-the-rational-choice-theory_fig2_27199089.

Two variables in rational behavior theory are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), which mainly affect the user's attitude to using the new technology, and then affect the user's willingness and behavior [4].

(1) Perceived Usefulness (PU): It is defined as a user's subjective belief that a new technology can effectively improve their work performance, and maintain a positive attitude towards the technology.

(2) Perceived Ease of Use (PEOU): It is defined as the ease of using technology when users use new technology, so that users can use technology is easy to use and operate.

(3) User attitude toward using: The usefulness and ease of use of new technology will affect users' positive or negative ideas about new technology.

(4) Behavioral Intention to use: The strength of the user's willingness to use new technology.

Its model is shown in the following figure:

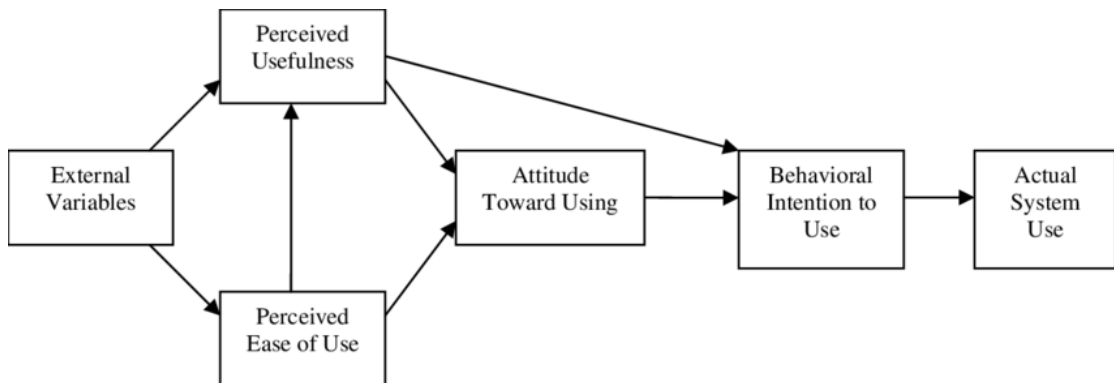


Figure 3. Data Source :Davis et al.(1989)

II. RESEARCH METHODS

2.1. Research framework

In this study, the Technology Acceptance Model (TAM) is the basic framework, which proposes whether the two components of perceptual usefulness and perceptual ease affect the user's intention to use, and whether the use intention component further affects the user's usage behavior. In addition, an external variable, "social association", is added to this research framework, which delves into users' willingness to use mobile payments. The framework of the research hypothesis of this study is shown in Figure 4.

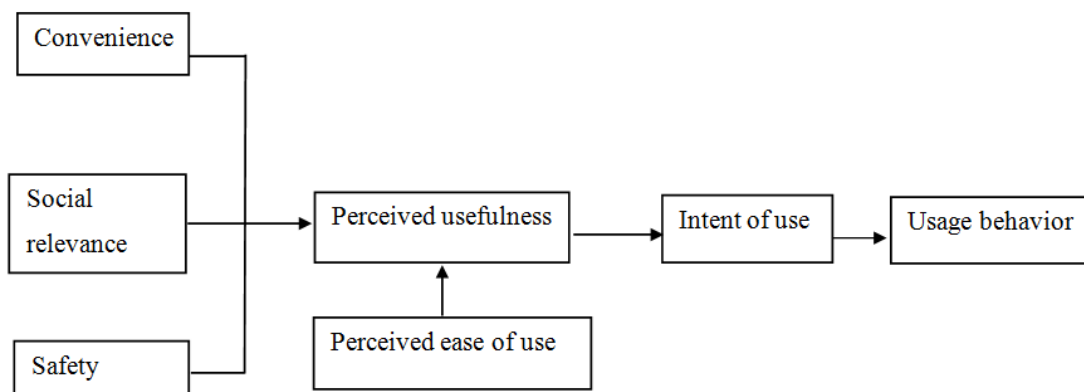


Figure 4 Research framework

2.2 Research hypotheses

According to the literature review, the research framework of this study, the causal relationship between the variables in the proposed framework, and then derived six hypotheses as follows:

H1: The convenience of mobile payments has a positive impact on their perceived usefulness

H2: The security of mobile payments has a positive impact on their perceived usefulness

H3: The social association of mobile payments has a positive impact on their perceived usefulness

H4: The perceived ease of use of mobile payments has a positive impact on perceived usefulness

H5: The perceived ease of use of mobile payments has a positive impact on usage intention

H6: The intention to use mobile payment has a positive impact on usage behavior

III. Research analysis and results

The status of sample collection

This study takes smartphone users as the research object, and distributes and recycles online questionnaires to local users through social networks. A total of 216 questionnaires were collected, and a total of 215 valid questionnaires were obtained after deducting 1 for those who did not use smartphones.

3.1 The results of descriptive statistical analysis

In this study, 215 valid samples were analyzed, and the results showed that 81 (37.7%) men (37.7%) and 134 women (62.3%) filled out the questionnaire, with the majority of women and a minority of men. In the age group, 37 (17.2%) were under 20 years old, 136 (63.3%) were 21 to 30 years old, 13 (6%) were 31 to 40 years old, 18 (8.4%) were 41 to 50 years old, 11 (5.1%) were 51 years old or older, and the majority of respondents were young people. In the vocational sector, there were 126 students (58.6%), 7 military and public education (3.3%), 46 (21.4%) in the service industry, 11 (5.1%) in the financial and insurance industry, 10 (4.7%) in the sales industry, 5 (2.3%) in the household management industry, and 10 other people (4.6%), indicating that the majority of students filled out the questionnaire. 116 (54%) used a credit card and 99 (46%) did not.

3.2 The results of factor analysis

In this study, the Kaiser-Meyer-Olkin value was 0.907, the Bartlett's spherical test value was 5082.736, and the significance was 0.000 ($p < 0.001$), reaching a significant level, and the characteristic values of each component of the variant part were greater than 1, while the component matrix factor problem after pivot was well analyzed, and the factor load of each question was greater than 0.4.

3.3 The results of reliability analysis

In this study, Cronbach's Alpha was used to test the reliability of each component question, with an alpha value of 0.836 for the "Convenience" section, 0.924 for the "Security" section, 0.829 for the "Social Connection" section, 0.669 for the "Perceptual Usefulness" section, 0.922 for the "Perceptual Ease of Use" section, 0.833 for the "Intent to Use" section, and 0.833 for the "Behavior of Use" section. The partial alpha value was 0.924, and the overall alpha value was 0.905, and the results showed that except for "perceptual usefulness" Cronbach's alpha value was less than 0.7, all other Cronbach's alpha values were higher than 0.7.

3.4 Relevant analysis results

From the correlation number analysis, it is shown that the correlation between "convenience" and "perceptual usefulness" is moderately positive. "Security" is negatively correlated with "perceptual usefulness"; The degree of correlation between "social association" and "perceptual usefulness" was moderately positive; "Perceptual ease of use" is positively correlated with "perceptual usefulness". However, from the relevant analysis results, it is known that the two components of "perceptual ease of use" and "use behavior" have no significant relationship with "use intention", which means that the two components of "perceived ease of use" and "use behavior" cannot be independently related to the component of "use intention". Therefore, after evaluation, the "use intent" of its aspects will be discarded; Later, the hypothesis H5 and H6 were not discussed.

Table 1 Related analysis results

	Safety	perceptual usefulness	perceptual ease of use	convenience	social association
Safety	1				
perceptual usefulness	-.192**	1			
Perceived ease of use	-.030	.713**	1		
convenience	-.122	.681**	.668**	1	
social association	.037	.416**	.357**	.372**	1

Note: **At a significant level of 0.01 (double-tailed), the correlation is significant.

Source: Compiled from this study

3.5 Regression analysis

This study progressively explores the relationship between self-variable and dependent variable.

Regression analysis for H1: Simple linear regression analysis of "convenience" and "perceptual usefulness"

The analysis results are as follows, from the table, it can be found that the overall significance $p < 0.001$ is very significant, and its viewing is .690 (69.0%), which means that the "convenience" of users when using mobile payment will positively affect "perceived usefulness", so H1 is established.

Regression analysis for H2: Simple linear regression analysis of "safety" and "perceptual usefulness"

The analysis results are as follows, from the table, it can be found that the overall significant $p < 0.001$ is very significant, and its viewing is .048 (4.8%), which means that the "security" of users when using mobile payment will positively affect "perceived usefulness", so H2 is established.

Regression analysis for H3: Simple linear regression analysis of "social associations" and "perceptual usefulness"

The analysis results are as follows, and it can be found from the table that the overall significant $p < 0.001$ is very significant, and its viewing is .292 (29.2%), which means that the user's "social association" when using mobile payment positively affects "perceptual usefulness", so H3 is established.

Regression analysis for H4: Simple linear regression analysis of "perceptual ease of use" and "perceptual usefulness"

The analysis results are as follows, from the table, it can be found that the overall significant $p < 0.001$ is very significant, and its viewing is .702 (70.2%), which means that the user's "perceptual ease of use" when using mobile payment will positively affect the "perceptual usefulness", so H4 is established.

Regression analysis for H5: Simple linear regression analysis of "perceptual ease of use" and "intention of use"

The analysis results are as follows, from the table, it can be found that the overall significant $p < 0.001$ is very significant, and its viewing is .728 (72.8%), which means that the user's "perceived ease of use" when using mobile payment will positively affect the "usage intention", so H5 is established.

Regression analysis for H6: Simple linear regression analysis of "intention to use" and "behavior of use"

The analysis results are as follows, from the table, it can be found that the overall significant $p < 0.001$ is very significant, and its viewing is .702 (70.2%), which means that the user's "usage intention" when using mobile payment will positively affect the "usage behavior", so H6 is established.

Table 2. Regression analysis for Hypothesis

Hypothesis	Testing Result
H1: The convenience of mobile payments has a positive impact on their perceived usefulness	established
H2: The security of mobile payments has a positive impact on their perceived usefulness	established
H3: The social association of mobile payments has a positive impact on their perceived usefulness	established
H4: The perceived ease of use of mobile payments has a positive impact on perceived usefulness	established
H5: The perceived ease of use of mobile payments has a positive impact on usage intention	established
H6: The intention to use mobile payment has a positive impact on usage behavior	established

IV. Discussion of research results

The effect of "convenience" on "perceptual usefulness"

The results of this study found that convenience has a significant positive impact on users' perceptual usefulness, indicating that users believe that mobile payment can provide payment convenience, which in turn affects the intention to use mobile payment.

The effect of "safety" on "perceptual usefulness"

The results of this study found that security has a significant impact on the perceived usefulness of users, so the security of mobile payment is one of the reasons for deciding whether to use mobile payment, and it is also one of the concerns of users.

The effect of "social association" on "perceptual usefulness"

The findings of this study found that social associations have a significant effect on the usefulness of perception, and that in the theory of technological acceptance models, social influences themselves are the extent to which individuals feel influenced by others. Individuals most commonly behave under the influence of those around them, and then doubt and change their original opinions, judgments, and behaviors, and change in the direction that most people feel decides. Therefore, when users use mobile payments, the higher the degree of influence they feel affected by others, the more useful the user's perception of mobile payment will be, and the attitude will tend to be positive. For example, users may find mobile payments useful because their friends use them, and therefore think that mobile payments will be useful to the users themselves.

The effect of "perceptual usefulness" on "perceptual ease of use"

The results of this study found that perceptual usefulness has a significant impact on usage intention, in order to strengthen user acceptance, achieve the purpose of user acceptance and use, and then improve overall

performance. Therefore, the easier it is for users to use mobile payment, the more positive the user's perception of mobile payment.

The impact of "Intention to Use" on "Usage Behavior"

The results of this study found that usage intention has a significant impact on usage behavior, and if mobile payment use is convenient or there will be some discount feedback, then the higher the willingness of users who use mobile payment to continue using mobile payment in the future.

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